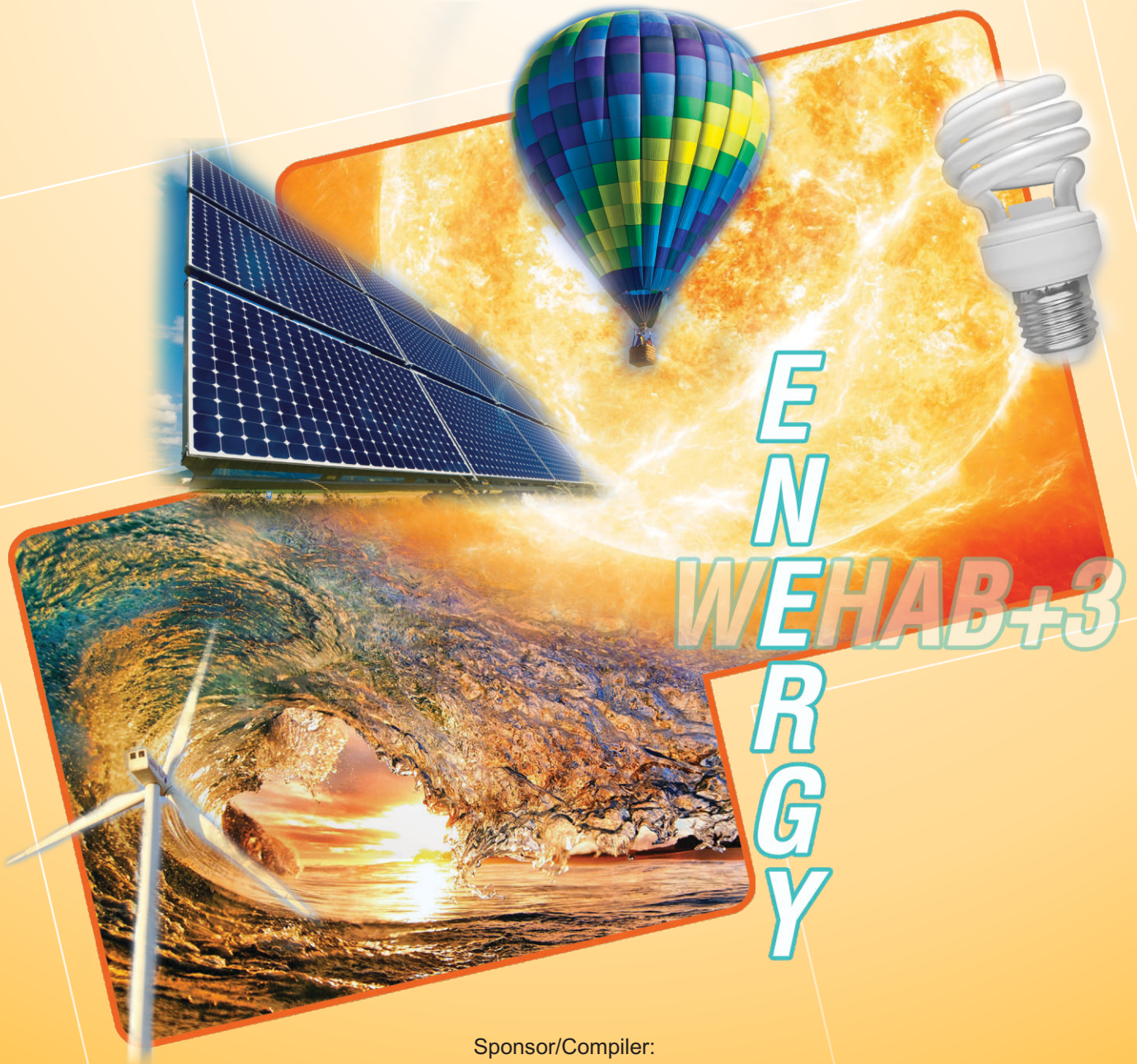




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A SELECTED COMPENDIUM OF SEASN MEMBERS' RESEARCH PUBLICATIONS ON WEHAB+3: ENERGY

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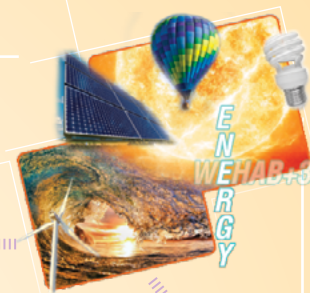


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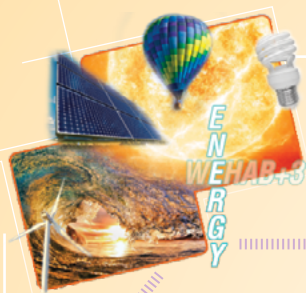
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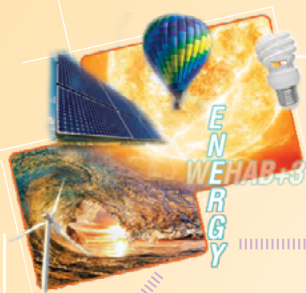
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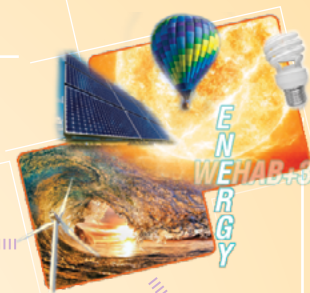


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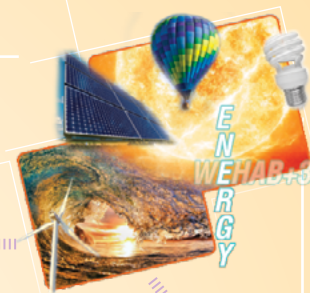
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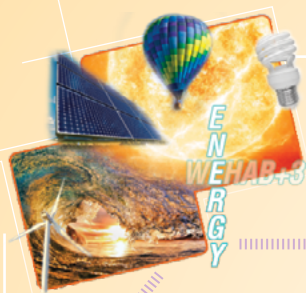
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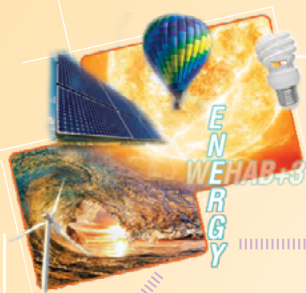
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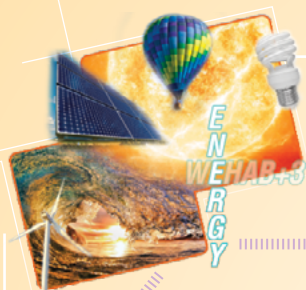
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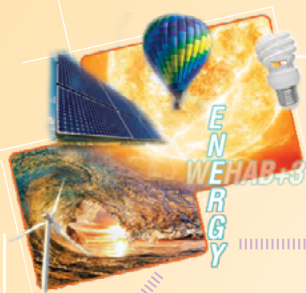
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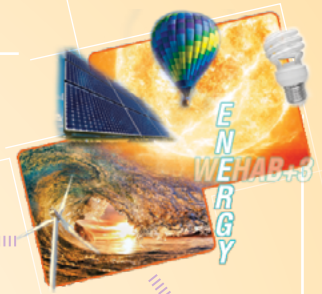
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Foreword



Assalamualaikum Warahmatullahi Wabarakatuh and greeting of peace

The establishment of South East Asia Sustainability Network (SEASN) has provided a platform to support higher education institutions and other related sustainability organisations in South East Asian countries for exchanging ideas, findings, information, and good practices in teaching, research, community engagement and institutional arrangement that relate to their work. In order to expedite this process by sharing information and best practices in sustainability studies, the SEASN Secretariat at Universiti Sains Malaysia has taken the initiative to publish a compendium entitled 'A Selected Compendium of SEASN Members' Research Publications on WEHAB+3'.



The focus of this book is on the sectors, Water, Energy, Health, Agriculture, Biodiversity (WEHAB); and cross-sectors, Climate Change and Disaster Risk Management, Consumption and Production, and Population and Poverty; collectively represented as WEHAB+3. The Water (W) compendium had been successfully published and in this second compendium is focused on Energy (E). Energy is central to sustainable development and poverty reduction efforts in all countries. It affects all aspects of development - social, economic, and environmental - including livelihoods, access to water, agricultural productivity, health, population levels, education, and gender-related issues. None of the Millennium Development Goals (MDGs) can be met without major improvement in the quality and quantity of energy services in developing countries.

Incidentally, WEHAB was launched at the World Summit on Sustainable Development by Kofi Annan in 2002 as a priority set of sectors for sustainability implementation, where quick results are possible with available technology and resources. When we add the three cross sectoral issues, the approach becomes very comprehensive and a broad treatment WEHAB+3 would cover almost all major sustainability challenges.

In this sense, the current compendium will help promote better understanding of sustainable management of Energy and create knowledge societies that ensure improved quality of life for the present and future generations.

I would like to extend my sincere appreciation and gratitude to all the contributors, authors and editors for their hard work in materializing this compendium. The dedication and tireless efforts of the CGSS staff for the success of this compendium is fully recognized and acknowledged.

Hope the 'WEHAB+3' compendium series will be a medium to exchange research findings in sustainability and to promote sustainability at the global level for the benefit of the wider community of higher educational institutions.

Professor Dato' Dr. Omar Osman

**Chairman
South East Asia Sustainability Network (SEASN)**



Preface

Assalamualaikum Warahmatullahi Wabarakatuh and greeting of peace

The South East Asia Sustainability Network (SEASN) is an alliance of higher education institutions and other related sustainability institution in South East Asian countries committed to promote, engage and integrate sustainability in their mission areas in a systematic way. In this regard, 'A Selected Compendium of SEASN Members' Research Publications on WEHAB+3' is in line with the vision and objectives of SEASN.



Energy is one of the identified priority challenges of SEASN's sustainability focus. At the World Summit on Sustainable Development (WSSD), held in Johannesburg in 2002, the delegates endorsed that poverty reduction, energy security and climate change mitigation were all interlinked issues requiring a coordinated response from the development community.

This book is seen mainly as a means to build a platform for the sharing of research findings in the form of abstracts of published papers. Our survey has revealed that there is enough scope for eight volumes of valuable information that has already been published in the eight areas of WEHAB+3. We have selected the abstract, including reference details, in the hope that it will make life easier for prospective researchers to focus on critical sustainability issues that matter most to their respective countries or the global community at large.

In compiling the abstracts we are mindful of the Intellectual Property Rights of original authors, and in acknowledgement, CGSS declares that we do not make any claim on IP issues whatsoever.

We do hope that this effort will provide a tangible and inspiring example of publication to address sustainability challenges quickly and cost effectively. It is also hoped that this book will contribute towards development and progress that is best suited for the environment, individuals and the economy without compromising the ability of future generations to meet their needs and ultimately ensuring a sustainable future for all.

Professor Dr. Kamarulazizi Ibrahim

**Secretary
South East Asia Sustainability Network (SEASN)**



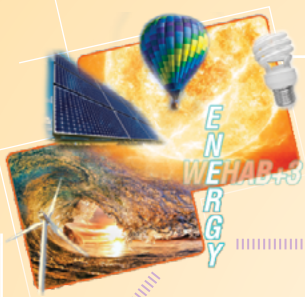
Introduction

This Publication on Energy consists of a compilation of abstracts of SEASN's (South East Asia Sustainability Network) sustainability research output and the resulting publications related to the Energy sector. SEASN is a professional network which includes South East Asia higher education institutions, other related sustainability organisations, agencies, NGOs and industries in South East Asia countries with an interest in sustainability.

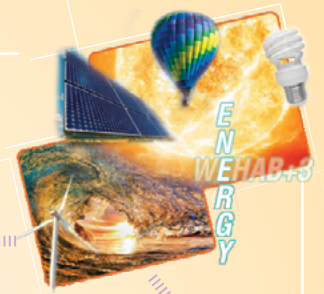
It is common knowledge that Energy is essential for development. The global community reaffirmed during Rio+20 (UNCSD, 2012) the critical role energy plays in national development, health, production and overall social inclusivity. Access to modern energy services for all, increased use of renewable energy sources, adoption of low emission technologies while increasing energy efficiency and supporting international efforts aimed at the Energy for All initiative of the United Nations are urgent measures that the international community agreed to promote.

Overall, the global targets are to provide access to more than two billion people who lack modern energy; promote renewable energy; improve energy efficiency; reduce energy overconsumption; sustainable energy education; and implement the Kyoto Protocol to address climate change (Hamid, 2010). Yet two billion people currently go without energy, condemning them to remain in the poverty trap. We need to make clean energy supplies accessible and affordable. We need to increase the use of renewable energy sources and improve energy efficiency. Moreover, we must not flinch from addressing the issue of overconsumption - the fact that people in the developed countries use far more energy per capita than those in the developing world. It is important also to do-away with market distorting energy subsidies and tax incentives that perpetuate the status quo and stifle the development of new and promising alternatives.

This book aims to share information and best practices in sustainability studies focused in the 8 known areas of sustainability (WEHAB+3), to exchange ideas, concepts and research findings in sustainability and to promote sustainability at the global level for the benefit of the wider higher educational community. The first book in this series has been published which focused on sustainability research on Water (W). This second book will focus on sustainability research on Energy (E). In addition, similar volumes on Health (H), Agriculture (A), Biodiversity (B) as well as the three major cross-sectoral areas, which include Climate Change and Disaster Risk Management (CC+DRM), Production and Consumption (PC) and Population and Poverty (PP) which will be published soon.



This book comprises researched knowledge on Energy from many primary sources of member of SEASN into a single publication. Some of the primary sources were given by the organization and some others were extracted from Sciencedirect, Scopus and Thomson Reuters ISI. It is hoped that this book will provide a quick and relatively easy to understand overview regarding sustainability research output on Energy. Thus, it is hoped that the volume will provide a foundation for further studies, and will catalyse new research in the South East Asia region.



1.0

Chulalongkorn University, Thailand

1.1

Renewable Energy, Volume 36, Issue 6, June 2011, Pages 1728-1733

Design and performance of a moderate temperature difference Stirling engine

Angkee Sripakagorn, Chana Srikam

The present work developed a prototype Stirling engine working at the moderate temperature range. This study attempts to demonstrate the potential of the moderate temperature Stirling engine as an option for the prime movers for Concentrating Solar Power (CSP) technology. The heat source temperature is set to 350–500°C to resemble the temperature available from the parabolic trough solar collector. This moderate temperature difference allows the use of low cost materials and simplified mechanical designs. With the consideration of local technological know how and manufacturing infrastructure, this development works with a low charged pressure of 7 bar and uses air as a working fluid. The Beta-type Stirling engine is designed and manufactured for the swept volume of 165 cc and the power output of 100 W. The performance of engine is evaluated at different values of charge pressures and wall temperatures at the heater section. At 500°C and 7 bar, the engine produces the maximum power of 95.4 W at 360 rpm. The thermal efficiency is 9.35% at this maximum power condition. Results show that the moderate temperature operation offers a clear advantage in terms of the specific power over the low temperature operation. In terms of the West number, the present work demonstrated that the moderate temperature difference operations could offer the performance on par with the high temperature operations with more simple and less costly development.

Keywords

Stirling engine; Concentrating solar power; Distributed generation; Solar energy; Parabolic trough



1.2

Journal of Proteomics, Volume 93, 20 November 2013, Pages 234-244

Biofuels as a sustainable energy source: An update of the applications of proteomics in bioenergy crops and algae

Bongani Kaiser Ndimba, Roya Janeen Ndimba, T. Sudhakar Johnson, Rungaroon Waditee-Sirisattha, Masato Baba, Sophon Sirisattha, Yoshihiro Shiraiwa, Ganesh Kumar Agrawal, Randeep Rakwal

Sustainable energy is the need of the 21st century, not because of the numerous environmental and political reasons but because it is necessary to human civilization's energy future. Sustainable energy is loosely grouped into renewable energy, energy conservation, and sustainable transport disciplines. In this review, we deal with the renewable energy aspect focusing on the biomass from bioenergy crops to microalgae to produce biofuels to the utilization of high-throughput omics technologies, in particular proteomics in advancing our understanding and increasing biofuel production. We look at biofuel production by plant- and algal-based sources, and the role proteomics has played therein.

Keywords

Biofuel crops; Biomarkers; Proteomics technology; Sustainable energy; Translational proteomics



1.3

Energy, Volume 55, 15 June 2013, Pages 98-106

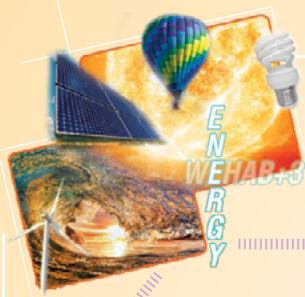
Performance analysis of an integrated biomass gasification and PEMFC (proton exchange membrane fuel cell) system: Hydrogen and power generation

*Bhawasut Chutichai, Suthida Authayanun, Suttichai Assabumrungrat,
Amornchai Arpornwichanop*

The PEMFC (proton exchange membrane fuel cell) is expected to play a significant role in next-generation energy systems. Because most hydrogen that is used as a fuel for PEMFCs is derived from the reforming of natural gas, the use of renewable energy sources such as biomass to produce this hydrogen offers a promising alternative. This study is focused on the performance analysis of an integrated biomass gasification and PEMFC system. The combined heat and power generation output of this integrated system is designed for residential applications, taking into account thermal and electrical demands. A flowsheet model of the integrated PEMFC system is developed and employed to analyze its performance with respect to various key operating parameters. A purification process consisting of a water-gas shift reactor and a preferential oxidation reactor is also necessary in order to reduce the concentration of CO in the synthesis gas to below 10 ppm for subsequent use in the PEMFC. The effect of load level on the performance of the PEMFC system is investigated. Based on an electrical load of 5 kW, it is found that the electrical efficiency of the PEMFC integrated system is 22%, and, when waste heat recovery is considered, the total efficiency of the PEMFC system is 51%.

Keywords

Biomass gasification; PEMFC; Hydrogen; Integrated system; Performance analysis



1.4

Applied Thermal Engineering, Volume 31, Issue 5, April 2011, Pages 701-707

Effect of tube diameter on the specific energy consumption of the ice making process

C. Tangthieng

One of the favorite forms of ice for consuming is tube ice, which is produced by a refrigeration unit referred to as an ice making tower. In order to redesign the tower for the energy-efficiency purpose, the aim of this paper is to numerically investigate the effect of tube diameter on the ice thickness, the cooling load, and the specific energy consumption. The mathematical model of the ice formation within the tube is developed by assuming unsteady and one-dimensional heat conduction. The governing equations are composed of the wall and the ice regions with the convective boundary condition and isothermal solidification at the interface. The governing system is transformed into a dimensionless form and numerically solved by the finite difference method. The numerical results are validated by comparing the ice thickness obtained from the numerical prediction and that obtained from the field measurement, resulting in qualitative agreement. The variations of ice thickness, cooling load, and specific energy consumption with time for four different tube diameters are presented. The result shows the location of the minimum specific energy consumption as a function of time. By comparing between different tube diameters, the value of the minimum specific energy consumption of a small diameter tube is lower than that of a large diameter one. On the other hand, the behavior of the specific energy consumption of a large diameter tube indicates the existence of a low specific energy consumption period of time beyond the minimum point. Therefore, by choosing a proper tube diameter, the minimum value of the average specific energy consumption over the entire production cycle is obtained, leading to higher energy efficiency.

Keywords

Tube ice; Numerical prediction; Tube diameter; Specific energy consumption



1.5 Energy Procedia, Volume 9, 2011, Pages 245-251

Improving Light Olefins and Light Oil Production Using Ru/MCM-48 in Catalytic Pyrolysis of Waste Tire

Chaiyaporn Witpathomwong, Rujirat Longloilert, Sujitra Wongkasemjit, Sirirat Jitkarnka

Mobil Composition of Matter (MCM) is the name given for a series of mesoporous materials. The MCM-48 is one of three phases of the mesoporous materials, which is cubic crystalline structure. The MCM-48 in this work was synthesized from silatrane route, and Ru metal was loaded by incipient wetness impregnation. This work investigated the activity and selectivity of MCM-48 and Ru/MCM-48 used as the catalysts for waste tire pyrolysis. The results showed that Ru/MCM-48 improved the gas yield. In addition, the use of Ru/MCM-48 catalyst produced light olefins twice as much as the non-catalytic pyrolysis. On the other hand, the catalyst helped to improve the oil quality by increasing light oil portion. Furthermore, it also reduced poly- and polar-aromatic compounds and sulfur content in the derived oil. Surface area analysis, XRD, and CHNS analysis were performed to explain the experimental results.

Keywords

Pyrolysis; Waste tires; Light olefins; Ruthenium; Silica MCM-48; Aromatics



1.6

Chemical Engineering and Processing: Process Intensification, Volume 61, November 2012, Pages 8-15

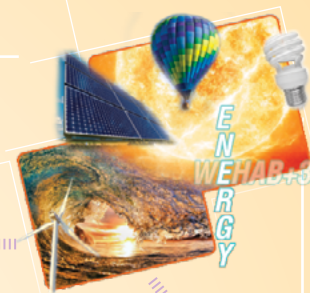
Hybrid hydrocyclone process operating with natural water

Chaiyaporn Puprasert, Vorasiri Siangsanung, Christelle Guigui, Céline Leveq, Gilles Hébrard

This research deals with a hybrid hydrocyclone process, involving micro-bubbles injection generated by the dissolved air flotation technique; the micro-bubbles allow the aerated flocs formed by coagulation and flocculation to be separated inside the hydrocyclone. The floc separation is induced by centrifugal force. The lighter phase moves toward the center of the hydrocyclone and the heavier one to the wall. This hybrid process is intended for natural water or industrial raw water and would be performed as an industrial water treatment process. For this study, the hybrid hydrocyclone process was performed under steady state conditions with natural water coming from the river Marne. Efficiencies of $61 \pm 4\%$ for turbidity decrease and $77 \pm 20\%$ for suspended solids removal were obtained. The separation efficiency between the clarified water and the flocs reached $95 \pm 10\%$. This process achieved continuous operation with 1000 L/h inlet flow. In industrial wastewater treatment, which requires a reliable, compact and efficient process, this hybrid technology shows strong potential, with a significant reduction of the plant footprint.

Keywords

Hybrid hydrocyclone as new water treatment process; Special flocs embedding micro bubbles, Separation under centrifugal forces, Hybrid process performed on continuous operation with surface water, Suspended solid separation efficiency up to $95 \pm 10\%$.



1.7

International Journal of Hydrogen Energy, Volume 38, Issue 25, 21 August 2013, Pages 10417-10430

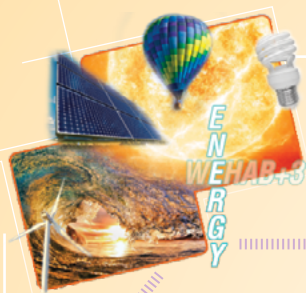
Experiment and computational fluid dynamics simulation of in-depth system hydrodynamics in dual-bed gasifier

Chanin Manchasing, Prapan Kuchonthara, Benjapon Chalermssinsuwan, Pornpote Piumsomboon

Dual-bed gasifier is a new gasifier system with separated combustion and gasification zones. The two-zone separation makes it possible to increase calorific value of the producer gas. In order to develop and improve the process operation, understanding of system dynamics and parameters that describe the in-depth hydrodynamics are essential. Computational fluid dynamics is a tool that can be used to explain the complex multiphase system behavior. The considered dual-bed gasifier had 3.00 m height and the maximum width diameters of riser and downcomer were 0.14 and 0.40 m, respectively. Conservation equations of mass, momentum, energy and species for each phase were solved coupling with the kinetic theory of granular flow using ANSYS FLUENT version 12.1. Here, two-dimensional simulation had been successfully determined the flow pattern and chemical reaction corresponding with actual experimental and theoretical data. The calculated results of the solid volume fraction in the riser section showed the bubbling and slugging flow patterns. The product gas composition and gas temperature inside dual-bed gasifier reflected the advantages for this type of reactor over the other conventional gasifiers. The system turbulences were firstly explored in dual-bed system which was normal Reynolds stresses and granular temperatures. For the effect of interphase exchange coefficient model, the pressure-loop using drag force model proposed by Gidaspow was in good agreement with the experiment than the ones proposed by Wen-Yu and Syamlal-O'Brien.

Keywords

Computational fluid dynamics; Eulerian approach; Fluidized bed; Gasifier; Kinetic theory of granular flow



1.8

Carbon, Volume 49, Issue 6, May 2011, Pages 2039-2045

Simple method for the layer-by-layer surface modification of multiwall carbon nanotubes

*Chularat Iamsamai, Apinan Soottitantawat, Uracha Ruktanonchai,
Supot Hannongbua, Stephan Thierry Dubas*

A simplified method for the surface modification of multiwall carbon nanotubes (MWCNTs) using the layer-by-layer (LbL) technique is proposed. In this approach, the minimum polyelectrolyte content was added to the solution in order to eliminate the tedious centrifugation step. The one pot LbL deposition of poly (diallyldimethylammonium chloride) (PDADMAC), and poly (sodium 4-styrenesulfonate), (PSS) is presented. UV-Vis spectroscopy and zeta potential measurements were used to determine the minimum PDADMAC and PSS concentration needed for the deposition of each polyelectrolyte layer. The deposition cycle was repeated until six layers of PDADMAC/PSS were deposited. The film growth was confirmed by transmission electron microscopy and was found to increase as a function of the number of deposited layers with a final thickness of 18 nm. Evidence of the alternate deposition of oppositely charged polyelectrolytes was further investigated by measurement of the zeta potential values which were found to reverse from positive to negative as a function of the number of deposited layers thus confirming the overcompensation of the surface charge at each adsorption step. This simple method could be useful for the fast preparation of large volumes of MWCNTs solutions in a single batch without the need for centrifugation step.

Keywords

Layer-by-layer; Polyelectrolytes; Carbon nanotubes; Polyaniline



1.9

International Journal of Hydrogen Energy, Volume 38, Issue 3, 6 February 2013, Pages 1348-1362

Effect of catalyst preparation on Au/Ce_{1-x}Zr_xO₂ and Au-Cu/Ce_{1-x}Zr_xO₂ for steam reforming of methanol

Chinchanop Pojanavaraphan, Apanee Luengnaruemitchai, Erdogan Gulari

We tested 3 wt% gold (Au) catalysts on CeO₂-ZrO₂ mixed oxides, prepared by co-precipitation (CP) and the sol-gel (SG) technique, for steam reforming of methanol (SRM). Uniform Ce_{1-x}Zr_xO₂ solid solution was dependent on the Zr/Ce ratio, where the incorporation of Zr⁴⁺ into the Ce⁴⁺ lattice with a ratio of 0.25 resulted in smaller ceria crystallites and better reducibility, and was found to be efficient for SRM activity. The catalytic activity was suppressed when the ratio was ≥0.5, which led to the segregation of Zr from solid solution and sintering of Au nanoparticles. It was found that the CP technique produced better catalysts than SG in this case. For the bimetallic catalysts, the co-operation of Au-Cu supported on Ce_{0.75}Zr_{0.25}O₂ (CP) exhibited superior activities with complete methanol conversion and low CO concentration at 350 °C. Furthermore, the size of the alloy particle was strongly dependent on the pH level during preparation.

Keywords

Steam reforming of methanol; Hydrogen; Alloy; Solid solution; CeO₂; ZrO₂



1.10

International Journal of Hydrogen Energy, Volume 36, Issue 22, November 2011, Pages 14428-14434

Adsorption-membrane hybrid system for ethanol steam reforming: Thermodynamic analysis

Dang Saebea, Amornchai Arpornwichanop, Yaneeporn Patcharavorachot, Suttichai Assabumrungrat

In this study, an adsorption-membrane hybrid system in which a carbon dioxide adsorbent is used to remove undesired carbon dioxide and a membrane is applied for hydrogen separation is theoretically investigated with the aim to improve the performance of an ethanol steam reforming. A thermodynamic analysis of such the system was performed and compared with a membrane reactor and an adsorptive reactor. It was found that the removal of hydrogen by membrane separation has higher impact on the reformer performance than the carbon dioxide capture by adsorption. The adsorption-membrane hybrid system for ethanol steam reforming gives the highest hydrogen yield. Considering a possibility for carbon formation, the simulation results showed that the use of membrane for pure hydrogen production increases the trend toward carbon formation. This is due to an increase in carbon monoxide concentration in the reaction zone that promotes the Boudouard reaction. In contrast, the use of carbon dioxide adsorbent reduces the formation of carbon as carbon monoxide is less generated in the system.

Keywords

An adsorption-membrane hybrid system of ethanol reforming was studied; Thermodynamic analysis of such the system was performed; H₂ removal has more impact on the reformer performance than CO₂ capture; Use of membrane for H₂ separation increases the trend toward carbon formation; Use of CO₂ adsorbent trends to reduce carbon formation.



1.11

International Journal of Hydrogen Energy, Volume 38, Issue 11, 15 April 2013, Pages 4748-4759

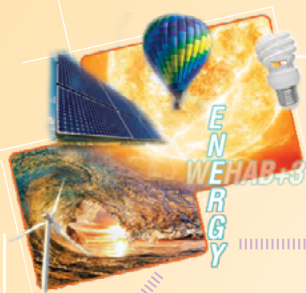
Analysis of a pressurized solid oxide fuel cell–gas turbine hybrid power system with cathode gas recirculation

Dang Saebea, Yaneeporn Patcharavorachot, Suttichai Assabumrungrat, Amornchai Arpornwichanop

A pressurized solid oxide fuel cell–gas turbine hybrid system (SOFC–GT system) has been received much attention for a distributed power generation due to its high efficiency. When considering an energy management of the system, it is found that a heat input is highly required to preheat air before being fed to the SOFC stack. The recirculation of a high-temperature cathode exhaust gas is probably an interesting option to reduce the requirement of an external heat for the SOFC–GT system. This study aims to analyze the pressurized SOFC–GT hybrid system fed by ethanol with the recycle of a cathode exhaust gas via a simulation study. Effect of important operating parameters on the electrical efficiency and heat management of the system is investigated. The results indicate that an increase in the operating pressure dramatically improves the system electrical efficiency. The suitable pressure is in a range of 4–6 bar, achieving the highest system electrical efficiency and the lowest recuperation energy from the waste heat of the GT exhaust gas. In addition, it is found that the waste heat obtained from the GT is higher than the heat required for the system, leading to a possibility of the SOFC–GT system to be operated at a self-sustainable condition. Under a high pressure operation, the SOFC–GT system requires a high recirculation of the cathode exhaust gas to maintain the system without supplying the external heat; however, the increased recirculation ratio of the cathode exhaust gas reduces the system electrical efficiency.

Keywords

Solid oxide fuel cell; Gas turbine; Ethanol reforming; Hybrid system; Cathode gas recirculation



1.12 Energy, Volume 51, 1 March 2013, Pages 305-313

Use of different renewable fuels in a steam reformer integrated into a solid oxide fuel cell: Theoretical analysis and performance comparison

*Dang Saebea, Suthida Authayanun, Yaneeporn Patcharavorachot,
Woranee Paengjuntuek, Amornchai Arpornwichanop*

Hydrogen production from renewable energy resources has received significant attention with advances in fuel cell technology. The fuel type and operational reforming conditions directly affect fuel cell electricity generation. This study analyzes the theoretical performance of a solid oxide fuel cell (SOFC) integrated with a steam reforming process using three different renewable fuels: ethanol, glycerol and biogas. The effects of key steam reformer operating parameters on the hydrogen production for SOFCs are investigated. The performances of SOFC systems run on different fuels are compared in terms of electrical and thermal efficiencies. It is found that the biogas-fueled SOFC system requires the most energy, whereas the ethanol-fueled SOFC system achieves the highest electrical and thermal efficiencies.

Keywords

Renewable fuels; Steam reformer; Hydrogen production; Solid oxide fuel cell; Integrated system



1.13 Renewable Energy, Volume 51, March 2013, Pages 310-316

Techno-economic comparison of energy usage between azeotropic distillation and hybrid system for water-ethanol separation

D. Kunnakorn, T. Rirksomboon, K. Siemanond, P. Aungkavattana, N. Kuanchertchoo, P. Chuntanalert, K. Hemra, S. Kulprathipanja, R.B. James, S. Wongkasemjit

Conventional azeotropic distillation, consuming very high energy, is mostly used to produce high purity ethanol for renewable energy usage. In this study, the techno-economic comparison between azeotropic distillation (distillation followed by practical azeotropic distillation) and hybrid system (distillation followed by pervaporation system) for producing high purity of ethanol is demonstrated using the Pro II by Provision version 8.0. In the hybrid system, NaA zeolite membrane is used to separate the water from ethanol-water mixture. It is found that the hybrid system is the most effective technique for producing more than 99.4%wt of ethanol with an energy consumption of 52.4% less than the azeotropic distillation.

Keywords

Techno-economic analysis; Azeotropic distillation; NaA zeolite membrane; Pervaporation



1.14

Chemical Engineering and Processing: Process Intensification, Volume 50, Issue 1, January 2011, Pages 22-30

Freeze-dried solid foams prepared from carbon nanotube aqueous suspension: Application to gas diffusion layers of a proton exchange membrane fuel cell

Kyuya Nakagawa, Yoshinaga Yasumura, Napawon Thongprachan, Noriaki Sano

Freeze-dried macroporous solid foams were prepared from the multi-walled carbon nanotube (MWCNT) aqueous suspensions dispersed by chitosan. Thin film shaped CNT solid foams were prepared, and applied to the gas diffusion layers (GDLs) of a laboratory scale proton exchange membrane fuel cell (PEMFC). It was demonstrated that the prepared carbon foams in this study were useful to a fuel cell GDL material. The prepared cell performances were fairly comparable to the cell prepared with conventional carbon paper for GDL material. The microstructures of the prepared carbon foams were found to affect on the PEMFC performances. It was suggested that the interconnected carbon networks formed during the freezing step closely link to the cell performances. Hence, the deflection of the interconnected microstructure lead degradation of the GDL quality. The impedance measurement made clear that the prepared foam materials were also advantageous for reducing the ohmic resistance in PEMFC assembly. The kinetic resistance values and the thermal conductive characteristics suggested that the freezing process would also control the degree of overlaps among single CNTs in a freeze-dried bulk that influenced on the electrochemical properties.

Keywords

Porous media; Fuel cell; Ice crystal; Microstructure; Freeze-drying; Carbon nanotube



1.15 International Journal of Hydrogen Energy, Volume 36, Issue 8, April 2011, Pages 5067-5075

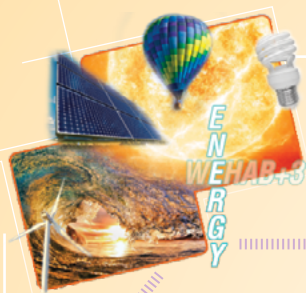
Performance improvement of bioethanol-fuelled solid oxide fuel cell system by using pervaporation

I. Choedkiatsakul, S. Charojrochkul, W. Kiatkittipong, W. Wiyaratn, A. Soottitantawat, A. Arpornwichanop, N. Laosiripojana, S. Assabumrungrat

This work proposes an improvement in performance with respect to the electrical efficiency of a bioethanol-fuelled Solid Oxide Fuel Cell (SOFC) system by replacing a conventional distillation column by a pervaporation unit in the bioethanol purification process. The simulation study indicates that the membrane separation factor has a significant influence on the electrical power and heat energy required to generate a feed of 25 mol% ethanol in water to the reformer. The values of overall electrical efficiency of the SOFC systems with a distillation column and with a pervaporation unit are compared under the thermally self-sufficient condition ($Q_{net} = 0$) which offers their maximum electrical efficiency. At the base case, the SOFC system with a pervaporation unit provides an electrical efficiency of 42% compared with 34% achieved from the system with a distillation unit, indicating a significant improvement by using a pervaporation unit. An increase in ethanol recovery can further improve the overall electrical efficiency. The study also reveals that further improvement of the membrane selectivity can slightly enhance the overall efficiency of the SOFC system. Finally, an economic analysis of a bioethanol-fuelled SOFC system with pervaporation is suggested as the basis for further development.

Keywords

Solid oxide fuel cell; Bioethanol; Pervaporation; Process improvement



1.16 Fuel Processing Technology, Volume 111, July 2013, Pages 22-28

Application of heterogeneous catalysts for transesterification of refined palm oil in ultrasound-assisted reactor

I. Choedkiatsakul, K. Ngaosuwan, S. Assabumrungrat

This research investigated the application of commercial heterogeneous catalysts i.e., calcium oxide (CaO) and potassium phosphate (K_3PO_4) for biodiesel production in an ultrasound-assisted reactor (US). For comparison, the results from the use of homogeneous catalysts i.e., sodium hydroxide (NaOH) and sulfuric acid (H_2SO_4) as well as from the use of conventional mechanical stirred reactor (MS) were also studied. High methyl ester yields were achieved in the US reactor for both CaO (90%) and K_3PO_4 (80%). The mixing characteristics generated from US and MS reactors resulted in the different performance (activation and deactivation) of CaO and K_3PO_4 catalyzed transesterification. The major overcome of using US reactor for heterogeneously catalyzed transesterification was found in the catalyst reusability test. Methyl ester yield of CaO catalyst gradually reduced when applying US reactor compared to MS reactor, particularly in the last cycle. The dissolution effect was more severe when employing K_3PO_4 catalyst in the MS reactor due to the mechanical stress and the mixing characteristic effects. Therefore, the use of US reactor did not only provide the high methyl ester yield in a short reaction time but also showed the hindrance of dissolution compared to the MS reactor. It can be concluded that the heterogeneously catalyzed transesterification in US reactor was not only favorable in the activation but also diminishable in the deactivation of solid catalysts.

Keywords

Biodiesel; Reusability of catalyst; Calcium oxide; Potassium phosphate; Mixing characteristics; Ultrasound-assisted reactor



1.17 International Journal of Hydrogen Energy, Volume 36, Issue 10, May 2011, Pages 5865-5874

Evaluation of the thermodynamic equilibrium of the autothermal reforming of dimethyl ether

Kajornsak Faungnawakij, Nawin Viriya-empikul, Wiwut Tanthapanichakoon

In the present study, a thermodynamic analysis of the autothermal reforming of dimethyl ether (DME) for the production of hydrogen was carried out. The results clearly indicated that the carbon formation behavior, the boundary conditions between coke-free and coking regions, and the equilibrium composition of the reformat were dependent on the steam/DME ratio, O_2 /DME ratio, temperature, and pressure of the system. For instance, carbon formation was effectively suppressed as the steam/DME ratio increased from 0 to 5, the O_2 /DME ratio increased from 0 to 3, or the temperature rose from 100 to 1000 °C. In contrast, carbon formation was enhanced as the pressure was increased from 0.5 to 10 atm. The boundary temperature of coke-free operation decreased with an increase in the steam/DME and O_2 /DME ratios. More specifically, at a steam/DME ratio of 3–5 and an O_2 /DME ratio of 0–3, the boundary temperature ranged from 50 to 280 °C (when CH_4 formation was promoted) and 380 to 670 °C (when CH_4 formation was suppressed), respectively. Furthermore, at elevated temperatures, H_2 and CO formations were enhanced, and CH_4 formation was inhibited. The addition of steam enhanced H_2 production while reducing CO formation. On the contrary, an increase in the O_2 /DME ratio reduced H_2 production while enhancing CO formation. Interestingly, the desired temperature for thermo-neutral condition, in which energy consumption was zero, can be achieved by correctly controlling the O_2 /DME and steam/DME ratios.

Keywords

Thermodynamic analysis; Carbon formation boundary; Dimethyl ether autothermal reforming; Steam reforming; Partial oxidation; Hydrogen



1.18 International Journal of Hydrogen Energy, Volume 37, Issue 3, February 2012, Pages 2498-2508

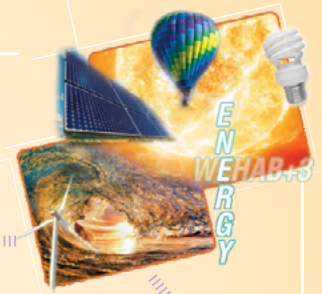
Neural network hybrid model of a direct internal reforming solid oxide fuel cell

Kattiyapon Chaichana, Yaneeporn Patcharavorachot, Bhawasut Chutichai, Dang Saebea, Suttichai Assabumrungrat, Amornchai Arpornwichanop

A mathematical model is an important tool for analysis and design of fuel cell stacks and systems. In general, the complete description of fuel cells requires an electrochemical model to predict their electrical characteristics, i.e., cell voltage and current density. However, obtaining the electrochemical model is quite a difficult and complicated task as it involves various operational, structural and electrochemical reaction parameters. In this study, a neural network model was first proposed to predict the electrochemical characteristics of solid oxide fuel cell (SOFC). Various NN structures were trained based on the back-propagation feed-forward approach. The results showed that the NN with optimal structure reliably provides a good estimation of fuel cell electrical characteristics. Then, a neural network hybrid model of a direct internal reforming SOFC, combining mass conservation equations with the NN model, was developed to determine the distributions of gaseous components in fuel and air channels of SOFC as well as the performance of the SOFC in terms of power density and fuel cell efficiency. The effects of various key parameters, e.g., temperature, pressure, steam to carbon ratio, degree of pre-reforming, and inlet fuel flow rate on the SOFC performance under steady-state and isothermal conditions were also investigated. A combination of the first principle model and NN presents a significant advantage of predicting the SOFC performance with accuracy and less computational time.

Keywords

Solid oxide fuel cell; Neural network; Hybrid model; Direct internal reforming; Performance analysis.



1.19 **Procedia Engineering, Volume 42, 2012, Pages 1292-1301**

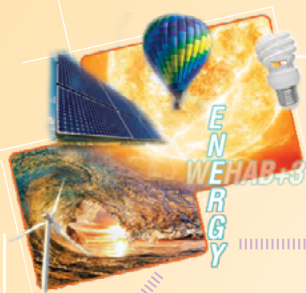
Optimal design of biodiesel production process from waste cooking palm oil

Lida Simasatitkul, Rafiqul Gani, Amornchai Arpornwichanop

A design methodology for biodiesel production from waste cooking palm oil is proposed. The proposed method is flexible to the biodiesel process using various catalyst types: alkali and acid catalyst in homogenous and heterogeneous forms, and different process: enzyme process and supercritical process. A two-step approach of hydrolysis and esterification processes is also considered. Waste cooking palm oil consists of a mixture of triglyceride (e.g., trilaurin, tripalmitin, triolein, tristearin, trilinolein and trilinolenin) and free fatty acids (e.g., lauric acid, palmitic acid, stearic acid, oleic acid, linoleic and linolenic acid). A driving force approach and thermodynamic insight are employed to design separation units (e.g., flash separator and distillation) minimizing the energy consumption. Steady-state simulations of the developed biodiesel processes are performed and economic analysis is used to find a suitable biodiesel process. The results show that based on a net present value, the heterogeneous acid catalyzed process is the best process for biodiesel production. With the design methodology, the proposed biodiesel process can save the energy requirement of 41.5%, compared with a conventional process.

Keywords

Process design; Biodiesel production; Waste cooking palm oil; Superstructure



1.20 Computers & Chemical Engineering, Volume 57, 15 October 2013, Pages 48-62

Design methodology for bio-based processing: Biodiesel and fatty alcohol production

Lida Simasatitkul, Amornchai Arpornwichanop, Rafiqul Gani

A systematic design methodology is developed for producing multiple main products plus side products starting with one or more bio-based renewable source. A superstructure that includes all possible reaction and separation operations is generated through thermodynamic insights and available data. The number of alternative processes is systematically reduced through a screening procedure until only feasible alternatives are obtained. As part of the methodology, process intensification involving reaction–separation tasks is also considered to improve the design by shifting the equilibrium reactions. Economic analysis and net present value are determined to find the best economically and operationally feasible process. The application of the methodology is presented through a case study involving biodiesel and fatty alcohol productions.

Keywords

Design methodology; Superstructure; Process intensification; Biodiesel production; Fatty alcohol production



1.21

Resource and Energy Economics, In Press, Corrected Proof, Available online 17 October 2013

Intergenerational equity with individual impatience in a model of optimal and sustainable growth

Lee H. Endress, Sittidaj Pongkijvorasin, James Roumasset, Christopher A. Wada

Among the ethical objections to intergenerational impartiality is the violation of consumer sovereignty given that individuals are impatient. We accommodate that concern by distinguishing intra- and inter-generational discounting in an OLG model suitable for analyzing sustainability issues. Under the assumption of constant elasticity of marginal felicity, the optimum trajectory of aggregate consumption is guided, via the Ramsey condition, by the intergenerational discount rate but not the personal discount rate. In an economy with produced capital and a renewable resource, intergenerational neutrality results in a sustained growth path, without the necessity of a sustainability constraint, even in the presence of intragenerational impatience. We also find that green net national product remains constant along the optimal approach path to golden rule consumption.

Keywords

Sustainability of optimal growth; Intergenerational equity; Intra-generational discounting; Renewable resources; GNNP



1.22 International Journal of Hydrogen Energy, Volume 37, Issue 15, August 2012, Pages 11104-11112

Hydrogen production from alcohol wastewater by an anaerobic sequencing batch reactor under thermophilic operation: Nitrogen and phosphorous uptakes and transformation

Patcharee Intanoo, Pramoch Rangsunvigit, Weerachart Namprohm, Bandhit Thamprajamchit, Jittipan Chavadej, Sumaeth Chavadej

The objective of this study was to investigate hydrogen production from alcohol wastewater using an anaerobic sequencing batch reactor (ASBR) under thermophilic operation and at a constant pH of 5.5. Under the optimum COD loading rate of 68 kg/m³d, the produced gas contained 43% H₂ without methane and the system provided a hydrogen yield and specific hydrogen production rate of 130 ml H₂/g COD removed and 2100 ml H₂/l d, respectively, which were much higher than those obtained under the mesophilic operation. Under thermophilic operation, both nitrogen and phosphate uptakes were minimal at the optimum COD loading rate for hydrogen production and most nitrogen uptake was derived from organic nitrogen. Under the thermophilic operation for hydrogen production, the nutrient requirement in terms of COD:N:P was found to be 100:6:0.5, which was much higher than that for the methanogenic step for methane production under both thermophilic and mesophilic operations and for the acidogenic step for hydrogen production under mesophilic operation.

Keywords

Hydrogen production; Alcohol wastewater; Anaerobic sequencing batch reactor (ASBR); Thermophilic operation; N and P requirement



1.23 **Renewable and Sustainable Energy Reviews, Volume 15, Issue 1, January 2011, Pages 564-573**

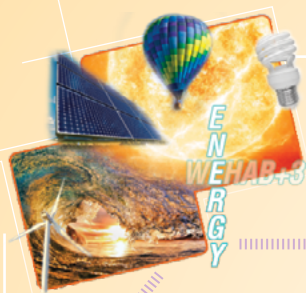
Status and outlook for Thailand's low carbon electricity development

Narumitr Sawangphol, Chanathip Pharino

Thailand is facing an urgency to enhance its energy security and capacity to cope with global warming impacts, as demands on fossil fuel consumption keep rising. This paper reviewed the latest situation on renewable powers and developmental strategies toward low carbon electricity generation in Thailand. Government recently has spent tremendous financial and legislative supports to promote the uses of indigenous renewable energy resources and fuel diversification while contributing in reduction of global greenhouse gas. Major policy challenge is on which types of renewable energy should be more pronounced to ensure sustainable future of the country. Regions in Thailand present different potentials for renewable supply on biomass, municipal wastes, hydropower, and wind. To maximize renewable energy development in each area, location is matter. Currently, energy-derived biomass is widely utilized within the country, however if droughts happen more often and severe, it will not only affect food security but also energy security. Life cycle of biomass energy production may cause other social issues on land and chemical uses. Meanwhile, deployment of wind and solar energy has been slow and needs to speed up to the large extent in comparison with energy proportion from biomass. Nuclear power has already been included in the Thai power development plan 2010 (PDP-2010). However, public acceptance is a major issue. Setting up strategic renewable energy zone to support power producer according to pre-determined potential location may assist development direction. Furthermore, government has to strongly subsidize research and development to lower technology cost and promote private investment on renewable energy industry. In the future, revision of electricity price is needed to allow fair competition between non-renewable and renewable energy once subsidy programs are ended. Environmental tax according to fuel types could help government progressing toward low carbon electricity. Stimulating renewable energy development and utilization at local community is a key for Thai sufficiency economy.

Keywords

Low carbon electricity; Renewable energy expansion; Fuel diversification



1.24 **Ceramics International, Volume 37, Issue 2, March 2011, Pages 659-663**

TiO₂/modified natural clay semiconductor as a potential electrode for natural dye-sensitized solar cell

Ni-on Saelim, Rathanawan Magaraphan, Thammanoon Sreethawong

TiO₂/modified natural bentonite clay semiconductor, as a potential electrode of dye-sensitized solar cell, having a Ti:Si molar ratio of 85:15 was, for the first time, compared with pure TiO₂ (commercial P25) electrode in terms of solar cell efficiency and characteristics. 4-Chloro-2,5-difluorobenzoic acid and 4-(chloromethyl)benzoyl chloride were added to the electrodes to increase light harvesting ability of natural dyes extracted from red cabbage, rosella, and blue pea. The results showed that the TiO₂/clay semiconductor provided a higher surface area but a slightly lower efficiency than the pure TiO₂. The best natural sensitizer was found to be the dye extracted from red cabbage. Besides, the 4-(chloromethyl)benzoyl chloride provided a higher short circuit current for the TiO₂/clay semiconductor.

Keywords

D. TiO₂; Modified natural bentonite clay; Dye-sensitized solar cell; Natural dye; Additive material



1.25 Energy Conversion and Management, Volume 52, Issues 8–9, August 2011, Pages 2815-2818

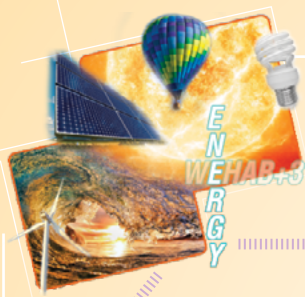
Preparation of sol-gel TiO₂/purified Na-bentonite composites and their photovoltaic application for natural dye-sensitized solar cells

Ni-on Saelim, Rathanawan Magaraphan, Thammanoon Sreethawong

The sol-gel TiO₂/purified natural clay electrodes having Ti:Si molar ratios of 95:5 and 90:10 were initially prepared, sensitized with natural red cabbage dye, and compared to the sol-gel TiO₂ electrode in terms of physicochemical characteristics and solar cell efficiency. The results showed that the increase in purified Na-bentonite content greatly increased the specific surface area and total pore volume of the prepared sol-gel TiO₂/purified Na-bentonite composites because the clay platelets prevented TiO₂ particle agglomeration. The sol-gel TiO₂/5 mol% Si purified Na-bentonite and sol-gel TiO₂/10 mol% Si purified Na-bentonite composites could increase the film thickness of solar cells without cracking when they were coated as a scattering layer on the TiO₂ semiconductor-based film, leading to increasing the efficiency of the natural dye-sensitized solar cells in this work.

Keywords

Sol-gel TiO₂; Purified natural clay; Dye-sensitized solar cell; Red cabbage dye; Scattering layer



1.26 Energy Procedia, Volume 9, 2011, Pages 207-215

Enhancing Biogas Production from Padauk Angsana Leave and Wastewater Feedstock through Alkaline and Enzyme Pretreatment

P. Juntarasiri, S. Nijsunkij, T. Buatick, E. Jamkrajang, S. Wacharawichanant,
M. Seadan, A. Wasantakorn, S. Suttiruengwong

This work aimed to investigate the effect of pretreatment conditions on biogas production of Padauk Angsana leave (PA) or *Pterocarpus indicus* Wild with industrial wastewater at ambient condition. The biomass with %TS of 2, 5 and 10 were used in the study. 2%wt NaOH and cellulase were used as pretreatment agents. The one step and two steps pretreatments using NaOH, cellulase and both were compared. The amount of produced biogas was collected every 6 hrs in the period of 54 days. The results for untreated biomass case showed the 10%TS of PA achieved the highest biogas production. Similarly, for pretreated biomass using 2wt% NaOH, 10%TS of PA showed the highest biogas production. the best condition for methane production was found to be the two steps pretreatment, where 5%TS of biomass was soaked in 2%wt NaOH for 24 hours, followed by soaking in cellulase for 24 hours.

Keywords

Biogas; Anaerobic digestion; Pretreatment; Cellulose; *Pterocarpus indicus* Wild



1.27 Applied Energy, Volume 107, July 2013, Pages 1-9

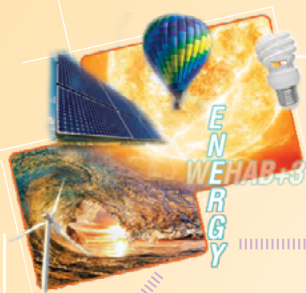
An optimization model for natural gas supply portfolios of a power generation company

Panida Jirutitijaroen, Sujin Kim, Oran Kittithreerapronchai, José Prina

This paper considers a deregulated electricity market environment where a natural gas-fired generation company can engage in different types of contracts to manage its natural gas supply as well as trade on the electricity market. If the contracts are properly designed, they can protect the company from fluctuations in electricity price and demand, at some cost to the company's expected profit. This reduction in profit can be mitigated by trading on the natural gas and electricity spot markets, but this trading activity may also sometimes result in losses. A stochastic programming model is formulated to capture the hedging decisions made by the company, as well as the interactions between the natural gas and electricity markets. The benefits offered by this approach for profit maximization in a variety of business scenarios, such as the case where the company can hold some amount of gas in storage are studied and presented. It is found that the stochastic model enables the company to optimize the electricity generation schedule and the natural gas consumption, including spot price transactions and gas storage management. Several managerial insights into the natural gas market, natural gas storage, and distribution profit are given.

Keywords

Energy portfolio; Natural gas supply portfolio; Stochastic programming; Value of the stochastic solution



1.28 International Journal of Hydrogen Energy, Volume 36, Issue 20, October 2011, Pages 12810-12821

Hydrogen production from alcohol distillery wastewater containing high potassium and sulfate using an anaerobic sequencing batch reactor

Pawinee Searmsirimongkol, Pramoch Rangsunvigit, Malinee Leethochawalit, Sumaeth Chavadej

In this study, the feasibility of hydrogen production from alcohol distillery wastewater containing high potassium and sulfate was investigated using an anaerobic sequencing batch reactor (ASBR). The seed sludge taken from an anaerobic tank treating the distillery wastewater was boiled for 15 min before being fed to the ASBR. The ASBR system was operated under different feed chemical oxygen demand (COD) values and different COD loading rates at a mesophilic temperature of 37 °C, a controlled pH at 5.5, and a cycle time of 6 cycles per day. When the studied ASBR was operated under the best conditions (providing a maximum hydrogen production efficiency) of a feed COD of 40,000 mg/l, a COD loading rate of 60 kg/m³ d, and a hydraulic retention time of 16 h, the produced gas was found to contain 34.7% H₂ and 65.3% CO₂, without any methane being detected. Under these best conditions, the specific hydrogen production rate (SHPR) of 270 ml H₂/g MLVSS d (or 3310 ml H₂/l d), and hydrogen yield of 172 ml H₂/g COD removed, were obtained. When the feed COD exceeded 40,000 mg/l, the process performance in terms of hydrogen production decreased because of the potassium and sulfate toxicity.

Keywords

Hydrogen production; Dark fermentation; Alcohol distillery wastewater; Anaerobic sequencing batch reactor



1.29

International Journal of Hydrogen Energy, Volume 36, Issue 1, January 2011, Pages 1200-1205

Catalyzed LiBH_4 and MgH_2 mixture for hydrogen storage

Pattaraporn Sridechprasat, Yindee Suttisawat, Pramoch Rangsunvigit, Boonyarach Kitiyanan, Santi Kulprathipanja

The hydrogen desorption/absorption of the 2:1 mole ratio of LiBH_4 and MgH_2 with and without a catalyst was investigated. In the case of the uncatalyzed $\text{LiBH}_4/\text{MgH}_2$ mixture, the first hydrogen desorption started at 50 °C. The amount of released hydrogen was 8.6 wt% at the first hydrogen desorption and dramatically reduced to 1.8 wt% at the tenth hydrogen desorption. The decrease in the hydrogen capacity in the subsequent hydrogen desorption may be due to the irreversibility of LiBH_4 . To investigate effects of a catalyst on the hydrogen desorption, 3 mol% of TiCl_3 , HfCl_4 , ZrCl_4 , or VCl_3 was added to the $\text{LiBH}_4/\text{MgH}_2$ mixture. The lowest hydrogen desorption temperature, 260 °C, was from the sample with TiCl_3 . An amount of the catalyst also influenced the kinetics of the hydride mixture and 5 mol% seems to be an optimum amount of TiCl_3 that resulted in the lowest hydrogen desorption temperature, 240 °C. In addition, the higher the amount of a catalyst, the lower the amount of the released hydrogen.

Keywords

LiBH_4 ; MgH_2 ; Catalyst; Hydrogen storage



1.30

Current Applied Physics, Volume 11, Issue 1, Supplement, January 2011,
Pages S163-S165

Fabrication and characterization of solar cells containing polydiacetylene

*Pennapa Muthitamongkol, Chanchana Thanachayanont,
Mongkol Sukwattanasinitt*

This report deals with a study of the incorporation of an amphiphilic polydiacetylene, poly(PCDA) in a polymer bulk heterojunction solar cell with MEH-PPV. A poly(PCDA) inserted layer was prepared by spin-coating a poly(PCDA) solution on PEDOT:PSS/ITO coated glass slide. The solar cells structure was completed by spin-coating MEH-PPV solution and Al sputtering, respectively, on top to form ITO/PEDOT:PSS/PDA/MEH-PPV/Al structure. Comparing to the device without poly(PCDA) layer, the current density–voltage characteristics of the device with poly(PCDA) showed an increase of the power conversion efficiency from 0.00035 to 0.00057%, fill factor from 0.18 to 0.19, open circuit voltage from 0.93 to 1.02 V and short-circuit current density from 0.0021 to 0.0029 mA/cm² under Air Mass 1.5 simulated solar illumination (100 mW cm⁻²). The surface morphology of the poly(PCDA) layer studied by AFM imaging revealed that the pre-coated layer of PEDOT:PSS layer improved the roughness and surface coverage of poly(PCDA) on the silicon wafer. Cyclic voltametry gave the HOMO and the LUMO of poly(PCDA) of -5.9 and -4.1 eV, respectively. UV–Vis absorption spectroscopy of poly(PCDA) film showed the absorption band in the range of 500–750 nm with the maximum absorption at around 680 nm.

Keywords

MEH-PPV; PCDA; Organic solar cells; PEDOT:PSS



1.31 **Renewable Energy, Volume 50, February 2013, Pages 365-372**

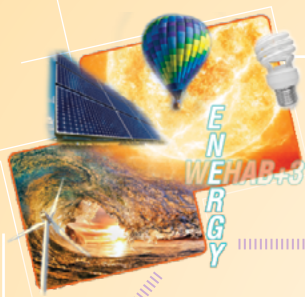
Road testing of a three-wheeler driven by a 5 kW PEM fuel cell in the absence and presence of batteries

Pornpote Piumsomboon, Kejvalee Pruksathorn, Mali Hunsom, Nisit Tantavichet, Krittika Charutawai, Waraporn Kittikiatsophon, Banyong Nakrumpai, Angkee Sripakagorn, Phisit Damrongkijkarn

The road testing and demonstration of a three-wheeler vehicle driven by a 5 kW proton exchange membrane fuel cell (PEMFC) was carried out in the absence and presence of lead acid batteries. Prior to integrating the PEMFC module and batteries in the three-wheeler, they were tested and demonstrated separately. The PEMFC module had a very fast response as the load was manually or, especially, automatically changed and it could supply a continuous power when the reactant was supplied continuously. In contrast, the 5 kW lead acid batteries alone could supply power for no longer than 300 s. In the presence of both the PEMFC module and batteries, when the drawing power was in the range of the PEMFC module capacity the propulsion motor gained its energy from the PEMFC module only, whilst the stack power output at all conditions was greater than the setting power of approximately 400 W. After integrating the PEMFC module and batteries into the three-wheeler, both energy sources were found to power the vehicle effectively. The motor power as well as the stack power changed as a linear proportion to the throttle. The motor consumed more power in case of high speed driving, take off or hill climbing, while it used only 0.354 kW in the absence of throttle. The hybrid system can achieve a maximum speed in this three-wheeler of around 24.9 km/h with a hydrogen consumption of 11 g H₂/km (71 g H₂/kWh) and an operating cost of 1.99 USD/km. The thermodynamic efficiency of the vehicle was 42.9%.

Keywords

Three-wheeler; Fuel cell stack; Hybrid system; Proton exchange membrane fuel cell



1.32

Fish & Shellfish Immunology, Volume 34, Issue 4, April 2013, Pages 990-1001

Prophenoloxidase system and its role in shrimp immune responses against major pathogens

Piti Amparyup, Walaiporn Charoensapsri, Anchalee Tassanakajon

The global shrimp industry still faces various serious disease-related problems that are mainly caused by pathogenic bacteria and viruses. Understanding the host defense mechanisms is likely to be beneficial in designing and implementing effective strategies to solve the current and future pathogen-related problems. Melanization, which is performed by phenoloxidase (PO) and controlled by the prophenoloxidase (proPO) activation cascade, plays an important role in the invertebrate immune system in allowing a rapid response to pathogen infection. The activation of the proPO system, by the specific recognition of microorganisms by pattern-recognition proteins (PRPs), triggers a serine proteinase cascade, eventually leading to the cleavage of the inactive proPO to the active PO that functions to produce the melanin and toxic reactive intermediates against invading pathogens. This review highlights the recent discoveries of the critical roles of the proPO system in the shrimp immune responses against major pathogens, and emphasizes the functional characterizations of four major groups of genes and proteins in the proPO cascade in penaeid shrimp, that is the PRPs, serine proteinases, proPO and inhibitors.

Keywords

Shrimp; *Penaeus*; Phenoloxidase; Melanization; proPO system



1.33 Current Applied Physics, Volume 11, Issue 3, May 2011, Pages 393-401

Effect of dielectric constant and electric field strength on dielectrophoresis force of acrylic elastomers and styrene copolymers

R. Kunanuruksapong, A. Sirivat

The effects of dielectric constant and electric field strength on the deflection angle and the dielectrophoresis force of acrylic elastomers and styrene copolymers were investigated. The dielectrophoresis forces of six elastomers were determined in a vertical cantilever fixture by measuring the deflection distance under various electric field strengths. The forces were calculated from the non-linear deflection theory of the cantilever. As an electric field is applied, five elastomers, with the exception of SAR, deflect towards the anode side of the electrodes. For these elastomers, internal dipole moments are generated under electric field leading to the attractive force between the elastomers and the anode. SAR contains metal impurities (Cu and Zn) determined by EDX. Their presence introduces a repulsive force between the Cu^{2+} and Zn^{2+} ions and the anodic electrode, leading to the bending towards the neutral electrode. The dielectrophoresis forces of the six elastomers generally increase with increasing electric field strength, and increase monotonically with the dielectric constants. AR71 ($\epsilon' = 6.33$) has the lowest electrical yield point (75 V/mm) but it generates the highest force. On the other hand, SIS ($\epsilon' = 2.74$) has the highest electrical yield point (400 V/mm) and it generates the lowest force.

Keywords

Dielectric properties; Elastomers; Dielectrophoresis force; Block copolymers; Electromechanical responses



1.34 **Bioresource Technology, Volume 120, September 2012, Pages 6-12**

Biofuel production from crude palm oil with supercritical alcohols: Comparative LCA studies

*Ruengwit Sawangkeaw, Sunsanee Teeravitud, Pornpote Piumsomboon,
Somkiat Ngamprasertsith*

A recent life cycle assessment (LCA) reported that biodiesel production in supercritical alcohols (SCA) produces a higher environmental load than the homogeneous catalytic process because an enormous amount of energy is required to recover excess alcohol. However, the excess alcohol could be dramatically reduced by increasing the operating temperature to 400 °C; although the product would have to be considered as an alternative biofuel instead of biodiesel. A comparative LCA of the biodiesel production in two SCA at 300 °C (C-SCA) and novel biofuel production in the same two SCA at 400 °C (N-SCA) is presented. It was clear that the N-SCA process produces a dramatically reduced environmental load over that of the C-SCA process due to a lower amount of excess alcohol being used. The N-SCA process could be improved in terms of its environmental impact by changing from fossil fuel to biomass-based fuels for the steam generation.

Keywords

Biofuel; Biodiesel; Life cycle assessment; Supercritical alcohol; Vegetable oil



1.35 Fuel Processing Technology, Volume 92, Issue 12, December 2011, Pages 2285-2292

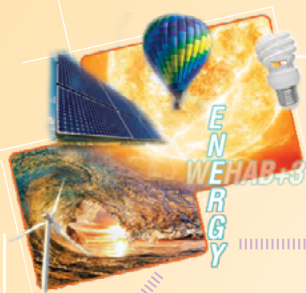
Continuous production of biodiesel with supercritical methanol: Optimization of a scale-up plug flow reactor by response surface methodology

Ruengwit Sawangkeaw, Kunchana Bunyakit, Somkiat Ngamprasertsith

A scale-up plug flow reactor was evaluated for the continuous production of biodiesel from refined palm kernel oil (PKO) with supercritical methanol and optimized by response surface methodology. The effects of the operating temperature (270–350 °C), pressure (15.0–20.0 MPa) and methanol:PKO molar ratio (20:1–42:1) were evaluated at a constant residence time of 20 ± 2 min by using a central composite design. Analysis of variance demonstrated that a modified quadratic regression model gave the best coefficient of determination ($R^2 = 0.9615$) and adjusted coefficient of determination (Adj. $R^2 = 0.9273$). The interaction terms in the regression model illustrated small synergistic effects of both temperature–pressure and temperature–methanol:PKO molar ratio. The optimal conditions were 325 ± 5 °C, 18.0 ± 0.5 MPa and a methanol:PKO molar ratio of 42 ± 2 :1, attaining a maximum production rate of 18.0 ± 1.5 g biodiesel/min with a fatty acid methyl ester content of $93.7 \pm 2.1\%$. The product obtained from the optimal conditions had high cetane number, and could be considered as a fuel additive for cetane number enhancement.

Keywords

Biodiesel; Supercritical methanol; Plug flow reactor; Response surface methodology; Scale-up reactor



1.36 Bioresource Technology, Volume 102, Issue 22, November 2011, Pages 10704-10710

Biofuel production from palm oil with supercritical alcohols: Effects of the alcohol to oil molar ratios on the biofuel chemical composition and properties

*Ruengwit Sawangkeaw, Sunsanee Teeravitud, Kunchana Bunyakiat,
Somkiat Ngamprasertsith*

Biofuel production from palm oil with supercritical methanol (SCM) and supercritical ethanol (SCE) at 400 °C and 15 MPa were evaluated. At the optimal alcohol to oil molar ratios of 12:1 and 18:1 for the SCM and SCE processes, respectively, the biofuel samples were synthesized in a 1.2-L reactor and the resulting biofuel was analyzed for the key properties including those for the diesel and biodiesel standard specifications. Biofuel samples derived from both the SCM and SCE processes could be used as an alternative fuel after slight improvement in their acid value and free glycerol content. The remarkable advantages of this novel process were: the additional fuel yield of approximately of 5% and 10% for SCM and SCE, respectively; the lower energy consumption for alcohol preheating, pumping and recovering than the biodiesel production with supercritical alcohols that use a high alcohol to oil molar ratio of 42:1.

Keywords

Biofuel; Fuel properties; Supercritical alcohol; Thermal cracking; Vegetable oil



1.37 Renewable and Sustainable Energy Reviews, Volume 25, September 2013, Pages 97-108

A review of lipid-based biomasses as feedstocks for biofuels production

Ruengwit Sawangkeaw, Somkiat Ngamprasertsith

This review aims to provide up-to-date knowledge on existing feedstocks for biofuels production (mainly biodiesel) from lipid-based biomasses. The 1st generation of lipid-based feedstocks was edible plant oils, whilst other alternative feedstocks were discovered and reported as the 2nd generation feedstocks. The 2nd generation feedstocks that are summarized in this work include non-edible oils, waste vegetable oil, animal fats, industrial wastes and by-products, lipid derived from insects and microorganisms. The general strong points of the 2nd generation feedstocks are that they are inexpensive, of high productivity and typically do not compete ethically or economically with food crops (edible oils). However, all 2nd generation feedstocks usually have a high level of moisture and free fatty acids that cause an extremely negative effect on conventional biodiesel production process. Thus, this article provides basic information on the processing techniques that are capable of handling 2nd generation feedstocks as well.

Keywords

Animal fat; Biodiesel; Biofuel; Lipid-based biomass; Vegetable oil



1.38 Computer Aided Chemical Engineering, Volume 31, 2012, Pages 250-254, Copyright © 2012 Elsevier B.V. All rights reserved

Heat-integrated reactive distillation for biodiesel production from Jatropha oil

*Samapom Phuenduang, Porntida Chatsirisook, Lida Simasatitkul,
Woranee Paengjuntuek, Amornchai Arpornwichanop*

Minimizing the biodiesel production cost by using inexpensive and inedible feedstock like Jatropha oil is more practical as it is readily available and also not competes with edible oils. However, Jatropha oil contains high free fatty acid content, which causes operational problems in biodiesel production via alkaline-based transesterification reaction. This study aims to design a biodiesel production process from Jatropha oil. A hydrolysis reactor is applied to convert triglyceride in Jatropha oil to fatty acid. The fatty acid obtained then reacts with methanol to produce methyl ester (biodiesel product) using an esterification process. A reactive distillation is employed to intensify reaction and separation tasks for the esterification process. In order to minimize energy consumption, the heat integration of a reactive distillation process is considered. The simulation result using a flowsheet simulator indicates that the heat-integrated reactive distillation can improve the biodiesel production by minimizing the energy requirements, compared with a conventional process.

Keywords

Reactive distillation; Heat integration; Biodiesel production; Jatropha oil



1.39 International Journal of Hydrogen Energy, Volume 36, Issue 11, June 2011, Pages 6553-6559

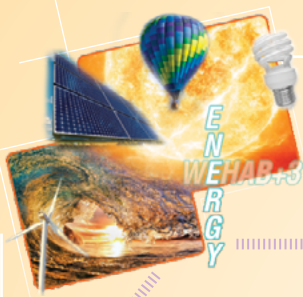
Synthesis of mesoporous-assembled TiO₂ nanocrystals by a modified urea-aided sol-gel process and their outstanding photocatalytic H₂ production activity

Singto Sakulphaemaruehai, Thammanoon Sreethawong

Mesoporous-assembled TiO₂ nanocrystals with very high photocatalytic H₂ production activity were synthesized through a modified sol-gel process with the aid of urea as mesopore-directing agent, heat-treated under various calcination temperatures, and assessed for their photocatalytic H₂ production activity via water splitting reaction. The resulting mesoporous-assembled TiO₂ nanocrystals were systematically characterized by N₂ adsorption-desorption analysis, surface area and pore size distribution analyses, X-ray diffraction (XRD), scanning electron microscopy (SEM), and transmission electron microscopy (TEM). The experimental results showed that the photocatalytic H₂ production activity of the synthesized mesoporous-assembled TiO₂ nanocrystal calcined at 500 °C, which possessed very narrow pore size distribution, was extraordinarily higher than that of the commercially available P-25 TiO₂ and ST-01 TiO₂ powders.

Keywords

TiO₂; Urea; Sol-gel; Photocatalysis; Hydrogen production



1.40 Renewable Energy, Volume 60, December 2013, Pages 439-445

An assessment of Thailand's feed-in tariff program

Sopitsuda Tongsopit, Chris Greacen

Thailand was one of the first Asian countries with a comprehensive feed-in tariff program, with streamlined interconnection regulations adopted by the Thai Cabinet in 2002 and technology-specific tariff 'Adders' in 2006. This paper presents an overview of the country's feed-in tariff, or Adder, program and its development. As of December 2011, Thailand has about 8000 MW of renewable energy projects in the pipeline seeking Adder and about 1000 MW already connected and selling power to the grid. Thailand's feed-in tariff program has undergone significant transitions especially since 2010 in tariff levels and screening criteria partly in response to applications for 471 solar electric power plants exceeding 2000 MW. A powerful new oversight committee comprising utility and Ministry of Energy representatives has raised concerns regarding transparency and consistency, and significantly reduced approval rates of new applications.

Keywords

Feed-in tariff; Adder; Thailand; Renewable energy policy; VSPP; SE Asia



1.41 Fuel Processing Technology, Volume 115, November 2013, Pages 11-18

Synergetic effect during co-pyrolysis/gasification of biomass and sub-bituminous coal

Supachita Krerkkaiwan, Chihiro Fushimi, Atsushi Tsutsumi, Prapan Kuchonthara

In this work, the co-pyrolysis of Indonesian coal (sub-bituminous) and two types of biomass, rice straw and *Leucaena leucocephala* wood, was studied using a drop tube fixed-bed reactor. The gasification reactivity of the obtained co-pyrolyzed char with steam was examined using a rapid heating thermobalance reactor. In the co-pyrolysis, a synergetic effect, in terms of higher gas yield and lower tar and char yields, was manifested especially at a biomass and coal ratio of 1:1. This synergetic effect could be explained by the transferring of active OH and H radicals from the biomass to the coal as well as the catalytic role of potassium (K) from the biomass. In the steam gasification, the *in situ* pyrolyzed char from the coal/biomass blend exhibited a higher reactivity than that from the coal or the biomass. This could be related to the increased surface area and pore volume of chars from the blend as well as the influence of volatile K released from the biomass. In addition, the biomass type appeared to have a significant influence not only on the magnitude of the synergetic effect during the co-pyrolysis but also on the reactivity of the resultant chars.

Keywords

Co-pyrolysis; Co-gasification; Coal; Biomass; Synergetic effect; Thermobalance reactor



1.42 **Solar Energy, Volume 91, May 2013, Pages 174-185**

Shortwave thermal performance for a glass window with a curved venetian blind

Somsak Chaiyapinunt, Nopparat Khamporn

This paper presents a study of thermal performance for a glass window with a curved venetian blind installed on the indoor side in terms of heat gain in the shortwave part of radiation. The curved venetian blind, whose optical properties are considered nonspecular, is modeled as an effective layer. The mathematical model of the combined glass window and venetian blind is developed by combining the mathematical model of glass window and the mathematical model of a curved venetian blind using the matrix layer calculation method. The experiment is performed in a test room to measure the heat gain due to solar radiation passing through the glass window with a curved venetian blind installed in the shortwave part of radiation. The predicted results from the developed model are compared with the experimental results. The agreement between the predicted results and the experimental results is good. From the study it is found that installing a curved venetian blind to the glass window causes a significant reduction in heat gain compared to the plain glass window. The heat gain through the glass window with blind in the shortwave part of radiation (solar heat gain coefficient in the shortwave part of radiation (ShW SHGC)) is analyzed. It is found that the ShW SHGC is mainly affected by the slat properties, slat angle and solar profile angle. The glass window using blind with a lower value of slat reflectance, will have a smaller value of ShW SHGC. The slat distance also affects the ShW SHGC. The glass window using blind with a lower value of slat distance has a lower value of ShW SHGC. The effect of the slat curvature on the ShW SHGC is small when compared to the effect of other parameters. The effects of the investigated parameters on the ShW SHGC for diffuse radiation are similar to the effects on the ShW SHGC for direct radiation. When installing blind to different kinds of glass window other than clear glass window, it is found that the thermal performance is similar to the case of clear glass window. The magnitude of the ShW SHGC for the glass window with blind is also dependent on the optical properties of the glass window used. The glass window with blind using a lower value of the glass transmittance has a lower value of the ShW SHGC. The absorptance of the glass window has direct effect on the solar heat gain coefficient in the longwave part of radiation (LoW SHGC).

Keywords

Venetian blind; Glass window; Solar heat gain coefficient; Shortwave radiation; Thermal performance



1.43 International Journal of Hydrogen Energy, Volume 36, Issue 9, May 2011, Pages 5246-5261

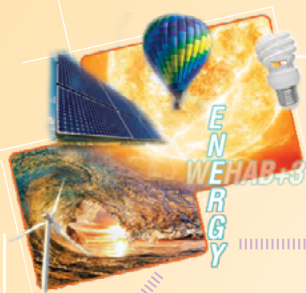
Hydrogen production from water splitting under UV light irradiation over Ag-loaded mesoporous-assembled TiO_2 - ZrO_2 mixed oxide nanocrystal photocatalysts

Surakerk Onsuratoom, Sumaeth Chavadej, Thammanoon Sreethawong

Hydrogen production from the photocatalytic water splitting reaction is very attractive because it is an environmentally friendly process, where hydrogen is produced from two abundantly renewable sources, i.e. water and solar energy, with the aid of photocatalysts. TiO_2 is the most widely investigated photocatalyst; however, it alone still exhibits low performance to photocatalytically produce hydrogen. Hence, the aim of this work focused on the enhanced photocatalytic hydrogen production over Ag-loaded mesoporous-assembled TiO_2 - ZrO_2 mixed oxide nanocrystal photocatalysts under UV light irradiation. The TiO_2 - ZrO_2 mixed oxides with various TiO_2 -to- ZrO_2 molar ratios were synthesized by a sol-gel process with the aid of a structure-directing surfactant, followed by Ag loading via a photochemical deposition method. The influences of photocatalyst preparation parameters, i.e. calcination temperature, phase composition, and Ag loading, were studied. The results revealed that the mesoporous-assembled TiO_2 - ZrO_2 mixed oxide nanocrystal photocatalyst with a TiO_2 -to- ZrO_2 molar ratio of 93:7 calcined at 500 °C exhibited the highest photocatalytic hydrogen production activity, and the Ag loading of 0.5 wt.% further greatly enhanced the photocatalytic activity of such TiO_2 - ZrO_2 mixed oxide photocatalyst.

Keywords

Photocatalytic water splitting; Hydrogen production; Mesoporous assembly; TiO_2 - ZrO_2 mixed oxide; Ag loading



1.44 International Journal of Hydrogen Energy, Volume 38, Issue 10, 1 April 2013, Pages 3930-3936

Thermodynamic analysis of combined unit of biomass gasifier and tar steam reformer for hydrogen production and tar removal

Supawat Vivanpatarakij, Suttichai Assabumrungrat

A combined unit of biomass gasifier and tar steam reformer (CGR) was proposed in this study to achieve simultaneous tar removal and increased hydrogen production. Tar steam reforming calculations based on thermodynamic equilibrium were carried out by using Aspen Plus software. Thermodynamic analysis reveals that when selecting appropriate operating conditions, exothermic heat available from the gasifier could sufficiently supply to the heat-demanding units including feed preheaters, steam generator and reformer. The effects of gasification temperature (T_{gs}), reforming temperature (T_{ref}) and steam-to-biomass ratio ($S:BM$) on percentages of tar removal and improvement of H_2 production were investigated. It was reported that the CGR system can completely remove tar and increase H_2 production (1.6 times) under thermally self-sufficient condition. The increase of H_2 production is mainly via the water-gas shift reaction.

Keywords

Biomass gasification; Tar reformer; H_2 production



1.45 International Journal of Hydrogen Energy, Volume 38, Issue 14, 10 May 2013, Pages 5555-5562

Comparative study of fuel gas production for SOFC from steam and supercritical-water reforming of bioethanol

Suwimol Wongsakulphasatch, Worapon Kiatkittipong, Suttichai Assabumrungrat

Theoretical study of fuel gas ($H_2 + CO$) production for SOFC from bioethanol was carried out to compare performances between two reforming technologies, including steam reforming (SR) and supercritical-water reforming (SCWR). It demonstrates that the fuel gas productions are comparable among the two reforming systems; however, SCWR requires the operation at much higher temperature and pressure than SR. The maximum hydrogen yield can be obtained at 850 K, atmospheric pressure, ethanol to water molar feed ratio of 1:20 for SR system and at 1300 K, 22.1 MPa, and ethanol to water feed ratio of 1:20 for SCWR. The use of a distillation column to purify the bioethanol feed was proven to improve the fuel conversion efficiency of both systems. The analysis reveals that SCWR is a promising system for fuel production for SOFC when a gas turbine is incorporated to the system for energy recovery. Further, it is not necessary to distil bioethanol to obtain too high ethanol recovery (i.e. >90%) as higher energy consumption at the distillation column could lead to lower overall thermal efficiency.

Keywords

Steam reforming; Supercritical-water reforming; Bioethanol; Gibbs free energy minimization



1.46 Fuel, Volume 105, March 2013, Pages 345-352

Theoretical analysis of a glycerol reforming and high-temperature PEMFC integrated system: Hydrogen production and system efficiency

*Suthida Authayanun, Wisitsree Wiyaratn, Suttichai Assabumrungrat,
Amornchai Arpornwichanop*

The aim of this study is to theoretically analyze the performance and efficiency of a glycerol processing and high-temperature proton exchange membrane fuel cell (HT-PEMFC) integrated system. Glycerol is considered a renewable fuel source for hydrogen production. In comparison with methane, glycerol shows a better performance in terms of high hydrogen production and low possibility to carbon formation. However, the content of CO_2 in the reformat gas and its dilution effect as well as the energy required for the glycerol processor should be concerned. When considering the operation of the glycerol processor for HT-PEMFCs, the reformer temperature (T_r) has a significant influence on hydrogen content in the reformat gas, whereas the steam-to-carbon ratio (S/C) affects hydrogen production slightly. In addition, the content of CO in the reformat gas satisfies the required constraint for HT-PEMFC operation. The performance and efficiency of the glycerol reforming process and HT-PEMFCs integrated system are evaluated by considering a heat recovery and a water balance.

Keywords

High-temperature PEMFC; Fuel processor; Glycerol; Hydrogen production; Theoretical analysis



1.47 **Materials Research Bulletin, Volume 46, Issue 10, October 2011, Pages 1604-1609**

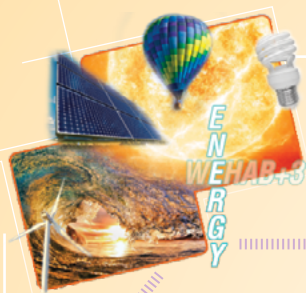
Hydrothermal synthesis of titanate nanoparticle/carbon nanotube hybridized material for dye sensitized solar cell application

T. Charinpanitkul, P. Lorturn, W. Ratismith, N. Viriya-empikul, G. Tumcharern, J. Wilcox

With the hydrothermal treatment, titanate nanostructure with distinctively different morphology and surface characteristics was successfully synthesized from commercial rutile titania powder dispersed in accommodating media which were deionized water or NaOH solution. Hybridized materials of titanate nanoparticles and carbon nanotubes (CNT) were also synthesized by the hydrothermal treatment process. Intrinsic interaction of titanate nanoparticles and CNTs could be confirmed by spectroscopic analysis. The synthesized titanate nanoparticle/CNT hybridized material was then employed for fabricating a working electrode of dye-sensitized solar cells (DSSC). Based on experimental results, DSSC fabricated from the hybridized titanate nanoparticles and carbon nanotubes could provide the highest photoconversion efficiency of approximately 3.92%.

Keywords

A. Composites; A. Nanostructures; C. Electron microscopy; C. Infrared spectroscopy



1.48 International Journal of Hydrogen Energy, Volume 38, Issue 11, 15 April 2013, Pages 4368-4379

Hydrogen production from catalytic supercritical water reforming of glycerol with cobalt-based catalysts

Thirasak Pairojpiriyakul, Eric Croiset, Worapon Kiatkittipong, Kunlanan Kiatkittipong, Amornchai Arpornwichanop, Suttichai Assabumrungrat

Glycerol reforming under catalytic supercritical water at temperatures in the range of 723–848 K using Co catalyst deposited on various supports including ZrO_2 , yttria-stabilized zirconia (YSZ), La_2O_3 , $\gamma-Al_2O_3$, and $\alpha-Al_2O_3$ was investigated. An increase in operating temperature promoted the continued increase in glycerol conversion; however, carbon formation causing system operation failure was observed for $\gamma-Al_2O_3$ and $\alpha-Al_2O_3$ at high operating temperatures (i.e. 748–798 K). Co supported on YSZ provided the most efficient performance for hydrogen production. 10 wt.% Co loading on YSZ support was an optimum amount to enhance the reaction. The increase in glycerol conversion and reduction of the amount of liquid products were observed for lower weight hourly space velocity (WHSV), higher operating temperature or higher cobalt loading. On Co/YSZ catalyst, glycerol conversion of 0.94 and hydrogen yield of 3.72 was obtained with WHSV of 6.45 h^{-1} at 773 K.

Keywords

Hydrogen production; Supercritical water; Glycerol reforming; Cobalt-based catalysts



1.49 Energy Procedia, Volume 14, 2012, Pages 1286-1291

Fuel Gas Generation from Thermochemical Conversion of Crude Glycerol Mixed with Biomass Wastes

Viboon Sricharoenchaikul, Duangduen Atong

Greater usage of biodiesel worldwide results in significant generation of glycerol waste from transesterification process of plant oil. In the work reported here, thermal conversion of biodiesel manufacturing wastes including extracted physic nut and palm shell mixed with glycerol waste was carried out using a tubular reactor at 700-900 °C. Studied parameters were reaction temperature, ratio of each wastes, air factor and residence time. Mixed wastes were first pelletized to cylindrical shape of 2 mm diameter and 3 mm height before feeding into the reaction vessel at the feeding rate of 5 g/min. Air and nitrogen were used as reacting and carrier gases, respectively. Product gases contained mainly of CO, CO₂, H₂, CH₄ were continuously measured by dedicated online TCD/NDIR analyzer. Results indicated that as reaction temperature increased, CO₂ decreased while yields of CO, CH₄ and H₂ increased. Greater conversion to CO₂, CO, H₂ occurred with air factor increased from 0.0 to 0.3. Further increase in air factor resulted in lesser CO and H₂ from greater competing combustion reactions. CH₄ decreased when air factor changed from 0.0 to 0.6. The maximum gas LHV's are 3.48 MJ/m³ and 2.27 MJ/m³ for glycerol waste mixed with physic nut waste and palm shell waste, respectively. The maximum of mole ratio of H₂ to CO obtained is 0.59 for physic nut and 0.37 for palm shell mixed wastes. These findings showed that products from co-gasification of mixed wastes from biodiesel production may be used for power generation or further upgraded to produce value added fuel product which would significantly improve the economics of this waste-to-energy process.

Keywords

Biodiesel; Glycerol; Gasification; Thermal Conversion



1.50 **International Journal of Electrical Power & Energy Systems, Volume 39, Issue 1, July 2012, Pages 36-47**

Optimal sizing of photovoltaic distributed generators in a distribution system with consideration of solar radiation and harmonic distortion

Vichakorn Hengsitawat, Thavatchai Tayjasanant, Natthaphob Nimpitiwan

This paper presents a probabilistic approach to design an optimal size of photovoltaic distributed generator (PV-DG) in a distribution system. A steady-state voltage stability index is applied to select PV-DG locations. The objective of the proposed technique is to minimize average system active power losses, while considering power quality constraints (i.e., voltage regulation, total harmonic voltage distortion, total demand distortion and harmonic currents). Monte Carlo simulation is applied to acquire solar radiations, ambient temperatures, load demands and substation voltages. The proposed technique is tested on an actual 51-bus medium voltage distribution system in Thailand. From simulations, there is a different solution between selecting the optimal size of PV-DG from with and without considering background harmonics. Also in realistic cases, PV-DGs may improve voltage regulation and decrease losses in distribution systems; however, increase total harmonic voltage distortion values.

Keywords

Photovoltaic generation; Power quality; Probabilistic approach;
Distributed generation



1.51 International Journal of Hydrogen Energy, Volume 36, Issue 13, July 2011, Pages 7696-7706

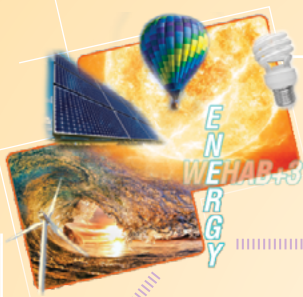
Selection of appropriate primary fuel for hydrogen production for different fuel cell types: Comparison between decomposition and steam reforming

W. Khaodee, S. Wongsakulphasatch, W. Kiatkittipong, A. Arpornwichanop, N. Laosiripojana, S. Assabumrungrat

In order to select a proper hydrogen production system being compatible with fuel cell, a variety of interesting primary fuels such as light hydrocarbons and alcohols were tested in the decomposition (D) and the steam reforming (SR) processes by thermodynamic approach. The reaction performances of the systems particularly under thermally self-sustained condition were focused on. To obtain self-sustained condition, two approaches, splitting feed and splitting gas product streams to the burner for heat supply to endothermic hydrogen processor, are investigated. Our results revealed that splitting gas product gave higher carbon capture than splitting feed but lower in hydrogen yield. As expected, steam reforming provides higher hydrogen production, however, lower in hydrogen purity and carbon capture comparing to decomposition process. By considering primary fuels, D-alcohols could be applied to MCFC and SOFC, among these, D-C₂H₅OH was preferable because it gives the highest ratio of H₂/CO. For D-light hydrocarbon systems, which is operated at 1100 K providing 97% hydrogen purity, is suitable to be connected to MCFC, SOFC and also PEMFC.

Keywords

Gibbs free energy minimization; Decomposition; Steam reforming; Hydrocarbon; Energy self-sustained operation



1.52 Energy Procedia, Volume 9, 2011, Pages 25-34

Impact of Economic Restructuring on the Energy System in Thailand

Weerin Wangjiraniran, Supawat Vivanpatarakij, Raksanai Nidhiritdhikrai

The objective of this study is to explore the scenarios of energy and energy-related greenhouse gases with different pictures of future economic structure to 2030. The scenario without change of economic structure under the current energy policy, namely reference scenario (REF)' is simulated. Economic activities in industrial and service sector rely on the current structure. The existing schemes of energy policy and planning, e.g. renewable energy and efficiency, are assumed to continue with the achievement on their target. Comparatively, an alternative scenario with the target of economic restructuring namely case with economic structural change (ECOS)' is illustrated. In this case, the activities in agricultural and service sector will become much more important, while the activities in industrial sector become saturated. By using an energy accounting model namely Long-range Energy Alternative Planning system (LEAP)', the impact of the economic structure change on the pattern of energy consumption and energy-related greenhouse gases by sector for two different scenarios will be comparatively revealed.

Keywords

Energy model; Energy-related greenhouse gases; Economic restructuring; Scenario



1.53 Fuel Processing Technology, Volume 116, December 2013, Pages 16-26

Diesel-like hydrocarbon production from hydroprocessing of relevant refining palm oil

*Worapon Kiatkittipong, Songphon Phimsen, Kunlanan Kiatkittipong,
Suwimol Wongsakulphasatch, Navadol Laosiripojana, Suttichai Assabumrungrat*

This paper demonstrates the initiated use of relevant refining palm oil for bio-hydrogenated diesel production. The conversions of crude palm oil (CPO) and its physical refining including degummed palm oil (DPO) and palm fatty acid distillate (PFAD) to diesel fuel by hydroprocessing were studied. The effects of operating parameters (i.e. reaction time, operating temperature, and pressure) and catalyst (i.e. Pd/C and NiMo/ γ -Al₂O₃) were examined in order to determine suitable operating condition for each feedstock. It was found that the hydroprocessing of CPO with Pd/C catalyst at 400 °C, 40 bar, and reaction time of 3 h provides the highest diesel yield of 51%. When gum which contains phospholipid compounds is removed from CPO, namely DPO, the highest diesel yield of 70% can be obtained at a shorter reaction time (1 h). In the case of PFAD, which consists mainly of free fatty acids, a maximum diesel yield of 81% could be observed at milder conditions (375 °C with the reaction time of 0.5 h). The main liquid products are *n*-pentadecane and *n*-heptadecane, having one carbon atom shorter than the corresponding fatty acids according to decarboxylation/decarbonylation pathways. Pd/C catalyst shows good catalytic activity for fatty acid feedstocks but becomes less promising for triglyceride feedstocks when compared to NiMo/ γ -Al₂O₃.

Keywords

Bio-hydrogenated diesel (BHD); Hydrotreated vegetable oil (HVO); Green diesel; Renewable liquid fuel; Deoxygenation; Phosphorous



1.54 Solar Energy, Volume 92, June 2013, Pages 189-195

Enhancing efficiency of $\text{Cu}(\text{In}, \text{Ga})\text{Se}_2$ solar cells on flexible stainless steel foils using NaF co-evaporation

W. Thongkham, A. Pankiew, K. Yoodee, S. Chatraphorn

The fabrication of $\text{Cu}(\text{In}, \text{Ga})\text{Se}_2$ (CIGS) thin film solar cells on flexible stainless steel (SS) foils or Na free substrates needs the impurity blocking barrier to prevent the diffusion of undesired elements from the substrate into the CIGS as well as the addition of alkali doping especially Na in the CIGS absorber layer. The amount Na in terms of the thicknesses of NaF was varied from 30 Å to 200 Å in order to study its contributions to the efficiency of the CIGS solar cells. The results show that the Na content in the CIGS films has a direct influence to the open-circuit voltage leading to the energy conversion efficiency and affects the distribution of Ga in the CIGS film. The influence of Na was studied and compared, based on the results of the performance of the solar cells, by using the NaF co-evaporation in various steps during the CIGS deposition process. The optimum thickness of NaF is approximately 50 Å to achieve the maximum efficiency of 15.8% without antireflection coating. In addition, the quantum efficiency (QE) indicated different absorption in the long wavelength regions depending upon the methods of Na addition.



1.55 **Applied Energy, Volume 88, Issue 3, March 2011, Pages 909-913**

Investigation of electrodeposited Ni-based coatings for biodiesel storage

*Yuttanant Boonyongmaneerat, Chamaiporn Sukjamsri, Ukrit Sahapatsombut,
Sawalee Saenapitak, Sittha Sukkasi*

Biodiesel commonly experiences oxidative and hydrolytic degradation, leading to problems of low storage stability and corrosion of fuel containers. This study investigates the fabrication and use of electrodeposited nickel and nickel–tungsten alloys as potential coating materials that effectively protect steel-based biodiesel containers from corrosion. Through long-term static immersion, surface analyses of the coatings, and assessments of the biodiesel's acidity, it is determined that the electrodeposited nickel is well compatible with biodiesel, whereas the addition of tungsten deteriorates the corrosion resistance of nickel. Tight control of the tungsten content in nickel deposits is required to enhance both mechanical integrity and corrosion resistance of the deposits exposed to biodiesel environments.

Keywords

Electroplating; Biofuel; Oxidation stability; Corrosion



2.0

Consumers Association of Penang, Malaysia

2.1

Energy Conversion and Management, Volume 43, Issue 13, September 2002, Pages 1725-1736

Daylighting as a passive solar design strategy in tropical buildings: a case study of Malaysia

A Zain-Ahmed, K Sopian, M.Y.H Othman, A.A.M Sayigh, P.N Surendran

The use of daylighting in buildings and architecture is not new. Natural lighting became out of vogue due to the availability of cheap electricity, the predictability and the ability to control illumination levels due to artificial lighting. However, the alarm over rapid depletion of energy resources and the environmental effects of their applications have led designers to reuse daylighting strategies in buildings in order to minimise energy use for lighting and air conditioning as a result of heat gains from the daylight sources and the electrical fixtures. This paper describes a study on the savings achieved by using daylight in passive solar design of buildings and, in this case, the size of windows. Simulated exterior illuminance levels based on long term measured solar irradiation and cloud cover data were used to estimate interior illumination on normal working planes using simple building configurations. Illumination on these planes decreases the need for artificial lighting, thus energy can be saved. A simple algorithm was then used to calculate the overall cooling load to ascertain that the daylighting strategies used do not invoke an increase in thermal gains through walls and glazings. The findings from this study show that at least 10% savings can be produced from simple daylighting strategies.

Keywords

Daylighting, Solar irradiation, Illumination, Energy



2.2

Building and Environment 39 (2004) 713 – 717

Sunlight control and daylight distribution analysis: the KOMTAR case study

Sharifah Fairuz Syed Fadzila, Sheau-Jiunn Sia

Direct sunlight penetration and daylight distribution analyses were carried out at KOMTAR Penang which is a near-circular office building with 12 bays of continuous orientation. Unlike rectangular plan buildings where one sun shading design device will protect one facade, this cylindrical building requires variations in sun shading devices around the whole perimeter. Daylight data were collected in overcast conditions and compared well with computer simulations, and further simulations were carried out to see the daylight reduction with calculated shading.

Keywords

Illumination level, Window, Residential building, Occupant's perception



2.3 Building and Environment 41 (2006) 1128–1135

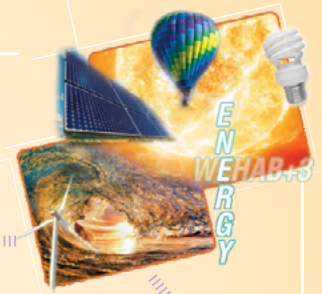
Evaluating visual comfort and performance of three natural lighting systems for deep office buildings in highly luminous climates

Carlos Ernesto Ochoa, Isaac Guedi Capeluto

This work, part of a wider study, presents a qualitative and quantitative approach to evaluate daylighting systems for use in office buildings located in latitudes where natural luminous conditions throughout the year are of high solar radiation, as in Israel. Their widespread application in this kind of climate, where the excessive penetration of direct radiation can be a problem, is possible. They can produce a consequent improvement of working conditions and energy savings, yet this is not the case now. Three different systems that affect penetration of daylight in a sidelit office space were analysed: a single window without any external protection, a horizontal lightshelf and a basic anidolic concentrator, mounted on the view window, together with improved reflectances of the surface's finishes making office space. These were simulated through Radiance in a prototype that responds to a deep office space typology for different seasons of the year and hours of the day. The systems are compared for illuminance and glare performance.

Keywords

Daylighting, Offices, Lightshelf, Anidolic concentrator, Glare, High solar radiation



2.4

Building and Environment, Volume 42, Issue 9, September 2007, Pages 3166-3175

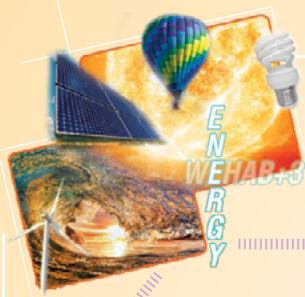
The relative influence of wind, sunlight and temperature on user comfort in urban outdoor spaces

D. Walton, V. Dravitzki, M. Donn

This paper presents the development of a comfort index that measures adaptivity in outdoor spaces. Over a 9-month period 649 people were surveyed in three locations, in temperatures between 10 and 28 °C. An exploratory factor analysis develops a 15-item scale of comfort that includes measures of adaptivity: clothing, exposure time and seating location. The scale is regressed on physical measures: average instantaneous wind speed; maximum wind speed; mean-exposed radiant temperature; mean-shaded radiant temperature and ambient temperature. The results model the relative contributions of the microclimatic factors for the comfort in the outdoor space. Analyses suggest gustiness and wind speed are most important in determining user satisfaction. There is strong support for the theory that people actively adapt to microclimatic conditions.

Keywords

Comfort, Outdoor, Public spaces, Wind, Temperature, Sunlight



2.5

Energy, Volume 34, Issue 2, February 2009, Pages 205-215

Can envelope codes reduce electricity and CO₂ emissions in different types of buildings in the hot climate of Bahrain?

H. Radhi

The depletion of non-renewable resources and the environmental impact of energy consumption, particularly energy use in buildings, have awakened considerable interest in energy efficiency. Building energy codes have recently become effective techniques to achieve efficiency targets. The Electricity and Water Authority in Bahrain has set a target of 40% reduction of building electricity consumption and CO₂ emissions to be achieved by using envelope thermal insulation codes. This paper investigates the ability of the current codes to achieve such a benchmark and evaluates their impact on building energy consumption. The results of a simulation study are employed to investigate the impact of the Bahraini codes on the energy and environmental performance of buildings. The study focuses on air-conditioned commercial buildings and concludes that envelope codes, at best, are likely to reduce the energy use of the commercial sector by 25% if the building envelope is well-insulated and efficient glazing is used. Bahraini net CO₂ emissions could drop to around 7.1%. The simulation results show that the current energy codes alone are not sufficient to achieve a 40% reduction benchmark, and therefore, more effort should be spent on moving towards a more comprehensive approach.

Keywords

Building codes, Electricity and CO₂ emissions benchmarks, Bahrain



2.6

Renewable Energy, Volume 31, Issue 5, April 2006, Pages 631-653

Towards green buildings: Glass as a building element—the use and misuse in the gulf region

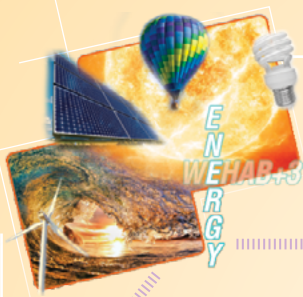
Mohsen M. Aboulnaga

The recent economic growth in the Gulf region notably in Dubai, United Arab Emirates (UAE) has led to a colossal number of buildings that has been constructed in the past 5 years. In the last decade, a total glazed building's façades became the icon of Dubai. This large area of glazing in each façade needs protection against overheating and sun glare in summer. According to leader in energy and environmental design (LEED) glass selection becomes a main element in this equation to contribute towards achieving a green building. The aim of this paper is to investigate the problems associated with misuse of glass, as a building element in UAE particularly in Dubai. Inadequate design with ill-selected glass/glazing type may lead not only to poor daylighting in building interiors but also contribute significantly to fatigue, insomnia, seasonal affective disorder (SAD) and above all increase CO₂ emission.

The purpose of the study is to specify the required improvements to permit natural, 'free' daylight to filter through the building façade into interior space, especially with the right type of glass. This paper examines the status of buildings in Dubai in terms of glass type, visible light transmittance, reflection (out/in) and relative heat gain. A quantitative analysis is conducted to assess the impact of glass on the building users' performance in terms of daylight environment. A recent built high-rise office building was selected in the investigation to assess whether selected glass provide the recommended daylight factor (DF) and daylight level (DL) according to IES standards. The results revealed that most the glass/glazing was misused in 70% of buildings in intermediate and low performance groups. The DF and DD in the selected office building were unexpectedly tremendous and found far beyond the recommended level due to the use of spectrally selective glazing (clear on both sides).

Keywords

Glass, Glazing, Green building, Energy consumption, Daylighting, Hot climate, Gulf region



2.7

Renewable Energy, Volume 22, Issues 1–3, January–March 2001, Pages 45-52

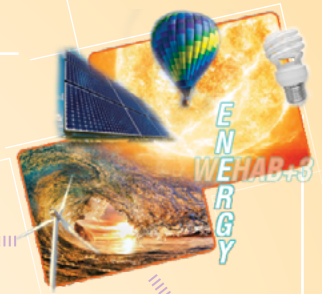
The importance of interior daylight distribution in buildings on overall energy performance

P Greenup, J.M Bell, I Moore

Simulations of daylight distribution within a house show that there can be significant visual discomfort associated with specific sky conditions. Thermal models of the same building, which include simplified daylight calculations and which calculate annual energy performance of the building, do not reflect extreme visual discomfort and high thermal load associated with these sky conditions. These results illustrate the importance of more detailed interior daylight distribution calculations in assessing the thermal and visual comfort of a building, and in developing energy performance ratings for buildings. Some techniques for incorporating more detailed interior daylight distribution calculations in simplified thermal models are discussed.

Keywords

Daylight, Lighting simulation, Thermal simulation, Building energy, Visual comfort



2.8

Building and Environment, Volume 44, Issue 3, March 2009, Pages 509-514

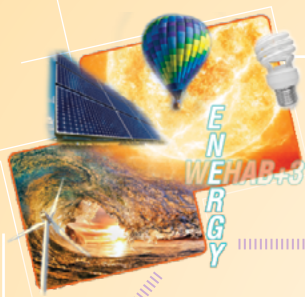
Estimation of lighting energy savings from daylighting

Pyonchan Ihm, Abderrezek Nemri, Moncef Krarti

This paper refines and validates the predictions of a simplified analysis method for evaluating the potential of daylighting to save energy use associated with electrical lighting. Specifically, impacts on daylighting performance are investigated for several combinations of building geometry, window size, and glazing type for several US and international locations. The impact of both dimming and stepped daylighting controls and their settings are also investigated. Predictions from the simplified method are validated using measurements obtained from field-testing of a daylighting control system utilized to operate lighting fixture illuminating an office space.

Keywords

Daylighting, Energy savings, Field-testing, Simplified method



2.9

Energy Policy, Volume 35, Issue 2, February 2007, Pages 1050-1063

An application of energy and exergy analysis in residential sector of Malaysia

R. Saidur, H.H. Masjuki, M.Y. Jamaluddin

In this paper, the useful concept of energy and exergy utilization is defined, analyzed and applied to the residential sector of Malaysia by taking into account the energy and exergy flows for a period of 8 years from the year 1997 to 2004. The energy and exergy efficiencies are determined for the devices used in this sector and found to be 70% and 28%, respectively. Energy and exergy flow diagrams for the overall efficiencies of Malaysian residential sector are also illustrated in this paper. It is found that the current methodology applied in Saudi Arabia is suitable to analyze energy and exergy use in Malaysian residential sector. It has been found that the exergy efficiency of the Malaysian residential sector appears to be much lower than its corresponding energy efficiency. It has been observed that about 21% of total exergy losses are caused by refrigerator-freezer and 12% of total loss is caused by air conditioner. Washing machine, fan and rice cooker contribute about 11%, 10% and 8% of total exergy losses, respectively.

Keywords

Energy, Exergy, Appliances



2.10 Energy Conversion and Management, Volume 48, Issue 5, May 2007, Pages 1601-1614

All sky modeling daylight availability and illuminance/irradiance on horizontal plane for Mahasarakham, Thailand

*Singthong Pattanasethanon, Charoenporn Lertsatitthanakorna,
Surat Atthajariyakul, Somchart Soponronnarit*

This paper presents the results of a study on all sky modeling and daylight availability for the tropical climate found in the central region of the northeastern part of Thailand (16°14'N, 103°15'E). The required components of sky quantities, namely global and diffuse horizontal irradiance and global horizontal illuminance for saving energy used in buildings are estimated. The empirical sinusoidal model and a novel sinusoidal model, which consists of polynomial or exponential functions, are validated. A and B values of the empirical sinusoidal model for all sky conditions are determined and developed to become a new function in the polynomial or exponential form of the sky conditions. Observation results from one year's total data indicate that the luminosity and the energy from the sky on a horizontal plane in the area around Mahasarakham are much greater than those of Bangkok. The accuracy of the validated model is determined in terms of the mean bias deviation (MBD), the root mean square deviation (RMSD) and the coefficient of correlation (R_2) values. Comparison of the estimated solar irradiation values and the observed values revealed a small error slide as well.

Keywords

All sky model, Daylight availability, Tropical climate



3.0

Diponegoro University, Indonesia

3.1

World Applied Sciences Journal 26 (11) , pp. 1464-1472, 2013

Biogas production kinetic from vinasse waste in batch mode anaerobic digestion

Budiyono, Syaichurrozi, I., Sumardiono, S.

Bottom product of distillation unit from bioethanol industry is often called as vinasse waste. Anaerobic treatment is one of good choice to convert vinasse into biogas. The purpose of this research was to study the biogas production kinetic from vinasse waste in batch mode anaerobic digestion. The kinetic model of biogas production was developed through modified Gompertz equation. Meanwhile, the kinetic of biodegradability of organic material was developed based on first order kinetic reaction. The research resulted the kinetic constant of biogas production were biogas production potential (A), maximum biogas production rate (U) and minimum time to produce biogas (λ) of 83,982 mL/(kg COD), 19,71 mL/(kg COD.day) and 1.004 days, respectively. Kinetic constant of organic biodegradability material (k) was $-0,059 \text{ day}^{-1}$. Kinetic model could be used to design volume of batch digester anaerobic with the formula $V_{\text{digester}} = 3 * ym (1 - \exp(-k*t)) * m$.

Keywords

Batch mode, Biogas production ,COD/N, Kinetic, Vinasse, Bioethanol industry



3.2

Telkomnika 11 (1) , pp. 17-28. 2013

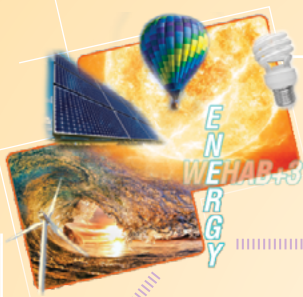
Electrical tracking formation on silane epoxy resin under various contaminants

Syakur, A., Berahim, H., Tumiran, Rochmadi

Contamination at the surface of the insulator becomes a serious problem. Especially for the tropical area, humidity and rainfall play an important role in wetness by the water at the insulator surface, which result in the presence of contaminant and leakage current flowing at the surface. This leakage current will generate heat which occurs at the surface of an insulator. This ultimately leads to flashover. This paper presents the influence of contaminants to leakage current and formation of electrical tracking at the surface of epoxy resin compound wit silicon rubber. The test was based on IPT method with NH_4Cl as contaminants. The industrial and coastal contaminants are used to explain the effect of contaminant at surface tracking process. The flow rate of contaminant was 0.3 ml/min. The 3.5 kV AC high voltage 50 Hz was applied to the top electrodes. It is found that industrial contamination resulting in the smallest surface leakage current is 327.6 mA. Also it is found that coastal contaminant showed the severest damage at surface of test sample. Therefore, special treatment of the sample is needed under these conditions so that the material performance can be improved, especially against the electrical tracking.

Keywords

Contaminant, Epoxy resin, Leakage current, Electrical tracking



3.3

Bioresource Technology 149 , pp. 390-397. 2013

Predicting kinetic model of biogas production and biodegradability organic materials: Biogas production from vinasse at variation of COD/N ratio

Syaichurrozi, I., Budiyono, Sumardiono, S.

The biogas fermentation of vinasse (TS $7.015 \pm 0.007\%$) was investigated within a wide range of COD (Chemical Oxygen Demand)/N (Total Nitrogen) ratio. Urea (46% nitrogen content) was added into substrate to adjust COD/N ratio of 400/7-700/7. This study used batch anaerobic digesters in laboratory-scale that were operated at room temperature in 60 days. The results showed that control variable, 400/7, 500/7, 600/7, 700/7 generated total biogas of 107.45, 123.87, 133.82, 139.17, 113.27 mL/g COD and had the value of COD removal of 31.274 ± 0.887 , 33.483 ± 0.266 , 36.573 ± 1.689 , 38.088 ± 0.872 , $32.714 \pm 0.881\%$, respectively. Variable with COD/N ratio of 600/7 was the best variable. In the kinetic model of biogas production, variable with COD/N of 600/7 had kinetic constant of A (mL/g COD), μ (mL/g COD.day), λ (days) of 132.580, 15.200, 0.213, respectively. The model equation of kinetic of biodegradability organic materials obtained was $c(t) = C_0 - \exp(-\mu t) = C_0 + C_e$.

Keywords

Biodegradability organic materials, Biogas, COD/N ratio, Kinetic model, Vinasse



3.4

World Applied Sciences Journal 28 (1) , pp. 9-19. 2013

Studies of thermal annealing on suppression of plasticization of the asymmetric hollow fiber mixed matrix membranes

Kusworo, T.D., Ismail, A.F., Mustafa, A., Budiyo

Combinations of polymer blending and heat treatment have been investigated to improve the performance of hollow fiber mixed matrix membrane for gas separation. Two types of membranes with polymer blending and combination of polymer blending-heat treatment were prepared to study the effect of combination process on its permeation properties. Asymmetric hollow fiber mixed matrix membranes for gas separation were spun using the dry/wet spinning process from spinning solutions containing polyimide/polyethersulfone blends and N-methyl-2-pyrrolidone (NMP) as a solvent. CO₂ permeance of the membrane with polymer blending but without heat treatment showed a slight increase with increasing feed pressure, indicating that a small amount of CO₂ plasticized the membrane material. As for the heat treated membrane, the effects of temperature and duration of heat treatment were investigated to study the reduction of undesirable CO₂ plasticization. Experimental results showed that the heat treatment at near and above glass transition temperature was sufficient to suppress the CO₂ plasticization. The better adherence of zeolite particles in the polymer matrix combined with formation of charge transfer complexes (CTCs) and cross-linking might be the main factors to enhance the anti-plasticization on the PI/PES-zeolite mixed matrix membrane. Field emission scanning electron microscopy (FESEM) micrographs showed that the selective layer and the substructure of hollow fibers became denser and more compact after the heat treatment. The FESEM micrographs also showed that the polymer blending and heat treatment was increased the adherence of zeolite particle and polymer. Mixed matrix membranes treated at 280°C for 2 hours indicated no plasticization effect and the CO₂ permeance remain practically constant over the applied feed pressures.

Keywords

Mixed matrix membrane, Heat treatment, Charge transfer complex



3.5

Middle East Journal of Scientific Research 18 (9) , pp. 1240-1252. 2013

Preparation of poly ether ether keton as alternative membrane for direct methanol fuel cell (DMFC)

Kusworo, T.D., Dewi, E.L., Arti, D.K., Dhuhita, A., Ismail, A.F., Mohd Norddin, M.N.A., Budiyo

The objective of this study focuses on the characterization of polyetheretherketone (PEEK) membranes for direct methanol fuel cells (DMFC) application. The PEEK membrane was modified with sulfonation and charged surface modifying macromolecule (cSMM) using MDI, DEG and HBS in NMP solvent. The characterized of membrane were done using Scanning Electron Microscopy (SEM), water uptake, contact angle, thermal stability, methanol permeability, proton conductivity and DMFC test. DMFC tests were performed at room temperature to obtain polarization curves that show voltages and power density of each variable. The results showed that the cSMM methode of the polymer increases water uptake, thermal stability, methanol permeability and proton conductivity. In terms of morphology, it was found that cSMM method can be applied for membrane modification for DMFC application. In terms of the DMFC tests of the membranes, SPEEK without modification proved to have the best performance in stability because of its low methanol permeability. In contrast, the best performance was achieved by the SPEEK/cSMM (with modification) in highest voltage and power density because of its high proton conductivity.

Keywords

Charged Surface, Modifying macromolecule, DMFC, Methanol permeability, Polarization Curves, Proton conductivity, SPEEK



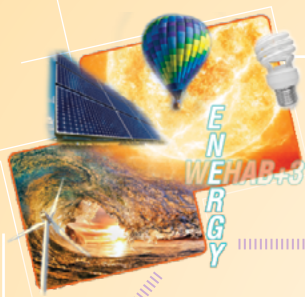
3.6

Syngas: Production, Applications and Environmental Impact, pp 99-120. 2013

Thermodynamic Analysis of Synthesis Gas and Higher Hydrocarbons Production from Methane

Istadi, I.

This chapter focused on thermodynamic chemical equilibrium analysis using method of direct minimization of Gibbs free energy for all possible methane reactions with oxygen (partial oxidation of methane), carbon dioxide (CO_2 reforming of methane), steam (steam reforming of methane), and autothermal reforming. Effects of feed ratios (methane to oxygen, carbon dioxide, and/or steam feed ratio), reaction temperature, and system pressure on equilibrium composition, conversion, and yield were studied. In addition, operating regions of carbon and no carbon formation were also considered at various reaction temperatures and feed ratios in the equilibrium system. It was found that the reaction temperature above 1100 K and CH_4/CO_2 ratio unity were favorable for synthesis gas production for methane-carbon dioxide reaction. The Carbon Dioxide Oxidative Coupling of Methane reaction to produce ethane and ethylene is less favorable thermodynamically. In addition, steam reforming of methane is the most suitable for hydrogen production from methane with low coke formation from thermodynamic point of view.



3.7

Journal of Science and Technology 35 (5) , pp. 563-568. 2013

Impact of hazardous components on CO₂ biofixation from synthetic flue gas using *Chlorella* sp. JPR-1 in a raceway pond photobioreactor

Kumoro, A.C., Hadiyanto, Susanto, H. Songklanakarin

This work aimed to investigate the effects of hazardous compounds (NO and SO₂) in flue gas on *Chlorella* JPR-1 growth in a raceway pond photobioreactor at ambient temperature (30 °C) without pH control. *Chlorella* JPR-1 exhibited its tolerant to CO₂ content in the flue gas as high as 50%. The maximum carbon fixation rate (1.84 g CO₂/L.day) observed when the flue gas contained 10% CO₂. Although the specific growth rate was 25.88% lower than the control culture when cultivated with 50 ppm SO₂, *Chlorella* JPR-1 still could grow when cultured with 100 ppm SO₂ with slightly longer lag phase period. A growth rate reduction of 3.53% of the control culture was observed when *Chlorella* JPR-1 was cultured with flue gas containing 50 ppm NO. This study has shown that *Chlorella* JPR-1 has a high potential to be used for CO₂ fixation from flue gas.

Keywords

Fixation, CO₂, SO₂, NO, Microalgae, Specific growth rate



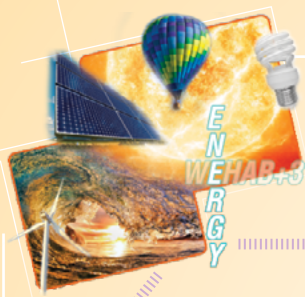
3.8

AIP Conference Proceedings 1554 , pp. 147-149. 2013

Fluorine doped-tin oxide prepared using spray method for dye sensitized solar cell application

Widiyandari, H., Purwanto, A., Diharjo, K., Suyitno, Hidayanto, E.

Fluorine-doped Tin Oxide (FTO) film was fabricated by spray deposition method. FTO films were prepared in different sheet resistance 6.7, 12.1, 19.3, and 23.5 Ω /sq. X-ray diffractograms showed that the as-grown FTO film was tetragonal SnO_2 . The prepared FTO film have an average transmittance of 80% in the visible region ($\lambda=400-800$ nm). These FTO films were then used to fabricate Dye Sensitized Solar Cell (DSSC). The working electrode was made from TiO_2 paste using doctor blade technique. DSSC samples were characterized using solar simulator under AM 1.5 (100 mW/cm^2). It is found that the efficiency of DSSC was much affected by sheet resistance of FTO film. The efficiency of DCCS was 2.32, 2.4, 1.1 and 0.97 (%) for the FTO sheet resistance 6.7, 12.1, 19.3, and 23.5 Ω /sq, respectively. It is shown that the optimum DSSC efficiency was made from FTO with sheet resistance 12.1 Ω /sq.



3.9

Advanced Materials Research 772 , pp. 735-738. 2013

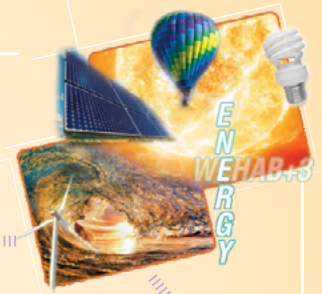
Computational fluids dynamics performances analysis of ramie-albizia composited for wind turbine rotor

Sono, S., Wanto, P., Soedarsono, J.W.

Computational Fluids Dynamics was performed to simulate the performance of torque and output power of wind turbine. Propeller of wind turbine is made by sandwich composite. The composite is combination of ramie fiber with Albizia wood as a core. FLUENT is used to perform simulation of propeller at different wind speeds. The wind speeds ranges from 3 to 5 m/s at coastal area of Kwaru, Bantul, Yogyakarta. Spallart-Almaras method uses to simulate the torque and power output at different Reynold Number. The simulation result shows that the torque of rotor ranges from 25 to 75 Nm, power outputs range from 50 to 240 W and power output coefficients are lay between 0.35 to 0.40 for wind speed from 3 to 5 m/s which is typical in coastal area of Indonesia.

Keywords

Computational Fluid Dynamic (CFD), Performance, Power output, Rotor, Torque



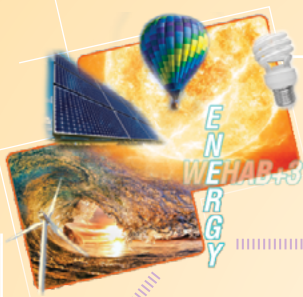
3.10

Journal of Computational and Theoretical Nanoscience 10 (9) , pp. 1956-1962. 2013

Heat transfer characteristic investigation of nanofluids laminar forced convection using numerical method

Afrianto, H., Bayara, N., Kuerbanjiang, W., Tony, M.S.K., Chung, H.S., Jeong, H.M.

The present study was aimed to investigate of laminar forced convection flow of water-Al₂O₃ nanofluids in a horizontal tube by using computational fluid dynamics (CFD) approach. ANSYS Fluent 12 was used to simulate the water based nanofluids considering as a single phase and two phase models as well as employed with constant and dependent temperature. The both models of laminar forced convection in horizontal tube have been simulated in volume concentrations of nanofluids 1% and 4% by varying the Reynolds number at 250 and 1050 respectively. The convective heat transfer coefficient for nanofluids is greater than only base fluid. The heat transfer enhancement increases by particle volume fraction of nanofluids. However it is responsible to the increases of wall shear stress value. Meanwhile, the numerical method showed that the two phase model with dependent temperature has better approach than single phase model with varied thermal properties. © 2013 American Scientific Publishers. All rights reserved.



3.11 Research Journal of Applied Sciences, Engineering and Technology 6 (10), pp. 1732-1739. 2013

Biodiesel production from bulk frying oil with ultrasound assisted

Widayat, Satriadi, H., Yuariski, O., Murwono, D.

The objective of this research is to optimize of biodiesel production with ultrasound assisted. Optimization was used central composite design methods. Biodiesel was produced from frying oil with KOH catalyst and ultrasonic assisted. The variables were investigated temperature, catalyst concentration and ratio of methanol to oil. Biodiesel was separated from reactant and impurities with decantation process and distillation process. The results of research obtained optimum conversion 85.95% in operation condition are methanol/oil 5.05:1, catalyst concentration 1.65% and temperature reaction 50°C. Mathematic modeling for describe in this process like expressed; $Y = 86.2107 - 7.4287X_1 + 1.0661X_2 + 0.6289X_3 - 2.5319X_1^2 - 2.0603X_2^2 - 1.0618X_3^2$. © Maxwell Scientific Organization, 2013.

Keywords

ANOVA, Biodiesel, Central composite design, Optimum, Statistic, Ultrasonic assisted, Yield of biodiesel



3.12 Bulletin of Chemical Reaction Engineering and Catalysis 8 (1) , pp. 47-53. 2013

Preparation and characterization of zeolite membrane for bioethanol purification

Purbasari, A., Istirokhatun, T., Devi, A.M., Mahsunnah, L., Susanto, H.

The use of bioethanol as an alternative fuel with a purity of more than 99.5% wt has prompted research on bioethanol purification. One of the promising methods used for bioethanol purification is pervaporation. This research is aimed to prepare and characterize zeolite membranes for pervaporation. The membrane preparation consisted of two stages, namely support layer preparation and zeolite deposition on the support. In support preparation, α -alumina and kaolin with specific composition (50:30; 40:40; 50:30) was mixed with additives and water. After pugging and aging process, the mixture was extruded into a tubular shape. The tube was then calcined at temperature of 1250 °C for 3 hours. After that, zeolite 4A was deposited on the tubes using clear solution made of 10% wt zeolite and 90% wt water and heated at temperature of 80°C for 3 hours. Furthermore, the resulting zeolite membrane was washed with deionized water for 5 minutes and dried in oven at temperature of 100 °C for 24 hours. Characterization of zeolite membranes included mechanical strength test, XRD, and SEM. In the mechanical strength test, the membrane sample with α -alumina:kaolin = 50:30 (membrane A) had the highest mechanical strength of 46.65 N/mm². Result of the XRD analysis for the membrane A indicated that mullite and corundum phases were formed, where mullite phase was more dominant. Meanwhile the result of SEM analysis showed that zeolite crystals have been formed and covered the pores support, but the deposition of zeolite has not been optimal yet. The ethanol product concentration and permeate flux were influenced by the feed temperature, feed concentration and permeate pressure. The performance examination for bioethanol purification showed that the membrane could increase the purity of bioethanol with maximum purity was 98.5% wt. © 2013 BCREC UNDIP.



3.13 Journal of Applied Phycology , pp. 1-7 . 2013

Bioethanol production from the hydrolysate of *Palmaria palmata* using sulfuric acid and fermentation with brewer's yeast

Mutripah, S., Meinita, M.D.N., Kang, J.-Y., Jeong, G.-T., Susanto, A.B., Prabowo, R.E., Hong, Y.-K.

Seaweeds, particularly species of red macroalgae, are promising resources for bioethanol production because of their exceptionally high carbohydrate content. Of 20 seaweeds evaluated, *Palmaria palmata* (*Rhododymenia palmata*) contained the highest carbohydrate content (469.8 mg g⁻¹ seaweed) with a carrageenan content of 354 mg g⁻¹ seaweed. Such a high carrageenan content makes the high-volume production of bioethanol feasible. Acid hydrolysis of *P. palmata* in 0.4 M H₂SO₄ at 125 °C for 25 min released 27 mg of glucose, 218.4 mg of reducing sugars, and 127.6 mg of galactose per gram of seaweed. Ethanol fermentation of these hydrolysis products using an inoculum concentration of 1.5 mg mL⁻¹ at 30 °C and 72 h in a shaking incubator at 130 rpm yielded 17.3 mg of ethanol per gram of seaweed. © 2013 Springer Science+Business Media Dordrecht.

Keywords

Seaweed; *Palmaria palmata*; Rhodophyta carrageenan; Acid hydrolysis; Bioethanol; Fermentation

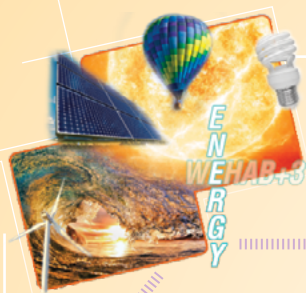


3.14 **Journal of Environmental Science and Technology 6 (2) , pp. 79-90. 2013**

Phytoremediations of Palm Oil Mill Effluent (POME) by using aquatic plants and microalga for biomass production

Hadiyanto, Christwardana, M., Soetrisnanto, D.

Phytoremediation by using aquatic plants and microalgae was evaluated in study to reduce waste load of Palm Oil Mill Effluent (POME). This study was aimed to utilize the aquatic plants i.e. water hyacinth (*Eichhornia crassipes*) and water lily (*Nymphaea* sp.) and alga *Spirulina* sp. to reduce COD and nutrients content in palm oil mill effluent. The phytoremediation was conducted in a sequence process. The aquatic plants were used in the first stage of remediation by varying height of culture (5-15 cm), length of remediation (3-8 days) and type of plants (water hyacinth and water lily). The effluent of the first stage was then transferred to the second remediation where microalgae *Spirulina* use this effluent as medium growth for 15 days. The results showed that the aquatic plants was able to reduce COD, N, P up to 50, 88 and 64%, respectively, while microalgae could reduce the COD, N, P up to 50.79, 96.5 and 85.92%, respectively. The maximum growth rate of *Spirulina platensis* was 0.412 day⁻¹, while the correlation between Optical Density (OD) and dry weight-g L⁻¹ was shown as dry weight (g L⁻¹) = 0.782.OD. In conclusion, two stage phytoremediation process gives promising method to reduce waste load and producing high value able biomass of algae. © 2013 Asian Network for Scientific Information.



3.15 Chemical Engineering Journal 217 , pp. 231-239. 2013

Hydrodynamic evaluations in high rate algae pond (HRAP) design

Hadiyanto, H., Elmore, S., Van Gerven, T., Stankiewicz, A.

Since open ponds are considered to be a proper means to produce microalgae biomass at large scale, the design of these ponds remains a major issue in this field. Besides light intensity, the hydrodynamic characteristics are critical to obtain high microalgae productivity. Hydrodynamic mixing is required to ensure frequent exposure of algae cells to light, to avoid the settling of algae cells, to homogenize the nutrient distribution and to enhance the utilization of CO₂ in the pond. However, the current design of algae ponds lacks visual assessment of hydrodynamic characteristics in the pond, resulting in the appearance of dead zones where the flow is stagnant and in the presence of non-uniform velocity throughout the pond, both of which are still major problems because of their negative impact on algae growth. Therefore, this paper describes these characteristics to support current pond design by using Computational Fluid Dynamic (CFD). In order to simulate the hydrodynamic characteristics of the pond, the variation of velocity, ratio of channel length to width (L/W), and depth of culture were performed and power consumption, dead zone volume and shear stress were evaluated. The results showed that a ratio of L/W higher than 10 yields better performance with respect to velocity uniformity and shear stress. However, power consumption increased, as well. The hydrodynamic flow in the modified pond was simulated, providing better understanding for dead zone volume reduction. To implement this modeling evaluation in the design, an experimental validation is, however, still required. © 2012 Elsevier B.V.

Keywords

Hydrodynamic flow; High rate algae pond (HRAP); Computational Fluid Dynamics (CFD); Turbulence



3.16 Bioresource Technology 130 , pp. 495-501. 2013

Anaerobic digestion of acidified slurry fractions derived from different solid-liquid separation methods

Sutaryo, S., Ward, A.J., Møller, H.B.

Batch assays investigating the ultimate methane yields (B_0) of acidified slurry fractions produced with different solid-liquid slurry separation techniques were done. The result showed that the anaerobic digestion (AD) process was inhibited when raw and liquid fractions of sow, pig and dairy cow acidified slurry are digested, but AD treating solid fractions (SF) acidified slurry showed no sulphide inhibition. The B_0 of SF acidified sow slurry increased significantly with increasing screen size in the screw press. No significant effect of acidification processes on B_0 of SF dairy cow slurry (DCS) was observed. The ultimate methane yields of SF acidified DCS and SF non acidified DCS were 278 ± 13 and $289 \pm 11 \text{ kg VS}^{-1}$, while in term of fresh weigh substrate were 59 ± 2.8 and $59 \pm 0.3 \text{ L kg substrate}^{-1}$, respectively. © 2012 Elsevier Ltd.

Keywords

Biogas; Solid liquid separation; Screen size; Drum screen; Methane balance



3.17 Applied Mechanics and Materials 253-255 (PART 1) , pp. 22-26. 2013

Architecture and environmental sustainability: Critical issues in vernacular kampong of bena, flores

Susetyarto, M.B., Budihardjo, E., Pangarsa, G.W., Hardiman, G.

The word of sustainability has acquired great importance due to the negative impact of various developments on the environment. The rapid developments in rural and urban area during the last decade have been accompanied by active construction which sometimes neglected the impact on the natural environment and human activities. One of the impacts of developments is occurred on the traditional heritage area, as the vernacular architecture of kampong of Bena, Flores, which has not been taken into consideration although the latter represents a rich resource for sustainable building practices. The study aims at examining these developments in the vernacular kampong of Bena, Flores by using an assessment tool that measures the performance of buildings in terms of their sustainability. This study attempts to: (a) develop a comprehensive definition of sustainability to suit the (indigenous) people needs; (b) classify sustainable building practices at local and regional levels; and (c) establish guidelines for future sustainable architecture. Results illustrate that average energy use in contemporary buildings is high and traditional buildings showed less sustainable measures in terms of energy features, energy performance and environmental features. Issues considered in the assessment of buildings such as energy use per square meter and CO₂ emission are alarming. Traditional buildings in the vernacular kampongs of Flores were more sustainable than contemporary buildings. © (2013) Trans Tech Publications, Switzerland.

Keywords

Architecture, Bena, Environment, Flores, Kampong, Sustainability, Vernacular



3.18 International Review of Mechanical Engineering 6 (7) , pp. 1601-1608. 2012

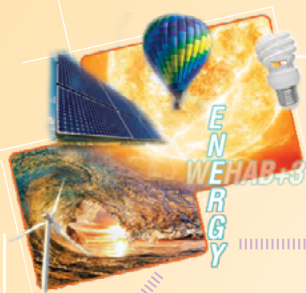
Study on production process of biodiesel from rubber seed (*Hevea Brasiliensis*) by in situ (trans)esterification method

Widayat, Wibowo, A.D.K., Hadiyanto, Jos, B.

Biodiesel is fatty acids methyl or ethyl esters made from vegetable oils (edible and non edible) or animal fats. The objective of this research was conducted on production of biodiesel from rubber seeds by in situ method with a goal for environmentally friendly alternative fuels from non edible raw materials. This research focuses on influence of reaction time, concentration of catalyst and ratio of raw materials to methanol. In the first stage was carried out in order to get reaction time based on the density and viscosity of mixture produced. In this process was used H_2SO_4 0.5% (v/v) and KOH 0.5% (w/v) as catalyst and ratio rubber seed to methanol (1:2). Experiments followed by influencing of catalyst concentration in range 0.1-1% and ratio rubber seed to methanol in range 1:1.5-1:3. Research methods included, the preparation of samples, biodiesel production, biodiesel separation, and biodiesel characterization include density, viscosity, GC analysis, acid value and Iodine number. The results shows that time operation for biodiesel production by using in situ method with acid catalyzed and alkaline catalyzed was 120 and 90 minutes respectively with yield of Fatty Acid Methyl Ester (FAME) was obtained at 91,05% and 58.79% respectively. © 2012 Praise Worthy Prize S.r.l. - All rights reserved.

Keywords

Biodiesel; Rubber seed; In situ; (trans)esterification; Fatty Acid Methyl Ester (FAME)



3.19 Bulletin of Chemical Reaction Engineering and Catalysis 7 (2) , pp. 150-157. 2012

Process parameters optimization of potential $\text{SO}_4^{2-}/\text{ZnO}$ acid catalyst for heterogeneous transesterification of vegetable oil to biodiesel

Istadi, I., Anggoro, D.D., Buchori, L., Utami, I., Solikhah, R.

Among the possible renewable energy resources, diesel fuels derived from triglycerides of vegetable oils and animal fats have shown potential as substitutes for petroleum-based diesel fuels. The biodiesel could be produced from vegetable oils over homogeneous catalyst, heterogeneous catalyst, or enzymatic catalyst. In this study, the synthesized $\text{SO}_4^{2-}/\text{ZnO}$ catalyst was explored to be used in the heterogeneous biodiesel production by using the vegetable oils and methanol. The study began with the preparation of $\text{SO}_4^{2-}/\text{ZnO}$ catalyst followed by the transesterification reaction between vegetable oil with methanol. The independent variables (reaction time and the weight ratio of catalyst/oil) were optimized to obtain the optimum biodiesel (fatty acid methyl ester) yield. The results of this study showed that the acid catalyst $\text{SO}_4^{2-}/\text{ZnO}$ was potential to be used as catalyst for biodiesel production through heterogeneous transesterification of vegetable oils. Optimum operating condition for this catalytic reaction was the weight ratio of catalyst/oil of 8:1 and reaction time of 2.6 h with respect to 75.5 % yield of methyl ester products. The biodiesel product was also characterized to identify the respected fatty acid methyl ester components. © 2012 BCREC UNDIP. All rights reserved.

Keywords

Biodiesel; Super acid catalyst; Palm oil; $\text{SO}_4^{2-}/\text{ZnO}$; Fatty acid methyl ester



3.20 Applied Mechanics and Materials 170-173 , pp. 2751-2755. 2012

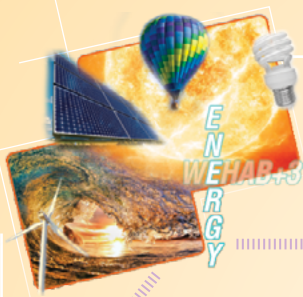
Comparative study of heat transfer in double skin facades on high-rise office building in Jakarta

Daryanto

Building envelope on high-rise office buildings have an important role of energy consumed. There are many methods and techniques that can be used to achieve this goal through energy efficiency for building envelope in the tropic area. The use of glass material becomes one of the alternatives that offer a more attractive appearance. Although the double skin facades (DSF) has been widely applied, but research on the thermal performance and behavior of the wind is still scarce for the tropics, so it is interesting to note related to energy conservation. To obtain a clear picture of the heat transfer and airflow, the research was conducted on the two office buildings with the same orientation and location but they were different on the building envelope. The study was conducted by the field measurements and simulation using CFD-ACE + software, to determine the performance of the heat transfer and behavior of airflow in the double skin facades. The results indicate that the role of wind on the design building envelope has an influence on the heat transfer and energy savings. © (2012) Trans Tech Publications, Switzerland.

Keywords

Computational Fluid Dynamic (CFD), Double Skin Facade, Energy, Heat transfer, Wind

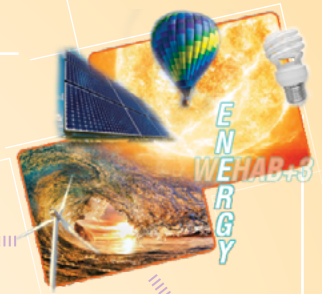


3.21 Bioresource Technology 114 , pp. 195-200. 2012

Thermophilic anaerobic co-digestion of separated solids from acidified dairy cow manure

Sutaryo, S., Ward, A.J., Møller, H.B.

This study examined the potential for partly substituting dairy cow manure (DCM) with solids from solid to liquid separation of acidified dairy cow manure (SFDCM) during thermophilic anaerobic digestion. Three different substituting levels with a maximum of 30% substitution were tested. All digesters substituting DCM with SFDCM showed a stable biogas production with low volatile fatty acid concentrations after a short transition period. An increased methane yield in terms of digester volume compared to DCM alone was obtained with increasing amount of SFDCM and about 50% more methane was achieved when 30% of DCM was substituted with SFDCM. The digestates were subsequently digested in a post digestion, during which the methane yield increased proportionally with increasing amounts of SFDCM. It can be concluded that SFDCM is a suitable biomass for co-digestion and can be used to increase methane yield in terms of digester volume at ratios up to at least 30%. © 2012 Elsevier Ltd.



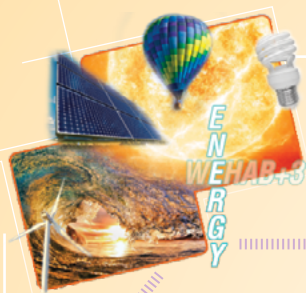
3.22

Journal of Applied Physics 111 (5) , art. no. 054301. 2012

Temperature-dependent ballistic transport in a channel with length below the scattering-limited mean free path

Arora, V.K., Zainal Abidin, M.S., Tan, M.L.P., Riyadi, M.A.

The temperature-dependent ballistic transport, using nonequilibrium Arora distribution function (NEADF), is shown to result in mobility degradation with reduction in channel length, in direct contrast to expectation of a collision-free transport. The ballistic mean free path (mfp) is much higher than the scattering-limited long-channel mfp, yet the mobility is amazingly lower. High-field effects, converting stochastic velocity vectors to streamlined ones, are found to be negligible when the applied voltage is less than the critical voltage appropriate for a ballistic mfp, especially at cryogenic temperatures. Excellent agreement with the experimental data on a metal-oxide-semiconductor field-effect transistor is obtained. The applications of NEADF are shown to cover a wide spectrum, covering regimes from the scattering-limited to ballistic, from nondegenerate to degenerate, from nanowire to bulk, from low- to high-temperature, and from a low electric field to an extremely high electric field. © 2012 American Institute of Physics.



3.23 Thin Solid Films 520 (6) , pp. 2092-2095. 2012

Fabrication of high-performance fluorine doped-tin oxide film using flame-assisted spray deposition

Purwanto, A., Widiyandari, H., Jumari, A.

A high-performance fluorine-doped tin oxide (FTO) film was fabricated by flame-assisted spray deposition method. By varying the NH_4F doping concentration, the optimal concentration was established as 8 at.%. X-ray diffractograms confirmed that the as-grown FTO film was tetragonal SnO_2 . In addition, the FTO film was comprised of nano-sized grains ranging from 40 to 50 nm. The heat-treated FTO film exhibited a sheet resistance of $21.8 \Omega/\square$ with an average transmittance of 81.9% in the visible region ($\lambda = 400\text{-}800 \text{ nm}$). The figures of merit shows that the prepared FTO film can be used for highly efficient dye-sensitized solar cells electrodes. © 2011 Elsevier B.V. All rights reserved.

Keywords

Drying, Adsorption, Regeneration, Energy efficiency, Zeolite



3.24

International Journal of Food Engineering 7 (6) , art. no. 4. 2011

Low temperature drying with air dehumidified by zeolite for food products: Energy efficiency aspect analysis

Djaeni, M., Van Asselt, C.J., Bartels, P.V., Sanders, J.P.M., Van Straten, G., Van Boxtel, A.J.

Developments in low temperature drying of food products are still an interesting issue; especially with respect to the energy efficiency. This research studies the energy efficiency that can be achieved by a dryer using air which is dehumidified by zeolite. Experimental results are fitted to a dynamic model to find important variables for the drying operation. The results show that ambient air temperature as well as the ratio between air flow for drying and air flow for regeneration, affect the energy efficiency significantly. Relative humidity of used air, and shift time have a minor effect on the dryer performance. From the total work, it can be noted that the dryer efficiency operated at 50-60°C achieves 75 percent, which is attractive for drying of food products. © 2011 De Gruyter. All rights reserved.



3.25 2011 International Semiconductor Device Research Symposium, ISDRS 2011, art. no. 6135315. 2011

Ballistic and high field transport in a nano-MOSFET

Riyadi, M.A., Arora, V.K.

The ballistic transport has been extensively discussed for years in search for enhancement of device and circuit performance. The device performance is expected to improve as channel length is reduced below the scattering-limited mean free path (mfp). However, several experimental observations [1-3] reveal that the mobility degrades when the channel length decreases below the long-channel mean free path. Riyadi and Arora[4, 5] point to the fact that ballistic injection from the contacts play a predominant role in enhancing the ballistic mean free path. Non-stationary transient transport results in reduced mobility as transit time delay is below the collision-limited mean free time. Hence steady state is never realized in ballistic devices. The other factor that degrade the mobility is the presence of high electric field $E V/L$ that is necessarily high in scaled-down channel of length L . So far the applied voltage V is below the critical voltage for triggering nonlinear behavior, the high-field effects are negligible as in the experiments of Robertson and Dumin [2]. It was revealed that a mobility of $25,000 \text{ cm}^2/V.s$ in a 500-m channel reduces to only $800 \text{ cm}^2/V.s$ in a $0.2\text{-}\mu$ channel at 4.2 K . High mobilities are thus more susceptible to degradation. The critical voltage $V_{c\infty}$ and V_c play a predominant role in defining whether or not high-field effects are present. The criteria to unscramble ballistic effects from high-field effects will be presented. Fig. 1 shows the critical voltage in a ballistic as well as long-channel MOSFET. As expected, ballistic effect disappears at longer channel length. Actually high-field effects are suppressed in a ballistic channel. At a low voltage of $V=0.1 \text{ V}$, the high-field effects are largely absent at which experimental data is obtained. As applied voltage increases and surpasses the critical voltage, high-field effect further suppresses the mobility. Fig. 2 gives the results of a comparison of theoretical formalism developed with the experimental data. An expression for the ultimate saturation velocity as arising from the intrinsic velocity for a MOSFET is obtained and is critical to interpretation of the experimental data. This intrinsic velocity depends on temperature and carrier concentration. The agreement with the experimental data over a wide range of channel length and ambient temperature gives credence to the theory as well as elucidates new light as new directions are discovered for design and development of low-dimensional devices, including nanowires and carbon-based devices. © 2011 IEEE.



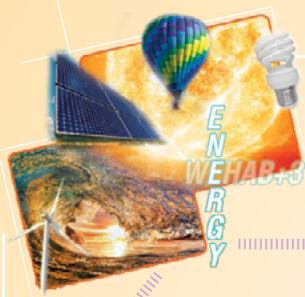
3.26

AIP Conference Proceedings 1341 , pp. 54-61. 2011

Changes in physical properties and molecular structure of polystyrene nanospheres exposed with solar flux

Wibawa, P.J., Agam, M.A., Nur, H., Saim, H.

The effects of solar radiations on physical properties and molecular structures of 200 nm polystyrene nanospheres (PSN) coated on silicon wafer were explored by field emission scanning electron microscope (FESEM) and attenuated total reflectance-Fourier transform infrared (ATR-FTIR) spectrometer. It is revealed the particles shape of PSN changed from spherical to dumbbell-like shape after solar irradiation. Reduction of the PSN size as much as 23.79% after 5 minutes exposure was also observed in PSN particles. We believed that some of the phenyl moieties of polystyrene broke down to facilitate carbon-carbon cross linkage bonds intra- as well as inter-PSN particles and were shown by ATR-FTIR spectrums. These results proven the shrinkage of PSN particles were caused by the change of the molecular structure of the irradiated PSN to be much more dense material. © 2011 American Institute of Physics.



3.27

Journal of Volcanology and Geothermal Research, Volume 261, 1 July 2013, Pages 260-294

Paroxysmal dome explosion during the Merapi 2010 eruption: Processes and facies relationships of associated high-energy pyroclastic density

Jean-Christophe Komorowski, Susanna Jenkins, Peter J. Baxter, Adrien Picquout, Franck Lavigne, Sylvain Charbonnier, Ralf Gertisser, Katie Preece, Noer Cholik, Agus Budi-Santoso, Surono

An 11-minute sequence of laterally-directed explosions and retrogressive collapses on 5 November 2010 at Merapi (Indonesia) destroyed a rapidly-growing dome and generated high-energy pyroclastic density currents (PDCs) spreading over 22 km² with a runout of 8.4 km while contemporaneous co-genetic valley-confined PDCs reached 15.5 km. This event formed Stage 4 of the multi-stage 2010 eruption, the most intense eruptive episode at Merapi since 1872. The deposits and the widespread devastating impact of associated high-energy PDCs on trees and buildings show striking similarities with those from historical volcanic blasts (Montagne Pelée, Martinique, Bezymianny, Russia, Mount St. Helens, USA, Soufrière Hills, Montserrat). We provide data from stratigraphic and sedimentologic analyses of 62 sections of the first unequivocal blast-like deposits in Merapi's recent history. We used high resolution satellite imagery to map eruptive units and flow direction from the pattern of extensive tree blowdown. The stratigraphy of Stage 4 consists of three depositional units (U0, U1, U2) that we correlate to the second, third and fourth explosions of the seismic record. Both U1 and U2 show a bi-partite layer stratigraphy consisting each of a lower L1 layer and an upper L2 layer. The lower L1 layer is typically very coarse-grained, fines-poor, poorly-sorted and massive, and was deposited by the erosive waxing flow head. The overlying L2 layer is much finer grained, fines-rich, moderately to well-sorted, with laminar to wavy stratification. L2 was deposited from the waning upper part and wake of the PDC. Field observations indicate that PDC height reached ~ 330 m with an internal velocity of ~ 100 m s⁻¹ within 3 km from the source. The summit's geometry and the terrain morphology formed by a major transversal ridge and a funneling deep canyon strongly focused PDC mass towards a major constriction, thereby limiting the loss of kinetic energy. This favored elevated PDC velocities and high particle concentration, promoted overspilling of PDCs across high ridges into other river valleys, and generated significant dynamic pressures to distances of 6 km that caused total destruction of buildings and the forest. The Merapi 2010 eruption highlights that explosive and gravitational disintegration of a rapidly growing dome can generate devastating high-energy, high-velocity PDCs. This constitutes a credible high impact scenario for future multi-stage eruptions at Merapi and at other volcanoes that pose particular monitoring, crisis response, and risk reduction challenges.



3.28 Catalysis Communications, Volume 12, Issue 6, 10 February 2011, Pages 525-529

Role of particle size for platinum-loaded tungsten oxide nanoparticles during dye photodegradation under solar-simulated irradiation

Agus Purwanto, Hendri Widiyandari, Takashi Ogi, Kikuo Okuyama

We report the role of size for platinum-loaded tungsten oxide (Pt-WO₃) nanoparticles during the photodegradation of amaranth under solar-simulated irradiation. The systematic variation of Pt-WO₃ size (7.3–42.3 nm) was evaluated for its impact on photodegradation. An optimal size for the highest photocatalytic activity was determined for Pt-WO₃ nanoparticles (18–26.4 nm). Based on the initial rate of photodegradation analysis, the optimal size of Pt-WO₃ exhibited an approximately 3.5-fold higher rate compared with other sizes. The dynamics of the electron/hole recombination process at different sizes indicates that photodegradation activity is dependent on particle size.

Keywords

Photocatalysis; Pt-WO₃; Amaranth; Degradation; Solar-simulated irradiation



4.0

Kampus ITS Surabaya, Indonesia

4.1

INDUSTRIAL CROPS AND PRODUCTS Volume: 33 Issue: 3 Pages: 624-628 , 2011

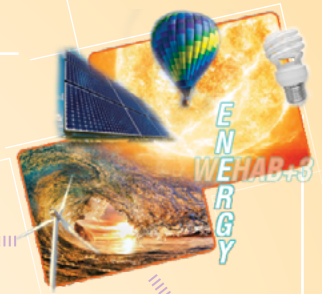
Rice bran, a potential source of biodiesel production in Indonesia

Gunawan, Setiyo; Maulana, Syahrizal; Anwar, Khairiel; et al.

Biodiesel is a biodegradable, renewable, non-toxic and environmentally friendly alternative fuel. The cost of raw materials comprises 60-88% of the production cost in commercial biodiesel (fatty acid methyl esters, FAMES) production. Therefore, the use of low-cost raw material as a substrate and an in situ process for biodiesel production are being preferred. In this case, rice bran, which contains 13.5% oil, was an interesting substrate. In situ esterification of high-acidity rice bran with methanol and sulfuric acid catalyst was investigated. The individual and interaction effects of methanol to rice bran ratio, sulfuric acid catalyst concentration and reaction time on purity and recovery of biodiesel were discussed. Our results suggest that under the following operation conditions: methanol to rice bran ratio of 5 mL/g, sulfuric acid concentration in methanol of 1.5 vol.%, and reaction time of 60 min, an in situ esterification operated on rice bran could yield FAMES with a high purity and recovery. By applying an in situ esterification with n-hexane/water extractions. Indonesia will be successful in obtaining biodiesel from rice bran up to 96,000 ton per year. (C) 2010 Elsevier B.V. All rights reserved.

Keywords

In situ esterification; Methanol to rice bran ratio; Rice bran; Sulfuric acid catalyst concentration



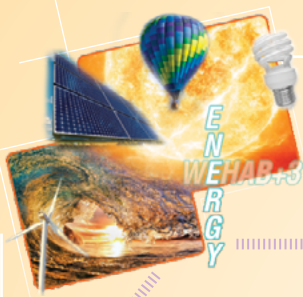
4.2

2012 INTERNATIONAL CONFERENCE ON ADVANCED COMPUTER SCIENCE AND INFORMATION SYSTEMS Pages: 71-75, 2012

A New Area Partitioning Strategy for Unequal Clustering of Wireless Sensor Networks

Suharjono, Amin; Wirawan; Hendrantoro, Gamantyo

It is believed that clustering is the best solution for the need of energy efficiency and scalability on Wireless sensor Networks (WSN). Most recent trend on WSN clustering is combining the multi-hop communication with clustering strategy. The method improves the scalability, especially for large scale networks. However, there is one negative effect of multi-hop communication that commonly called hot-spot problem, where the closer to base-station cluster-heads (CHs) suffer more load because they must relay data from outer CHs. One solution of the problem is designing an unequal cluster model. Some algorithms have been proposed to realize it, but just a little that give a comprehensive energy model. We propose a new circular model for energy consumption of unequal clustered WSN as an improvement version of previous square model. We also present the energy formulation for the proposed scheme.



4.3

JOURNAL OF ASIAN ARCHITECTURE AND BUILDING ENGINEERING Volume: 11
Issue: 2 Pages: 407-414, 2012

Reduction of Energy Consumption by AC due to Air Tightness and Ventilation Strategy in Residences in Hot and Humid Climates

Uno, Tomoko; Hokoi, Shuichi; Ekasiwi, Nastiti N.; et al.

This paper proposes strategies for reducing energy consumption for cooling in residences in hot and humid climates. Based on the results of fieldwork measurements and questionnaire surveys, a simulation of indoor thermal environments in consideration of air conditioner operation was carried out, in order to evaluate energy consumption by air conditioners. This simulation program takes into account both heat and moisture transfer in building materials. In order to simplify the calculation and due to lack of measurement of ventilation volumes, the ventilation volumes are assumed as constant values depending on open or closed windows. The combined effects of building air-tightness and the opening time of windows for ventilation were examined. Making an entire building airtight results in a small reduction in energy consumption, as the air-conditioned area increases. Meanwhile, simply making an air-conditioned room airtight is more effective for reducing cooling energy consumption. Irrespective of this, nighttime ventilation of non-air-conditioned spaces is quite effective in reducing sensible cooling load. Thus, introduction of not only a high degree of insulation but also air-tightness along with well controlled ventilation is required to achieve energy savings in hot and humid climates.

Keywords

Windows and doors opening period (ventilation operating time), Air-tightness, Energy consumption for air conditioners, Hot and humid climate



4.4

INTERNATIONAL CONFERENCE ON THEORETICAL AND APPLIED PHYSICS (ICTAP 2012)
Book Series: AIP Conference Proceedings Volume: 1555 Pages: 99-101 Published:
2013

Thermal Expansion Coefficient Prediction of Fuel-Cell Seal Materials from Silica Sand

Hidayat, Nurul; Triwikantoro; Baqiya, Malik A.; et al.

This study is focused on the prediction of coefficient of thermal expansion (CTE) of silica-sand-based fuel-cell seal materials (FcSMs) which in principle require a CTE value in the range of 9.5-12 ppm/degrees C. A semi-quantitative theoretical method to predict the CTE value is proposed by applying the analyzed phase compositions from XRD data and characterized density-porosity behavior. A typical silica sand was milled at 150 rpm for 1 hour followed by heating at 1000 degrees C for another hour. The sand and heated samples were characterized by means of XRD to perceive the phase composition correlation between them. Rietveld refinement was executed to investigate the weight fraction of the phase contained in the samples, and then converted to volume fraction for composite CTE calculations. The result was applied to predict their potential physical properties for FcSM. Porosity was taken into account in the calculation after which it was directly measured by the Archimedes method.

Keywords

Composite materials, Fuel cells, Heat treatment, Milling, Porosity, Sand, Sealing materials, Silicon compounds, Thermal expansion, X-ray diffraction



4.5

CHEMICAL ENGINEERING AND PROCESSING Volume: 72 Pages: 63-67
Published: OCT 2013

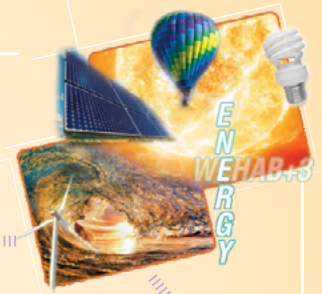
Palm oil transesterification in sub- and supercritical methanol with heterogeneous base catalyst

Asri, Nyoman Puspa; Machmudah, Siti; Wahyudiono; et al.

An environmentally benign process for the production of methyl ester using gamma-alumina supported heterogeneous base catalyst in sub- and supercritical methanol has been developed. The production of methyl ester in refluxed methanol conventionally utilized double promoted gamma-alumina heterogeneous base catalyst (CaO/KI/gamma-alumina); however, this process requires a large amount of catalyst and a long reaction time to produce a high yield of methyl ester. This study carries out methyl ester production in sub- and supercritical methanol with the introduction of an optimized catalyst used in the previous work for the purpose of improving the process and enhancing efficiency. CaO/KI/gamma-Al₂O₃ catalyst was prepared by precipitation and impregnation methods. The effects of catalyst amount, reaction temperature, reaction time, and the ratio of oil to methanol on the yield of biodiesel ester were studied. The reaction was carried out in a batch reactor (8.8 ml capacity, stainless steel, AKICO, Japan). Results show that the use of CaO/KI/gamma-Al₂O₃ catalyst effectively reduces both reaction time and required catalyst amount. The optimum process conditions were at a temperature of 290 degrees C, ratio of oil to methanol of 1:24, and a catalyst amount of 3% over 60 min of reaction time. The highest yield of biodiesel obtained under these optimum conditions was almost 95%. (C) 2013 Elsevier B.V. All rights reserved.

Keywords

Biodiesel; Heterogeneous base catalyst; Palm oil; Sub- and supercritical; Transesterification



4.6

TELKOMNIKA, Vol.9, No.2, August 2011, pp. 217~226

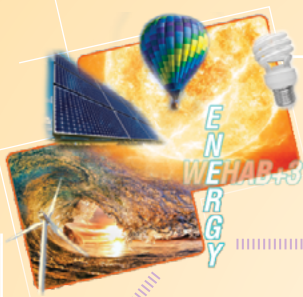
Maximum output power tracking of wind turbine using intelligent control

Yuhendri, M., Ashari, M., Purnomo, M.H.

The Output power of wind turbine is determined by wind speed. The Output power can be adjusted by controlling the generator speed and pitch angle of wind turbine. When the wind speed below the wind turbine rated, the output power of generator can be maximized by controlling the generator speed at point of maximum power coefficient. When the wind speed above the wind turbine rated, output power of wind turbine will exceed the power generators rated. In this condition, the output power of wind turbine needs to be regulated to conform to the generator power rate. Output power of wind turbine can be regulated by adjusting the pitch angle of wind turbine. In this paper is developed the control strategies based intelligent control for controlling the generator speed and pitch angle of wind turbine, so the maximum output power tracking (MOPT) of wind turbine can be obtained at any wind speed variations. Generator speed is controlled using PI Fuzzy Logic Controller (PI-FLC) based Direct Field Oriented Control (DFOC). Pitch angle of wind turbine is controlled using Elman Recurrent Neural Network (RENN). The simulation results with Matlab Simulink shows that the both controller was successfully regulates the output power when the wind speed above the wind turbine rated and the output power can be maximum when the wind speed below the wind turbine rated. © 2011 Universitas Ahmad Dahlan.

Keywords

MOPT, Wind turbine, PI-FLC, RENN, DFOC



4.7

Source of the Document 2011 IEEE 1st Conference on Clean Energy and Technology, CET 2011

Optimized curvature interior profile for Diffuser Augmented Wind Turbine (DAWT) to increase its energy-conversion performance

Nasution, A., Purwanto, D.W.

Suitable techniques to convert country's wind availability (mostly in the low-speed regimes) as a kind of renewable energy source need to be scrutinized to achieve effective and efficient conversion. The Diffuser-Augmented Wind Turbine (DAWT) concept offers possibility to cope with such unfavorable situation. In this paper we describe efforts to step-up the potential power augmentation offered by the DAWT. Modification of internal profile of the diffuser (based on Ohya's configuration without a flange) is done, i.e. by adding an optimized airfoil shape as interior profile of the diffuser. Additional velocity augmentation of 65.5% can be achieved in comparison to one with original flat interior. © 2011 IEEE.

Keywords

Diffuser-Augmented Wind Turbine, Interior profile, Optimized airfoil shape



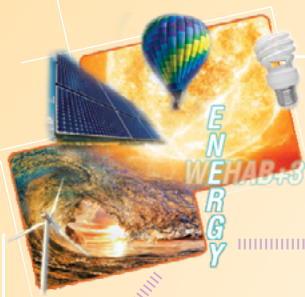
4.8

Proceedings of the 2nd IASTED Asian Conference on Modelling, Identification, and Control, AsiaMIC 2012

PID control for micro-hydro power plants based on neural network

Jasa, L., Priyadi, A., Purnomo, M.H.

Micro-hydro power plants are power plants with small capacity, which is built in specific locations. The main problem of micro-hydro is the voltage generated is not stable at 220 VA and frequency of 50 Hz. A microhydro that was constructed by Lie Jasa et al. in Gambuk village at Pupuan sub-district, Tabanan district of Bali province, Indonesia in 2010 is still an open loop system in which spin turbine is stable when it is set from the high water level in reservoirs. This will be problematic when the generator load changes. This study will overcome the problem by proposing to build a closed loop system from the change in output frequency for the control circuit. The control circuit is a circuit constructed neural networkbased PID control by using the Brandt-Lin algorithm to control the governor. The governor function is to regulate the amount volume of water running into turbine. By applying Matlab simulation, the result shows that the best output is obtained when the the change in frequency will stabilize at about 40 seconds and using the value of $K_p = 0.0637533$, $K_i = 0.00021801$ and $K_d = 0.00301846$.



4.9

TELKOMNIKA, Vol.11, No.2, June 2013, pp. 297~304

Modeling and control of excitation and governor based on particle swarm optimization for micro hydro power plant

Haddin, M., Soebagio, Soeprijanto, A., Purnomo, M.H.

This paper presents the modeling and control of the excitation system via the automatic voltage regulator (AVR) and governor system through the automatic generation control (AGC) or frequency load control (FLC) to improve stability on a micro hydro power plant (MHPP). Three main parts of the generation system are synchronous generator, AVR-excitation, AGC modelled linearly. Generator is modelled by a single machine connected to infinite bus (SMIB) which is equipped by AVR and excitation linear model. Excitation control system made by optimizing the gain of the AVR (KA) and the governor with the gain of the AGC (Ki). Optimization is done using the method improved particle swarm optimization (IPSO). The main purpose of setting the gain of the AVR-AGC is to stabilize the oscillation frequency of the MHPP which is connected to an infinite bus. Simulations are conducted by inputting step function with 5% load fluctuations as a representation of dynamic load. The simulation results show that the proposed method effectively raises the level of electromechanical damping oscillations the SMIB by generating the comprehensive damping index (CDI) is minimum.

Keywords

Control of excitation and governor, Micro hydro power plant, PSO

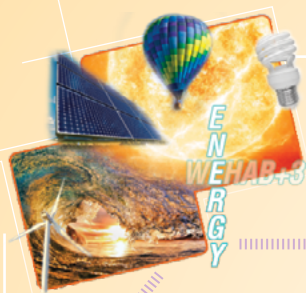


4.10 AIP Conf. Proc. 1554, 66 (2013)

Effects of nano anatase-rutile volume fraction with natural dye containing anthocyanin on the dye sensitized solar cell performance

Agustini, S., Wahyuono, R.A., Sawitri, D., Risanti, D.D.

Since its first development, efforts to improve efficiency of Dye Sensitized Solar Cell (DSSC) are continuously carried out, either through selection of dye materials, the type of semiconductor, counter electrode design or the sandwiched structure. It is widely known that anatase and rutile are phases of that often being used for fabrication of DSSC. Rutile is thermodynamically more stable phase having band-gap suitable for absorption of sunlight spectrum. On the other hand, anatase has higher electrical conductivity, capability to adsorb dye as well as higher electron diffusion coefficient than those of rutile. Present research uses mangosteen pericarp and *Rhoeo spathacea* extracted in ethanol as natural dye containing anthocyanin. These dyes were characterized by using UV-Vis and FTIR, showing that the absorption maxima peaks obtained at 389 nm and 413 nm, for mangosteen and *Rhoeo spathacea*, respectively. The nano TiO_2 was prepared by means of co-precipitation method. The particle size were 9-11 nm and 54.5 nm for anatase and rutile, respectively, according to Scherrer's equation. DSSCs were fabricated in various volume fractions of anatase and rutile TiO_2 . The fabricated DSSCs were tested under 17 mW/cm^2 of solar irradiation. The current-voltage (I-V) characteristic of DSSCs employing 75%: 25% volume fraction of anatase and rutile TiO_2 have outstanding result than others. The highest conversion efficiencies of 0.037% and 0.013% are obtained for DSSC employing natural dye extract from mangosteen pericarp and *Rhoeo spathacea*, respectively. © 2013 AIP Publishing LLC.



4.11 Journal of the Taiwan Institute of Chemical Engineers 44 (2013) 924–928

Effect of acid-catalyzed methanolysis on the bioactive components of rice bran oil

Ju, Y.-H., Zullaikah, S.

The change in bioactive components in oil derived from rice bran oil after acid-catalyzed methanolysis was investigated in this study. The effects of catalyst amount, molar ratio of methanol to oil, reaction time, and nitrogen purging on acid-catalyzed methanolysis were investigated to find the optimum condition in converting all free fatty acids and acylglycerides into biodiesel with minimum loss of bioactive components. Acid-catalyzed esterification at 60 °C using 5 wt% of sulphuric acid as the catalyst can convert all free fatty acids (initial content = 59.19%) and acylglycerides (initial content = 19.31%) into fatty acid methyl esters in 5 h with a molar ratio of methanol to oil = 40. After the reaction, the losses of squalene, α -tocopherol, γ -tocotrienol, campesterol, stigmasterol, β -sitosterol, and γ -oryzanol are 50.07%, 18.06%, 63.09%, 21.68%, 28.74%, 25.42%, and 35.43%, respectively. When nitrogen purging was applied during the reaction, the losses of the aforementioned bioactive components became 42.54%, 0.00%, 43.47%, 23.47%, 26.66%, 24.07%, and 29.76%, respectively. In addition, oxidation products were not detected by GC-MS during acid-catalyzed methanolysis. From the present investigation, loss of bioactive components can be mitigated by carried out the reaction under nitrogen atmosphere. © 2013 Taiwan Institute of Chemical Engineers



5.0

Landmark Berhad, Malaysia

5.1

Building and Environment 41 (2006) 1128–1135

Evaluating visual comfort and performance of three natural lighting systems for deep office buildings in highly luminous climates

Carlos Ernesto Ochoa, Isaac Guedi Capeluto

This work, part of a wider study, presents a qualitative and quantitative approach to evaluate daylighting systems for use in office buildings located in latitudes where natural luminous conditions throughout the year are of high solar radiation, as in Israel. Their widespread application in this kind of climate, where the excessive penetration of direct radiation can be a problem, is possible. They can produce a consequent improvement of working conditions and energy savings, yet this is not the case now. Three different systems that affect penetration of daylight in a sidelit office space were analysed: a single window without any external protection, a horizontal lightshelf and a basic anidolic concentrator, mounted on the view window, together with improved reflectances of the surface's finishes making office space. These were simulated through Radiance in a prototype that responds to a deep office space typology for different seasons of the year and hours of the day. The systems are compared for illuminance and glare performance.

Keywords

Daylighting, Offices, Lightshelf, Anidolic concentrator, Glare, High solar radiation



5.2

Building and Environment, Volume 42, Issue 9, September 2007, Pages 3166-3175

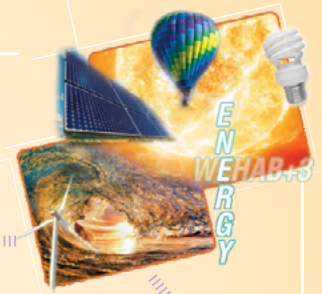
The relative influence of wind, sunlight and temperature on user comfort in urban outdoor spaces

D. Walton, V. Dravitzki, M. Donn

This paper presents the development of a comfort index that measures adaptivity in outdoor spaces. Over a 9-month period 649 people were surveyed in three locations, in temperatures between 10 and 28 °C. An exploratory factor analysis develops a 15-item scale of comfort that includes measures of adaptivity: clothing, exposure time and seating location. The scale is regressed on physical measures: average instantaneous wind speed; maximum wind speed; mean-exposed radiant temperature; mean-shaded radiant temperature and ambient temperature. The results model the relative contributions of the microclimatic factors for the comfort in the outdoor space. Analyses suggest gustiness and wind speed are most important in determining user satisfaction. There is strong support for the theory that people actively adapt to microclimatic conditions.

Keywords

Comfort, Outdoor, Public spaces, Wind, Temperature, Sunlight



5.3

Energy, Volume 34, Issue 2, February 2009, Pages 205-215

Can envelope codes reduce electricity and CO₂ emissions in different types of buildings in the hot climate of Bahrain?

H. Radhi

The depletion of non-renewable resources and the environmental impact of energy consumption, particularly energy use in buildings, have awakened considerable interest in energy efficiency. Building energy codes have recently become effective techniques to achieve efficiency targets. The Electricity and Water Authority in Bahrain has set a target of 40% reduction of building electricity consumption and CO₂ emissions to be achieved by using envelope thermal insulation codes. This paper investigates the ability of the current codes to achieve such a benchmark and evaluates their impact on building energy consumption. The results of a simulation study are employed to investigate the impact of the Bahraini codes on the energy and environmental performance of buildings. The study focuses on air-conditioned commercial buildings and concludes that envelope codes, at best, are likely to reduce the energy use of the commercial sector by 25% if the building envelope is well-insulated and efficient glazing is used. Bahraini net CO₂ emissions could drop to around 7.1%. The simulation results show that the current energy codes alone are not sufficient to achieve a 40% reduction benchmark, and therefore, more effort should be spent on moving towards a more comprehensive approach.

Keywords

Building codes, Electricity and CO₂ emissions benchmarks, Bahrain



5.4

Renewable Energy, Volume 31, Issue 5, April 2006, Pages 631-653

Towards green buildings: Glass as a building element—the use and misuse in the gulf region

Mohsen M. Aboulnaga

The recent economic growth in the Gulf region notably in Dubai, United Arab Emirates (UAE) has led to a colossal number of buildings that has been constructed in the past 5 years. In the last decade, a total glazed building's façades became the icon of Dubai. This large area of glazing in each façade needs protection against overheating and sun glare in summer. According to leader in energy and environmental design (LEED) glass selection becomes a main element in this equation to contribute towards achieving a green building. The aim of this paper is to investigate the problems associated with misuse of glass, as a building element in UAE particularly in Dubai. Inadequate design with ill-selected glass/glazing type may lead not only to poor daylighting in building interiors but also contribute significantly to fatigue, insomnia, seasonal affective disorder (SAD) and above all increase CO₂ emission.

The purpose of the study is to specify the required improvements to permit natural, 'free' daylight to filter through the building façade into interior space, especially with the right type of glass. This paper examines the status of buildings in Dubai in terms of glass type, visible light transmittance, reflection (out/in) and relative heat gain. A quantitative analysis is conducted to assess the impact of glass on the building users' performance in terms of daylight environment. A recent built high-rise office building was selected in the investigation to assess whether selected glass provide the recommended daylight factor (DF) and daylight level (DL) according to IES standards. The results revealed that most the glass/glazing was misused in 70% of buildings in intermediate and low performance groups. The DF and DD in the selected office building were unexpectedly tremendous and found far beyond the recommended level due to the use of spectrally selective glazing (clear on both sides).

Keywords

Glass, Glazing, Green building, Energy consumption, Daylighting, Hot climate, Gulf region



5.5

Renewable Energy, Volume 22, Issues 1–3, January–March 2001, Pages 45-52

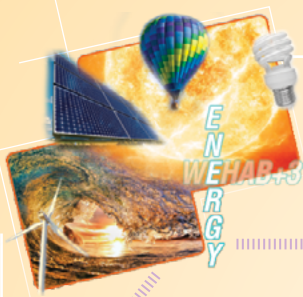
The importance of interior daylight distribution in buildings on overall energy performance

P Greenup, J.M Bell, I Moore

Simulations of daylight distribution within a house show that there can be significant visual discomfort associated with specific sky conditions. Thermal models of the same building, which include simplified daylight calculations and which calculate annual energy performance of the building, do not reflect extreme visual discomfort and high thermal load associated with these sky conditions. These results illustrate the importance of more detailed interior daylight distribution calculations in assessing the thermal and visual comfort of a building, and in developing energy performance ratings for buildings. Some techniques for incorporating more detailed interior daylight distribution calculations in simplified thermal models are discussed.

Keywords

Daylight, Lighting simulation, Thermal simulation, Building energy, Visual comfort



5.6

Building and Environment, Volume 44, Issue 3, March 2009, Pages 509-514

Estimation of lighting energy savings from daylighting

Pyonchan Ihm, Abderrezek Nemri, Moncef Krarti

This paper refines and validates the predictions of a simplified analysis method for evaluating the potential of daylighting to save energy use associated with electrical lighting. Specifically, impacts on daylighting performance are investigated for several combinations of building geometry, window size, and glazing type for several US and international locations. The impact of both dimming and stepped daylighting controls and their settings are also investigated. Predictions from the simplified method are validated using measurements obtained from field-testing of a daylighting control system utilized to operate lighting fixture illuminating an office space.

Keywords

Daylighting, Energy savings, Field-testing, Simplified method



5.7

Energy Policy, Volume 35, Issue 2, February 2007, Pages 1050-1063

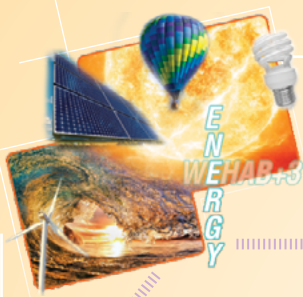
An application of energy and exergy analysis in residential sector of Malaysia

R. Saidur, H.H. Masjuki, M.Y. Jamaluddin

In this paper, the useful concept of energy and exergy utilization is defined, analyzed and applied to the residential sector of Malaysia by taking into account the energy and exergy flows for a period of 8 years from the year 1997 to 2004. The energy and exergy efficiencies are determined for the devices used in this sector and found to be 70% and 28%, respectively. Energy and exergy flow diagrams for the overall efficiencies of Malaysian residential sector are also illustrated in this paper. It is found that the current methodology applied in Saudi Arabia is suitable to analyze energy and exergy use in Malaysian residential sector. It has been found that the exergy efficiency of the Malaysian residential sector appears to be much lower than its corresponding energy efficiency. It has been observed that about 21% of total exergy losses are caused by refrigerator-freezer and 12% of total loss is caused by air conditioner. Washing machine, fan and rice cooker contribute about 11%, 10% and 8% of total exergy losses, respectively.

Keywords

Energy, Exergy, Appliances



5.8

Building and Environment 39 (2004) 713 – 717

Sunlight control and daylight distribution analysis: the KOMTAR case study

Sharifah Fairuz Syed Fadzila, Sheau-Jiunn Sia

Direct sunlight penetration and daylight distribution analyses were carried out at KOMTAR Penang which is a near-circular office building with 12 bays of continuous orientation. Unlike rectangular plan buildings where one sun shading design device will protect one facade, this cylindrical building requires variations in sun shading devices around the whole perimeter. Daylight data were collected in overcast conditions and compared well with computer simulations, and further simulations were carried out to see the daylight reduction with calculated shading.

Keywords

Illumination level, Window, Residential building, Occupant's perception



5.9

Energy Conversion and Management, Volume 48, Issue 5, May 2007, Pages 1601-1614

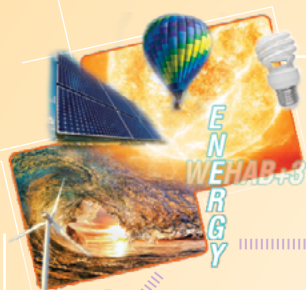
All sky modeling daylight availability and illuminance/irradiance on horizontal plane for Mahasarakham, Thailand

*Singthong Pattanasethanon, Charoenporn Lertsatitthanakorna,
Surat Atthajariyakul, Somchart Saponronnarit*

This paper presents the results of a study on all sky modeling and daylight availability for the tropical climate found in the central region of the northeastern part of Thailand ($16^{\circ}14'N$, $103^{\circ}15'E$). The required components of sky quantities, namely global and diffuse horizontal irradiance and global horizontal illuminance for saving energy used in buildings are estimated. The empirical sinusoidal model and a novel sinusoidal model, which consists of polynomial or exponential functions, are validated. A and B values of the empirical sinusoidal model for all sky conditions are determined and developed to become a new function in the polynomial or exponential form of the sky conditions. Observation results from one year's total data indicate that the luminosity and the energy from the sky on a horizontal plane in the area around Mahasarakham are much greater than those of Bangkok. The accuracy of the validated model is determined in terms of the mean bias deviation (MBD), the *root mean square deviation* (RMSD) and the coefficient of correlation (R^2) values. Comparison of the estimated solar irradiation values and the observed values revealed a small error slide as well.

Keywords

All sky model, Daylight availability, Tropical climate



6.0

Mae Fah Luang University, Thailand

6.1

Procedia Engineering, Volume 32, 2012, Pages 683-689

Carbon nanotubes architectures in electroanalysis

N. Punbusayakul

Electroanalysis is one of the promising analysis methods for various aspects. Carbon nanotubes (CNTs), a novel carbon form, has been also exploited as an electrode material in electroanalysis as a result of its extraordinary electronic, chemical and mechanical properties. In addition, CNTs is also stable and robustness and is compatible with various chemical and biological species, hence the nanotubes' abilities recognized to various analyzes associated to those species. However, not only the electrode materials can influence the electrode electrochemical properties, but also the electrode orientation or architecture does. This paper, therefore, reviews various carbon nanotubes (CNTs) oriented architectures practically employed in electroanalysis for different purposes. Those include 1) CNTs casting films and CNTs polymer composites, (2) CNTs paste and polymer composites, (3) as grown CNTs and individual CNT and (4) CNTs arrays.

Keywords

As grown CNTs; Carbon nanotubes; CNTs arrays; CNTs film; CNTs paste; Electroanalysis; Individual CNT



7.0

Prince Songkhla University, Thailand

7.1

International Journal of Hydrogen Energy, Volume 36, Issue 14, July 2011, Pages 8785-8793

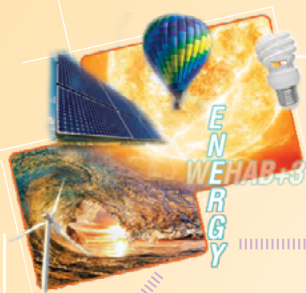
Energy developing a thermophilic hydrogen-producing microbial consortia from geothermal spring for efficient utilization of xylose and glucose mixed substrates and oil palm trunk hydrolysate

Adilan Hniman, Sompong O-Thong, Poonsuk Prasertsan

Xylose and glucose are the major sugar components of lignocellulosic hydrolysate. This study aims to develop thermophilic hydrogen-producing consortia from eight sediments-rich samples of geothermal springs in Southern Thailand by repeated batch cultivation at 60 °C with glucose, xylose and xylose–glucose mixed substrates. Significant hydrogen production potentials were obtained from thermophilic enriched cultures encoded as PGR and YLT with the maximum hydrogen yields of 241.4 and 231.6 mL H₂/g sugar_{consumed}, respectively. After repeated batch cultivation the hydrogen yield from xylose–glucose mixed substrate of PGR increased to 375 mL H₂/g sugar_{consumed} which was 30% higher than that of YLT (287 mL H₂/g sugar_{consumed}). Soluble metabolites from xylose–glucose mixed substrates were composed mostly of butyric acid (20.6–21.8 mM), acetic acid (7.2–13.5 mM), lactic acid (8.2–11.7 mM) and butanol (4.4–13.0 mM). Denaturing gradient gel electrophoresis (DGGE) profiles illustrated small difference in microbial patterns of PGR enriched with glucose, xylose–glucose mixed substrate and xylose. The dominant populations were affiliated with low G + C content Gram-positive bacteria, *Thermoanaerobacterium* sp., *Thermoanaerobacter* sp., *Caloramater* sp. and *Anoxybacillus* sp. based on the 16S rRNA gene. Cultivation of the enriched culture PGR in oil palm trunk hydrolysate, the maximum hydrogen yield of 301 mL H₂/g sugar_{consumed} was achieved at hydrolysate concentration of 40% (v/v). At higher concentration to 80% (v/v), the hydrogen fermentation process was inhibited. Therefore, the efficient thermophilic hydrogen-producing consortia PGR has successfully developed and has great potential for production of biohydrogen from mixed sugars hydrolysate.

Keywords

Thermophilic consortia; Microbial community analysis; Biohydrogen; Hemicellulose; Xylose and glucose mixed substrate



7.2

Sensors and Actuators B: Chemical, Volume 185, August 2013, Pages 725-734

A highly stable oxygen-independent glucose biosensor based on a chitosan-albumin cryogel incorporated with carbon nanotubes and ferrocene

Amin Fatoni, Apon Numnuam, Proespichaya Kanatharana, Warakorn Limbut, Chongdee Thammakhet, Panote Thavarungkul

A novel, excellently stable glucose biosensor was fabricated based on a chitosan-bovine serum albumin (Chi-BSA) cryogel with incorporated multiwalled carbon nanotubes (MWCNTs), ferrocene (Fc), and glucose oxidase (GOD). A porous Chi-BSA cryogel was prepared by freezing and thawing of the chitosan-albumin hydrogel, synthesized by crosslinking with glutaraldehyde. The electron transfer of the Chi-BSA cryogel was enhanced using MWCNTs mediated by the Fc trapped within the cryogel. The glucose response of this biosensor was amperometrically measured at an applied potential of 0.175 V versus Ag/AgCl in a flow injection system. The MWCNTs/Chi-BSA-Fc/GOD biosensor demonstrated high operational stability after more than 350 injections (RSD = 3.6%), with a wide linear range from 0.010 to 30 mM and a low Michaelis–Menten constant (1.5 mM). The fabricated biosensor response to glucose was not affected by dissolved oxygen and showed no response to the common interferences in blood samples such as, ascorbic acid and uric acid, in physiological levels. In comparison with the standard hexokinase-spectrophotometric method employed by the hospital, the glucose concentrations in blood plasma samples measured by the modified electrode were in good agreement ($P > 0.05$). This chitosan based cryogel would be an excellent enzyme supporting material for other biosensor applications.

Keywords

Cryogel; Chitosan; Glucose biosensor; Ferrocene; Multi walled carbon nanotubes



7.3

Energy Conversion and Management, Volume 73, September 2013, Pages 381-388

Response surface optimization of enzymatic hydrolysis of narrow-leaf cattail for bioethanol production

Arrisa Ruangmee, Chayanoot Sangwichien

Narrow-leaf cattail was employed as lignocellulosic biomass substrate for the investigation of the hydrolysis process of lignocellulosic ethanol. Cellulose saccharification into a high yield of fermentable sugar is an important step in ethanol production. Response surface methodology was utilized in the study of variables affecting enzymatic hydrolysis on the released glucose and xylose. Five levels (-2, -1, 0, +1, +2) of independent variable factors; cellulase (5–25 FPU/g substrate), β -glucosidase (0–20 U/g substrate), hydrolysis temperature (30–50 °C), and hydrolysis time (24–96 h), were randomly setup by using the Design of Experiment program. The significance of the regression model was high; with 95% confidence interval (less than 5% error). The predicted result after optimization was also in good agreement with the experimental data. An optimal condition; 13.50 FPU/g substrate, 16.50 U/g substrate, 50 °C and 24 h, was obtained, yielding a released glucose of 552.9 mg/g substrate (75.6% saccharification) and a released xylose of 74.0 mg/g substrate (45.6% saccharification).

Keywords

Narrow-leaf cattail; Lignocellulose; Glucose; Enzymatic hydrolysis; Response surface methodology



7.4

Journal of Environmental Sciences, Volume 25, Issue 4, 1 April 2013, Pages 751-757**Emissions of particulate matter and associated polycyclic aromatic hydrocarbons from agricultural diesel engine fueled with degummed, deacidified mixed crude palm oil blends**

*Khamphe Phoungthong, Surajit Tekasakul, Perapong Tekasakul,
Gumpon Prateepchaikul, Naret Jindapetch, Masami Furuuchi, Mitsuhiro Hata*

Mixed crude palm oil (MCPO), the mixture of palm fiber oil and palm kernel oil, has become of great interest as a renewable energy source. It can be easily extracted from whole dried palm fruits. In the present work, the degummed, deacidified MCPO was blended in petroleum diesel at portions of 30% and 40% by volume and then tested in agricultural diesel engines for long term usage. The particulates from the exhaust of the engines were collected every 500 hr using a four-stage cascade air sampler. The 50% cut-off aerodynamic diameters for the first three stages were 10, 2.5 and 1 μm , while the last stage collected all particles smaller than 1 μm . Sixteen particle bounded polycyclic aromatic hydrocarbons (PAHs) were analyzed using a high performance liquid chromatography. The results indicated that the size distribution of particulate matter was in the accumulation mode and the pattern of total PAHs associated with fine-particles ($< 1 \mu\text{m}$) showed a dominance of larger molecular weight PAHs (4–6 aromatic rings), especially pyrene. The mass median diameter, PM and total PAH concentrations decreased when increasing the palm oil content, but increased when the running hours of the engine were increased. In addition, Commercial petroleum diesel (PB0) gave the highest value of carcinogenic potency equivalent (BaP_{eq}) for all particle size ranges. As the palm oil was increased, the BaP_{eq} decreased gradually. Therefore the degummed-deacidified MCPO blends are recommended for diesel substitute.

Keywords

Mixed crude palm oil; Palm oil blend; Agricultural diesel engine; Polycyclic aromatic hydrocarbon; Particulate matter



7.5

Energy Conversion and Management, Volume 75, November 2013, Pages 302-310

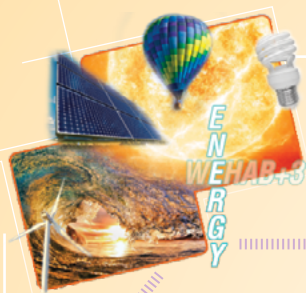
Two-stage continuous process of methyl ester from high free fatty acid mixed crude palm oil using static mixer coupled with high-intensity of ultrasound

Krit Somnuk, Pruittikorn Smithmaitrie, Gumpon Prateepchaikul

The two-stage continuous process of methyl ester from high free fatty acid (FFA) mixed crude palm oil (MCPO) was performed by using static mixer coupled with high-intensity of ultrasound. The 2×1000 W ultrasonic homogenizers were operated at 18 kHz frequency in the 2×100 mL continuous reactors. For the first-step, acid-catalyzed esterification was employed with 18 vol.% of methanol, 2.7 vol.% of sulfuric acid, 60 °C of temperature, and 20 L h^{-1} of MCPO flow rate, for reducing the acid value from 28 mg KOH g^{-1} to less than 2 mg KOH g^{-1} . For the second-step, base-catalyzed transesterification was carried out under 18 vol.% of methanol, 8 g KOH L^{-1} of oil, and 20 L h^{-1} of esterified oil flow rate at 30 °C. The high yields of esterified oil and crude biodiesel were attained within the residence time of less than 20 s in the ultrasonic reactors. The yields of each stage process were: 103.3 vol.% of esterified oil, 105.4 vol.% of crude biodiesel, and 92.5 vol.% of biodiesel when compared with 100 vol.% MCPO. The quality of the biodiesel meets the specification of biodiesel standard in Thailand.

Keywords

Base catalyst; Transesterification; Continuous; Static mixer; Ultrasound; Mixed crude palm oil



7.6

Energy Conversion and Management, Volume 68, April 2013, Pages 193-199

Optimization of continuous acid-catalyzed esterification for free fatty acids reduction in mixed crude palm oil using static mixer coupled with high-intensity ultrasonic irradiation

Krit Somnuk, Pruittikorn Smithmaitrie, Gumpon Prateepchaikul

The major problem of biodiesel production from mixed crude palm oils (MCPOs) is the high free fatty acid (FFA) content. To achieve good conversion from MCPO to esters, the FFA should not exceed 1 wt.% or 2 mgKOH g⁻¹ of acid value when using base-catalyzed transesterification to produce biodiesel. In this study, reduction of the acid value in MCPO with methanol in the presence of sulfuric acid as an acid-catalyst was performed in continuous esterification using static mixer coupled with ultrasonic reactor. A 1000 W ultrasonic homogenizer was operated at 18 kHz frequency in a 100 mL continuous-reactor. Response surface methodology (RSM); a 5-level, 2-factor, central composite design (CCD), was employed to optimize the two important reaction variables (methanol and sulfuric acid concentrations). To minimize chemical costs in order to reduce the acid value from 28 mgKOH g⁻¹ to less than 2 mgKOH g⁻¹, 18 vol.% of methanol, 2.7 vol.% of sulfuric acid, and 20 L h⁻¹ of MCPO flow rate are recommended.

Keywords

Acid catalyst; Esterification; Free fatty acid; Static mixer; Ultrasound; Mixed crude palm oil



7.7

Chemical Engineering and Processing: Process Intensification, Volume 70, August 2013, Pages 21-26

Transesterification of palm oil with methanol in a reactive distillation column

Kulchanat Prasertsit, Chokchai Mueanmas, Chakrit Tongurai

The higher feedstock and processing costs for biodiesel production can be reduced by applying reactive distillation (RD) in transesterification process. The effects of reboiler temperature, amount of KOH catalyst, methanol to oil molar ratio and residence time on the methyl ester purity were determined by using a simple laboratory-scale RD packed column. The results indicated that from the empty column, the system reached the steady state in 8 h. Too high reboiler temperature and the amount of catalyst introduce more soap from saponification in the process. The optimal operating condition is at a reboiler temperature 90 °C, a methanol to oil molar ratio of 4.5:1.0, KOH of 1 wt.% respect to oil and 5 min of residence time in the column. This condition requires the fresh feed methanol 25% lower than in the conventional process and produces 92.27% methyl ester purity. Therefore this RD column can be applied in small or medium biodiesel enterprise.

Keywords

Reactive distillation; Transesterification; Palm oil; Biodiesel



7.8

Bioresource Technology, Volume 147, November 2013, Pages 471-476

Coagulation–flocculation of marine *Chlorella* sp. for biodiesel production

Naruetsawan Sanyano, Pakamas Chetpattananondh, Sininart Chongkhong

Harvesting of marine *Chlorella* sp. by autoflocculation and flocculation by addition of coagulant with pH adjustment was investigated in this study. Autoflocculation provided low efficiency. Response surface methodology was employed to optimize the coagulant dosage and pH for flocculation. Aluminium sulfate and ferric chloride were investigated coagulants. The empirical models from RSM are in a good agreement with the experimental results. The optimum flocculation was achieved at ferric chloride dosage 143 mg/L, pH 8.1 and settling time 40 min. Biomass concentration also presented the significant effect on harvesting efficiency. Lipid extracted from marine *Chlorella* sp. cultivated in urea fertilizer medium with hexane as a solvent is suitable to produce biodiesel according to it contains high proportion of saturated fatty acids. The crude lipid should be purified to remove some impurities before making biodiesel. As the free fatty acid content was higher than 1% a two-step biodiesel production is recommended.

Keywords

Microalgae; *Chlorella* sp.; Flocculation; Fatty acid; Biodiesel



7.9

International Journal of Electrical Power & Energy Systems, Volume 44, Issue 1, January 2013, Pages 561-570

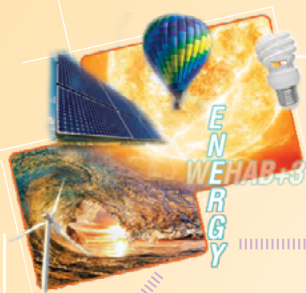
Multi-substation control central load area forecasting by using HP-filter and double neural networks (HP-DNNs)

Pituk Bunnoon, Kusumal Chalermyanont, Chusak Limsakul

Electricity load demand forecasting of Thailand using Hodrick–Prescott (HP) filters and double-neural networks (DNNs) is presented in this article by dividing whole country area into multi-substation areas. The signals of load demand in each subarea will be decomposed to trend and cycling signals by HP-filter before sent to DNNs for load demand forecast. The trend signals show close relationship with economic affecting features, while the cycling signals demonstrate strong relationship with weather features. These obvious correlations will be used for feature input selections. In the finally stage, the forecasting results from each subarea will be composed for the whole country area result. Comparing to other forecasting models, this approach not only reduce complexity of the forecasting model but also decrease mean absolute percent error (MAPE) as 1.42%. Moreover, this method can be applied to other load forecasting in power system and any application that can be separated into subarea.

Keywords

Forecasting; Double neural networks; Multi and whole area; Signal decomposition; HP-filter



7.10 International Journal of Hydrogen Energy, Volume 36, Issue 21, October 2011, Pages 14086-14092

Isolation and characterization of high hydrogen-producing strain *Clostridium beijerinckii* PS-3 from fermented oil palm sap

Pongsak Noparat, Poonsuk Prasertsan, Sompong O-Thong

Felled oil palm trunk (OPT) (25 years old) is an abundant biomass in Southern Thailand. The OPT composition was 31.28–42.85% cellulose, 19.73–25.56% hemicellulose, 10.74–18.47% lignin, 1.63–2.25% protein, 1.60–1.83% fat, 1.12–1.35% ash and trace amount of minerals (0.01–0.40%). Oil palm sap extracted from OPT was found to contain 15.72 g/L glucose, 2.25 g/L xylose, and 0.086 g/L arabinose. A total of twenty samples from hot springs (45–75 °C and pH 6.5–8.4), oil palm sap and palm oil mill effluent were enriched for isolation of hydrogen-producing bacteria. The highest hydrogen-producing strain was isolated from oil palm sap and identified as *Clostridium beijerinckii* PS-3 using biochemical test and 16S rRNA gene analysis. Among various carbon sources tested, glucose, xylose, starch and cellulose were the preferred substrates for hydrogen production. The strain PS-3 could produce the maximum hydrogen yield of 140.9 ml H₂/g total sugar and the cumulative hydrogen production of 1973 ml/L-oil palm sap. Therefore, *C. beijerinckii* PS-3 is a potential candidate for fermentative hydrogen production from mixed sugars of the oil palm sap.

Keywords

Oil palm sap; Hydrogen production; Mixed substrate; *Clostridium beijerinckii*



7.11 Enzyme and Microbial Technology, Volume 48, Issue 3, 7 March 2011, Pages 293-298

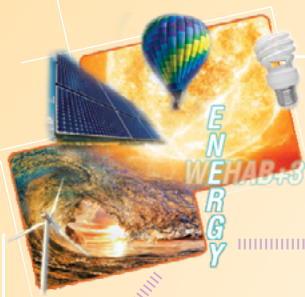
Selection of lipase producing yeasts for methanol-tolerant biocatalyst as whole cell application for palm-oil transesterification

Purimprat Srimhan, Khanitta Kongnum, Siriporn Taweerodjanakarn,
Tipparat Hongpattarakere

Methanol-tolerant lipase producing yeast was successfully isolated and selected through ecological screening using palm oil-rhodamine B agar as one step-approach. All 49 lipase-producing yeasts exhibited the ability to catalyze esterification reaction of oleic acid and methanol at 3 molar equivalents. However, only 16 isolates catalyzed transesterification reaction of refined palm oil and methanol. *Rhodotorula mucilagenosa* P11189 isolated from oil contaminated soil showed the strongest hydrolytic lipase activity of 1.2 U/ml against palm oil. The production of oleic methyl ester and fatty acid methyl ester (FAME) of 64.123 and 51.260% was obtained from esterification and transesterification reaction catalyzed by whole cell of *R. mucilagenosa* P11189 in the presence of methanol at 3 molar equivalents against the substrates, respectively. FAME content increased dramatically to 83.29% when 6 molar equivalents of methanol were added. Application of the methanol-tolerant-lipase producing yeast as a whole cell biocatalyst was effectively resolved major technical obstacles in term of enzyme stability and high cost of lipase, leading to the feasibility of green biodiesel industrialization.

Keywords

Methanol-tolerant-lipase producing yeast; Palm oil; Fatty acid methyl ester; Transesterification; Whole cell biocatalyst



7.12 **Procedia Engineering, Volume 32, 2012, Pages 239-245**

A Feasibility Study of Fatigue and Muscle Contraction Indices Based on EMG Time-dependent Spectral Analysis

S. Thongpanja, A. Phinyomark, P. Phukpattaranont, C. Limsakul

Parameters derived from EMG power spectrum are beneficial methods for assessing muscle fatigue. Two important indices are median frequency and mean frequency (MDF and MNF). They have been established as the global muscle fatigue indices, particularly in static muscle contraction of biceps brachii muscle. However, a major problem of these parameters is a nonlinear relationship between muscle load/force and feature value, particularly in cyclic dynamic muscle contraction of forearm muscles. In this study, EMG feature indices that can simultaneously identify both fatigue and load are proposed. Instead of using an entire EMG signal fast Fourier transformation (FFT), a concept of using consecutive FFT has been proposed as known as the "Time-Dependent MDF and MNF" (TD-MDF and TDMNF). The success of TD-MDF and TD-MNF features used to determine muscle fatigue have been presented in a lot of research works, whereas the performance of TD-MDF and TD-MNF used to determine muscle load have been proposed in a few research works. Moreover, it has not previously been evaluated with the forearm muscles. Thus it has been investigated in this study. Four forearm muscles are evaluated including flexor pollicis longus, supinator longus, extensor carpi radialis longus and pronator radii teres. The results showed that the proposed methods have a linear relationship with muscle load in some selected range of TD-MNF for flexor pollicis longus muscle that were not found for traditional MDF and MNF. Moreover, a statistically significant difference between TD-MNF values for different loading conditions ($p < 0.2$) was observed. The optimal method of TD-MNF was successful when overlapping consecutive window was performed with 512-sample window size and 128-sample window increment.

Keywords

Spectral Analysis; Feature Extraction Method; Electromyography (EMG) Signal



7.13 **Journal of Applied Geophysics, Volume 82, July 2012, Pages 110-118**

A university-developed seismic source for shallow seismic surveys

Sawasdee Yordkayhun, Jumras Na Suwan

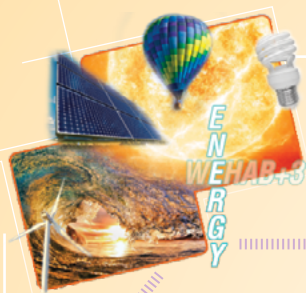
The main objectives of this study were to (1) design and develop a low cost seismic source for shallow seismic surveys and (2) test the performance of the developed source at a test site.

The surface seismic source, referred to here as a university-developed seismic source is based upon the principle of an accelerated weight drop. A 30 kg activated mass is lifted by a mechanical rack and pinion gear and is accelerated by a mounted spring. When the mass is released from 0.5 m above the surface, it hits a 30 kg base plate and energy is transferred to the ground, generating a seismic wave. The developed source is portable, environmentally friendly, easy to operate and maintain, and is a highly repeatable impact source.

To compare the developed source with a sledgehammer source, a source test was performed at a test site, a study site for mapping a major fault zone in southern Thailand. The sledgehammer and the developed sources were shot along a 300 m long seismic reflection profile with the same parameters. Data were recorded using 12 channels off-end geometry with source and receiver spacing of 5 m, resulting in CDP stacked sections with 2.5 m between traces. Source performances were evaluated based on analyses of signal penetration, frequency content and repeatability, as well as the comparison of stacked sections. The results show that both surface sources are suitable for seismic studies down to a depth of about 200 m at the site. The hammer data are characterized by relatively higher frequency signals than the developed source data, whereas the developed source generates signals with overall higher signal energy transmission and greater signal penetration. In addition, the repeatability of the developed source is considerably higher than the hammer source.

Keywords

Seismic source comparison; Seismic acquisition; Weight drop; Sledgehammer; Repeatability



7.14 International Journal of Hydrogen Energy, Volume 37, Issue 18, September 2012, Pages 13806-13814

Effect of initial pH, nutrients and temperature on hydrogen production from palm oil mill effluent using thermotolerant consortia and corresponding microbial communities

Siriporn Yossan, Sompong O-Thong, Poonsuk Prasertsan

Thermotolerant consortia were obtained by heat-shock treatment on seed sludge from palm oil mill. Effect of the initial pH (4.5–6.5) on fermentative hydrogen production palm oil mill effluent (POME) showed the optimum pH at 6.0, with the maximum hydrogen production potential of 702.52 mL/L-POME, production rate of 74.54 mL/L/h. Nutrients optimization was investigated by response surface methodology with central composite design (CCD). The optimum nutrients contained 0.25 g urea/L, 0.02 g Na_2HPO_4 /L and 0.36 g $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$ /L, giving the predicted value of hydrogen production of 1075 mL/L-POME. Validation experiment revealed the actual hydrogen production of 968 mL/L-POME. Studies on the effect of temperature (25–55 °C) revealed that the maximum hydrogen production potential (985.3 mL/L-POME), hydrogen production rate (75.99 mL/L/h) and hydrogen yield (27.09 mL/g COD) were achieved at 55, 45 and 37 °C, respectively. Corresponding microbial community determined by the DGGE profile demonstrated that *Clostridium* spp. was the dominant species. *Clostridium paraputrificum* was the only dominant bacterium presented in all temperatures tested, indicating that the strain was thermotolerant.

Keywords

Biohydrogen; Palm oil mill effluent; Optimization; Thermotolerant consortia; Microbial community



7.15 Materials Chemistry and Physics, Volume 126, Issues 1–2, 15 March 2011, Pages 167-177

Energy Recyclable UV and visible light photocatalytically active amorphous TiO₂ doped with M (III) ions (M = Cr and Fe)

Supat Buddee, Sumpun Wongnawa, Uraiwan Sirimahachai, Walailak Puetpaibool

Samples of amorphous TiO₂ doped with Cr(III) and Fe(III), designated as Cr-TiO₂ and Fe-TiO₂, were prepared via modified impregnation method. The resulting products were characterized by X-ray diffraction, scanning electron microscopy, specific surface area by the Brunauer, Emmett and Teller method, UV-vis absorption and diffuse reflectance spectroscopy, and electron spin resonance spectroscopy. Experimental results revealed that the concentrations of dopants under studied, from 0.05 to 0.2 mol%, had no effect on the phase of products. The band gap energies shifted from 3.28 eV in the undoped amorphous TiO₂ to 2.50 eV and 2.86 eV for Fe-TiO₂ and Cr-TiO₂, respectively. The doped amorphous TiO₂ showed photocatalytic activities under both UV and visible light with optimal results at 0.1 mol% dopants. Under UV irradiation, the 0.1 mol% doped samples decolorized methylene blue solutions to the same extent as the commercial TiO₂ samples (P25 and anatase) in 5 h. Under visible light, the doped samples decolorized dye solutions in 12 h while the commercial ones were much less active. The used catalysts can be recycled many times without any special treatment.

Keywords

► The low photocatalytic activity of amorphous TiO₂ was enhanced by doping with Cr(III) or Fe(III) ions. ► The doped catalysts performed close to P25 under UV light and better with visible light. ► The doped catalysts can be recycled.



7.16 Fuel Processing Technology, Volume 92, Issue 8, August 2011, Pages 1543-1548

Kinetics of methyl ester production from mixed crude palm oil by using acid-alkali catalyst

Surachai Jansri, Sukritthira B. Ratanawilai, Michael L. Allen, Gumpon Prateepchaikul

The production of biodiesel from high free fatty acid mixed crude palm oil using a two-stage process was investigated. The kinetics of the reactions was determined in a batch reactor at various reaction temperatures. It was found that the optimum conditions for reducing high free fatty acid (FFA) in MCPO (8–12 wt.%/wt oil) using esterification was a 10:1 molar ratio of methanol to FFA and using 10 wt.%/wt of sulfuric acid (based on FFA) as catalyst. The subsequent transesterification reaction to convert triglycerides to the methyl ester was found to be optimal using 6:1 molar ratio of methanol to the triglyceride (TG) in MCPO and using 0.6 wt.%/vol_{TG} sodium hydroxide as catalyst. Both reactions were carried out in a stirred batch reactor over a period of 20 min at 55, 60 and 65 °C. The concentration of compounds in each sample was analyzed by Thin Layer Chromatography/Flame Ionization Detector (TLC/FID), Karl Fischer, and titration techniques. The results were used for calculating the rate coefficients by using the curve-fitting tool of MATLAB. Optimal reaction rate coefficients for the forward and reverse esterification reactions of FFA were 1.340 and 0.682 l mol⁻¹ min⁻¹, respectively. The corresponding optimal transesterification, rate coefficients for the forward reactions of TG, diglyceride (DG), and monoglyceride (MG) of transesterification were 2.600, 1.186, and 2.303 l mol⁻¹ min⁻¹, and for the reverse reactions were 0.248, 0.227, and 0.022 l mol⁻¹ min⁻¹, respectively.

Keywords

Biodiesel; Free fatty acid; Kinetics; Methyl ester; Palm oil; Two-stage process



7.17 Fuel, Volume 90, Issue 4, April 2011, Pages 1487-1491

Comparative performance and emissions of IDI-turbo automobile diesel engine operated using degummed, deacidified mixed crude palm oil–diesel blends

T. Leevijit, G. Prateepchaikul

The performance and emissions of an indirect injection (IDI)-turbo automobile diesel engine operated with diesel and blends of degummed-deacidified mixed crude palm oil in diesel at portions of 20, 30, and 40 vol.% are examined and compared at various loads and speeds. Although fuel properties of the tested blends do not exactly meet all regulations of Thailand, they are all able to operate the engine. Comparing this with diesel, especially at full loads, shows that all blends produce the same maximum brake torque and power. A higher blending portion results in a little higher brake specific fuel consumption (+4.3% to +7.6%), a slightly lower brake thermal efficiency (–3.0% to –5.2%), a slightly lower exhaust gas temperature (–2.7% to –3.4%), and a significantly lower amount of black smoke (–30% to –45%). The level of carbon monoxide from the 20 vol.% blend is significantly lower (–70%), and the levels of nitrogen oxides from all blends are little higher.

Keywords

Diesel substitute; Mixed crude palm oil; Engine performance; Engine emission



8.0

Taylor's University

8.1

Journal of Engineering Science and Technology, Volume 8, Issue 6, December 2013, Pages 654-669 © School of Engineering, Taylor's University.

Eco-tourism sustainability through PV Technology: A comprehensive review

Aravind C.V., Al-Atabi M., Ravishankar J., Malik A., Arkar, Ambikairajah, E.

Through the Economic Transformation program the Malaysian government aims to consider tourism as one of the major contributors to the country's economy and as an industry that imbibe on the principles of environmental responsibility and sustainable development. The growing challenges in the prevention of expansion in agriculture, forestry and aquaculture, and overexploitation of the natural resources, have made ecotourism extremely popular as a solution for developing tourism sites. Ecotourism attracts many people who wish not only to explore natural wonders but also to protect them for future generations. Most of the ecotourism sites are presumably situated far from the conventional energy resources and thus transporting electricity to those areas are discussed as inefficient and unsustainable. However, solar photovoltaic (PV) system is clean and alternative energy to suffice the energy demands of eco-tourist sites. This paper puts statements of the energy demand in global and its impact on the traditional fossil fuels and proposes PV as an alternative renewable technology pertaining to the eco-tourism application. The paper especially focuses on solar PV systems which not only could supply the energy demand of tourist sites but can also maintain the image of the ecotourism. A case of a model lodge is used for the study, through the energy demand analysis. A comprehensive review on the PV architecture is presented that derive interest in the implementation of such structure for the case presented.

Keywords

Eco-tourism, Peak demand, Solar PV systems, Sustainability



8.2

Energy Conversion and Management, Volume 76, 2013, Pages 162-168
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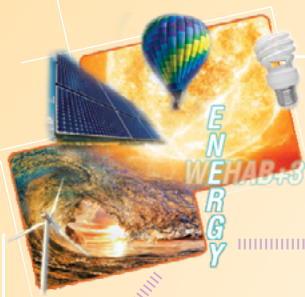
Energy, economic and environmental analysis of metal oxides nanofluid for flat-plate solar collector

Faizal M., Saidur R., Mekhilef S., Alim M.A.

For a solar thermal system, increasing the heat transfer area can increase the output temperature of the system. However, this approach leads to a bigger and bulkier collector. It will then increase the cost and energy needed to manufacture the solar collector. This study is carried out to estimate the potential to design a smaller solar collector that can produce the same desired output temperature. This is possible by using nanofluid as working fluid. By using numerical methods and data from literatures, efficiency, size reduction, cost and embodied energy savings are calculated for various nanofluids. From the study, it was estimated that 10,239 kg, 8625 kg, 8857 kg and 8618 kg total weight for 1000 units of solar collectors can be saved for CuO, SiO₂, TiO₂ and Al₂O₃ nanofluid respectively. The average value of 220 MJ embodied energy can be saved for each collector, 2.4 years payback period can be achieved and around 170 kg less CO₂ emissions in average can be offset for the nanofluid based solar collector compared to a conventional solar collector. Finally, the environmental damage cost can also be reduced with the nanofluid based solar collector.

Keywords

Economic, Energy saving, Environment, Flat-plate solar collector, Nanofluid



8.3

4th International Conference on Energy and Environment 2013, ICEE 2013, IOP Conference Series: Earth and Environmental Science, Volume 16, Issue 1, 2013, Article number 012004 © Published under licence by IOP Publishing Ltd.

Potential of size reduction of flat-plate solar collectors when applying MWCNT nanofluid

Faizal M., Saidur R., Mekhilef S.

Flat-plate solar collector is the most popular type of collector for hot water system to replace gas or electric heater. Solar thermal energy source is clean and infinite to replace fossil fuel source that is declining and harmful to the environment. However, current solar technology is still expensive, low in efficiency and takes up a lot of space. One effective way to increase the efficiency is by applying high conductivity fluid as nanofluid. This paper analyzes the potential of size reduction of solar collector when MWCNT nanofluid is used as absorbing medium. The analysis is based on different mass flow rate, nanoparticles mass fraction, and presence of surfactant in the fluid. For the same output temperature, it can be observed that the collector's size can be reduced up to 37% of its original size when applying MWCNT nanofluid as the working fluid and thus can reduce the overall cost of the system.



9.0

Universiti Kebangsaan Malaysia

9.1

Sains Malaysiana, 43 (1). pp. 95-101. ISSN 0126-6039 (2014)

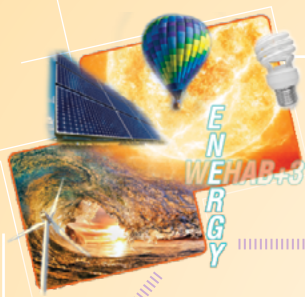
A novel ruthenium-tungsten bimetallic complex dye-sensitizer for photoelectrochemical cells application

Khuzaimah Arifin, Wan Ramli Wan Daud, Mohammad Kassim

A novel bimetallic double thiocyanate-bridged ruthenium and tungsten metal complex containing bipyridyl and dithiolene co-ligands was synthesized and the behavior of the complex as a dye-sensitizer for a photoelectrochemical (PEC) cell for a direct water splitting reaction was investigated. The ligands and metal complexes were characterized on the basis of elemental analysis as well as UV-Vis, Fourier transform infrared (FTIR) and nuclear magnetic resonance (^1H and ^{13}C NMR) spectroscopy. Cyclic voltammetry of the bimetallic complex showed multiple redox couples, in which half potentials $E_{1/2}$ at 0.625, 0.05 and 0.61V were assigned as the formal redox processes of Ru(III)/Ru(II) reduction, W(IV)/W(V) and W(V)/W(VI) oxidations, respectively. Photocurrent measurements were performed in homogeneous system and TiO_2 was used as the photoanode for photocurrent measurements. Current density generated by the bimetallic complex was higher than that of N3 commercial dye which suggested that the bimetallic complex donated more electrons to the semiconductor.

Keywords

Bimetallic; Bipyridyl; Dithiolene; Dye-sensitizer



9.2

Sains Malaysiana, 42 (10). pp. 1461-1466. ISSN 0126-6039 (2013)

Biomass and carbon estimation of *eugeissona tristis*

Syafinie, A.M. and Ainuddin, A.N.

Plant biomass represents a sink for atmospheric carbon dioxide, which is one of the most important greenhouse gas. *Eugeissona tristis* (Bertam) is a common palm species found in tropical lowland forest contributing to carbon and biomass stock estimation. However, the species has been neglected in most studies because of differences in sampling procedures and lack of equations. The objective of this study was to develop an allometric equation in estimating biomass and carbon content of *Eugeissona tristis*. This study was conducted in 10 20 m × 50 m plots in Ayer Hitam Forest Reserve (AHFR). Carbon content was estimated using carbon analyzer. The results showed AHFR contained 104 clumps/ha and distribution of *E. tristis* was not influenced by slope. The aboveground biomass of *E. tristis* was estimated to be 0.879 t ha⁻¹ corresponding to 1096 t for AHFR area (0.4% from total aboveground biomass). It contains 51% of carbon which contributes about 0.44 t C ha⁻¹ and 548 t C for the whole area, depicting that this species contributed to the overall carbon stock to a reasonable extent in AHFR.

Keywords

Biomass; Carbon; *Eugeissona tristis*



9.3

Sains Malaysiana, 42 (10). pp. 1365-1370. ISSN 0126-6039 (2013)

Biodegrading ability and enzymatic activities of some white rot fungi on kenaf (*Hibiscus cannabinus*)

Mohamed, R. and M.T. , Lim and Halis, R.

Lignocellulosic materials consist of lignin walls and cellulose fibrils that are bounded into lignin matrix preventing enzymatic activities to occur efficiently. Natural microorganisms such as fungi have the ability to break down this matrix and make the lignocellulosic components more accessible to enzymes. We report on the ability of four white rot fungi: *Oxyporus latemarginatus*, *Rigidoporus vinctus*, *Phanerochaete chrysosporium* and *Coriolus versicolor*, to degrade kenaf biomass. Fungi were inoculated separately onto kenaf medium and weight loss was determined after four weeks of incubation period. We observed *O. latemarginatus* as the fastest-growing fungus when compared with the rest and thus recorded the highest in biomass weight loss (3-fold higher). Filtrates from the fermentation were assayed for ligninase activity. All species produced high levels of lignin peroxidase (LiP), about the same amount of laccase except for *P. chrysosporium* and very low levels of manganese peroxidase (MnP). When analyzing for cellulase activities, all four species produced similar amounts of endoglucanase, exoglucanase and β -glucosidase. Because of its consistently fast growth and high enzymatic activities, *O. latemarginatus* stands as a superior candidate in biological pretreatment of lignocellulosic biomass.

Keywords

Basidiomycetes; Biological pretreatment; Cellulose; Enzyme



9.4

Sains Malaysiana, 40 (6). pp. 587-594. ISSN 0126-6039 (2011)

Biodiesel production via transesterification of palm oil using NaOH/Al₂O₃ catalysts

Yun Hin Taufiq-Yap, Nurul Fitriyah Abdullah, Mahiran Basri

Due to the increase in price of petroleum and environmental concerns, the search for alternative fuels has gained importance. In this work, biodiesel production by transesterification of palm oil with methanol has been studied in a heterogeneous system using sodium hydroxide loaded on alumina (NaOH/Al₂O₃). NaOH/Al₂O₃ catalyst was prepared by impregnation of alumina with different amount of an aqueous solution of sodium hydroxide followed by calcination in air for 3 h. The prepared catalysts were then characterized by using x-ray diffraction (XRD), Fourier transform infrared spectrometer (FT-IR), Brunner-Emmett-Teller surface area measurement (BET), scanning electron microscopy (SEM) and temperature-programmed desorption of CO₂ (CO₂-TPD). Moreover, the dependence of the conversion of palm oil on the reactions variables such as the molar ratio of methanol/oil, the amount of catalysts used, reaction temperatures and reaction times were performed. The conversion of 99% was achieved under the optimum reaction conditions. The biodiesel obtained was characterized by FT-IR and the pour point was measured

Keywords

Biodiesel; Heterogeneous catalyst; Palm oil; Transesterification



9.5

Sains Malaysiana, 43 (1). pp. 103-109. ISSN 0126-6039 (2014)

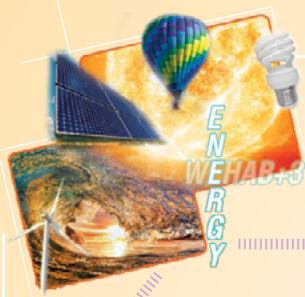
Combustion characteristics of refuse derived fuel (RDF) in a fluidized bed combustor

Johari, and Mat, R. and Alias, H. and Hashim, H. and Hassim, M.H. and Zakaria, Z.Y. and Rozainee, M.

The combustion characteristics of refuse derived fuel (RDF) in a fluidized bed have been studied. The gross heating value (GHV) of the RDF was 14.43 MJ/kg with moisture content of 25% by weight. Parameters of interest for sustainable bed combustion were the fluidization number and primary air factor. The study was performed in a rectangular fluidized bed combustor with dimensions of 0.3 m in width, 0.7 m in length and 2 m in height. Sand with mean particle size of 0.34 mm was used as a fluidization medium. The sand bed height was at 0.3 m above the standpipes air distributor. The range of fluidization number under investigation was 5–7 U_{mf} in which 5 U_{mf} was found to be the optimum. The study was continued for the determination of the optimum primary air factor with the selected range of primary air factors being 0.6, 0.8, 1.0 and 1.2 in experiments conducted at 5 U_{mf} . The final results showed that the optimum primary air factor was at 0.8. An energy balance was also performed to determine the thermal efficiency of the combustion. It was concluded that the thermal efficiency depended on the bed temperature and the primary air factor being used.

Keywords

Air factor; Fluidized bed combustor; Fluidization number; Operating parameter; Refuse derived fuel (RDF); Thermal efficiency



9.6

Sains Malaysiana, 43 (1). pp. 151-159. ISSN 0126-6039 (2014)

Combined similarity-numerical solutions of MHD boundary layer slip flow of non-newtonian power-law nanofluids over a radiating moving plate.

Nur Husna Md. Yusoff, Md. Jashim Uddin, Ahmad Izani Md. Ismail

A combined similarity-numerical solution of the magnetohydrodynamic boundary layer slip flow of an electrically conducting non-Newtonian power-law nanofluid along a heated radiating moving vertical plate is explored. Our nanofluid model incorporates the influences of the thermophoresis and the Brownian motion. The basic transport equations are made dimensionless first and then suitable similarity transformations are applied to reduce them into a set of nonlinear ordinary differential equations with the associated boundary conditions. The reduced equations are then solved numerically. Graphical results for the non-dimensional flow velocity, the temperature and the nanoparticles volume fraction profiles as well as for the friction factor, the local Nusselt and the Sherwood numbers are exhibited and examined for various values of the controlling parameters to display the interesting aspects of the solutions. It was found that the friction factor increases with the increase of the magnetic field (M), whilst it is decreased with the linear momentum slip parameter (α). The linear momentum slip parameter (α) reduces the heat transfer rates and the nanoparticles volume fraction rates. Our results are compatible with the existing results for a special case.

Keywords

Magnetic field; Momentum slip boundary condition; Non-Newtonian power-law nanofluids; Radiation



9.7

Sains Malaysiana, 42 (12). pp. 1781-1786. ISSN 0126-6039 (2013)

Effect of annealing temperature on the structural and optical properties of nanocrystalline ZnO thin films prepared by sol-gel method

Ibrahim, N.B. and Al-Shomar, S.M. and Ahmad, S.H.

Undoped zinc oxide (ZnO) thin films were prepared by a sol-gel method. The effect of annealing temperature from 500 to 700°C on the structural and optical properties of the films was studied. The films nanostructure characterized by the X-ray diffraction method showed that the films were single phase ZnO with wurtzite structure. The surface morphology studied using the field emission scanning electron microscope showed that the thickness of the films increased with the increment of annealing temperature. The grain size of the films increased with the increment of the annealing temperature. The film surface roughness measured using the atomic force microscope showed that the surface roughness of the film decreased (from 2.3 to 1.02 nm), when the annealing temperature increased from 500 to 600°C then it increased to 3.06 nm at 700°C. The optical properties were studied by the UV-Vis spectrophotometer. The results showed that the films had high transmittance (above 80%) in the visible range and the exciton absorption occurred at a wavelength of 379 nm. The energy gap decreased with the increment of annealing temperature.

Keywords

Annealing; Optical; Sol-gel; XRD; ZnO films



9.8

Sains Malaysiana, 42 (9). pp. 1327-1332. ISSN 0126-6039 (2013)

Effects of the nitric acid concentrations on the etching process, structural and optical properties of porous zinc oxide thin films.

C.G., Ching and Leonard, Lu and C.I., Ang and P.K., Ooi and S.S., Ng and Z. , Hassan and H. , Abu Hassan

The present study reports on the fabrication of porous zinc oxide by wet chemical etching. ZnO thin films were deposited via radio-frequency magnetron sputtering on p-type silicon with (111) preferred orientation. The etchants used in the present work were 0.1% and 1.0% nitric acid (HNO₃) solutions. ZnO were etched at various times and were characterized by X-ray diffraction (XRD), scanning electron microscopy (SEM) and photoluminescence (PL) spectroscopy to allow the examination of their structural and optical properties. The XRD results revealed that the intensity of ZnO(002) decreased when the thin films were etched in varying HNO₃ concentrations over different periods of time. The above observation is attributed to the dissolution of the ZnO(002). The SEM images showed that the thickness of the ZnO layers decreased over the etching time, which resulted from the isotropic etching by the HNO₃ solution. The PL emission intensity initially increased with increasing etching time. However, with further etching of the samples, the PL spectra showed a decreasing trend in intensity as a result of the decrease in the surface-to-volume ratio. All results lead to the conclusion that 1.0% HNO₃ has the capability to change the ZnO surface significantly.

Keywords

Photoluminescence spectroscopy; Scanning electron microscope; Wet chemical etching; X-ray diffraction; Zinc oxide



9.9

Sains Malaysiana, 42 (7). pp. 961-966. ISSN 0126-6039 (2013)

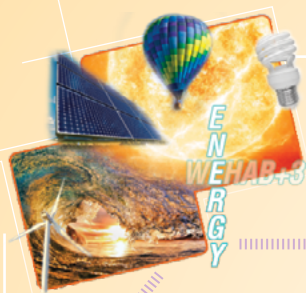
High transparency iron doped indium oxide ($\text{In}_{2-x}\text{Fe}_x\text{O}_3$, $x = 0.0, 0.05, 0.25, 0.35$ and 0.45) films prepared by the sol-gel method

Ibrahim, N.B. and Baqiah, H. and Abdullah, M.H.

High quality indium oxide and iron doped indium oxide nanocrystalline films were prepared by the sol-gel method followed by a spin coating technique. The samples were characterized by an X-ray diffractometer, an atomic force microscopy and a UV-vis spectroscopy. All samples had good crystallinity with a preferred orientation in the (222) direction. The crystallite size increased from 12.1 nm for the pure sample to 16.1 nm for the sample with $x=0.35$ and then decreased to 12.1 nm for the sample with $x=0.45$. All samples contained nanometer grain sizes with a smooth surface. All films showed a high transmission of over 91% in the wavelength range of 200-800 nm.

Keywords

Crystallization; Indium oxide; Transmission



9.10 Sains Malaysiana, 40 (9). pp. 993-997. ISSN 0126-6039 (2011)

Microbial fuel cells using mixed cultures of wastewater for electricity generation

*Zain .S.M, and Roslani .N.S, and Hashim .R, and Anuar .N, and Suja .N.F,
and Daud .W.R.W, and Basri .N.E.A,*

Fossil fuels (petroleum, natural gas and coal) are the main resources for generating electricity. However, they have been major contributors to environmental problems. One potential alternative to explore is the use of microbial fuel cells (MFCs), which generate electricity using microorganisms. MFCs uses catalytic reactions activated by microorganisms to convert energy preserved in the chemical bonds between organic molecules into electrical energy. MFC has the ability to generate electricity during the wastewater treatment process while simultaneously treating the pollutants. This study investigated the potential of using different types of mixed cultures (raw sewage, mixed liquor from the aeration tank & return waste activated sludge) from an activated sludge treatment plant in MFCs for electricity generation and pollutant removals (COD & total kjeldahl nitrogen, TKN). The MFC in this study was designed as a dual-chambered system, in which the chambers were separated by a Nafion™ membrane using a mixed culture of wastewater as a biocatalyst. The maximum power density generated using activated sludge was 9.053 mW/cm², with 26.8% COD removal and 40% TKN removal. It is demonstrated that MFC offers great potential to optimize power generation using mixed cultures of wastewater.

Keywords

Dual-chambered system; Electricity; Microbial fuel cell (MFC); Mixed cultures; Wastewater



9.11 Sains Malaysiana, 42 (9). pp. 1319-1325. ISSN 0126-6039 (2013)

Performance study of air-based photovoltaic-thermal (PV/T) collector with different designs of heat exchanger

Mohd. Yusof Hj. Othman, and Faridah Hussain, and Kamaruzzman Sopian, and Baharuddin Yatim, and Hafidz Ruslan

Three different designs of heat exchanger, V-groove, honeycomb and stainless steel wool had been tested to study their effectiveness in improving the overall performance of a photovoltaic/thermal (PV/T) air base solar collector. Heat exchangers were installed horizontally into the channel located at the back side of the PV module. The system was tested at irradiance of 828 W/m^2 with mass flow rate spanning from 0.02 kg/s to 0.13 kg/s . It was observed that at mass flow rate of 0.11 kg/s , the maximum thermal efficiency of the system with V-groove is 71%, stainless steel wool is 86% and honeycomb is 87%. The electrical efficiency of the systems is 7.04%, 6.88% and 7.13%, respectively. The experimental results showed that honeycomb design is the most efficient design as heat exchanger. The design which is simple and compact is suitable for building integration.

Keywords

Electrical efficiency; Heat exchanger; Photovoltaic/thermal; Thermal efficiency



10.0

Universiti Malaya

10.1 Renewable and Sustainable Energy Reviews, 20. pp. 279-293. ISSN 13640321 (2013)

A comprehensive overview of new designs in the hydraulic, electrical equipments and controllers of mini hydro power plants making it cost effective technology

Laghari, J.A.; Mokhlis, H.; Bakar, A.H.A.; Mohammad, H.

Implementations of mini hydro schemes with conventional hydraulic, electrical equipment's and controllers have proven very expensive and uneconomical. Many developing countries that are in need of rural electrification have encountered economical problem when setting up these mini hydro schemes. To address this problem, alternative options and new designs of these equipment's have been explored by many researchers around the world. The application of these new designs would reduce the overall cost of mini hydro development and would help in making it a cost effective technology. These new designs will also help developing countries to provide electricity to rural areas or remote regions where interconnection of transmission line from the electrical grid is uneconomical. The new designs can also be an enabling factor in boosting up electricity generation using a renewable energy source. This paper provides survey of all these alternative options and new designs in the controller, hydraulic turbine and generators that have been implemented in different countries of the world.

Keywords

New design in propeller turbine; Pump as turbine (PAT); Three-phase and six-phase induction generator; Six-phase synchronous generator; Intelligent controllers



10.2 Journal of the Taiwan Institute of Chemical Engineers. pp. 1-6. ISSN 1876-1070 (2013)

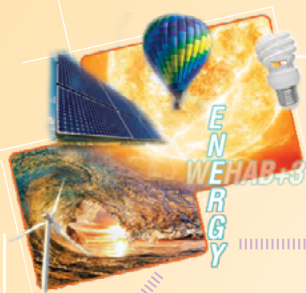
Blended aviation biofuel from esterified *Jatropha curcas* and waste vegetable oils

Baroutian, S.; Aroua, M.K.; Raman, A.A.A.; Shafie, A.; Ismail, R.A.; Hamdan, H.

Conventional petroleum-based jet fuels, including Jet A-1, are not renewable and generate a considerable amount of particulate and gaseous pollutants. Non-edible low cost vegetable oil such as waste vegetable oil (WVO) and *Jatropha curcas* can be used as feedstock for jet biofuel production with positive influence on the world climate change. In this work, an aviation biofuel was produced through blending of the methyl esters of waste vegetable and jatropha oils with Jet A-1 aviation fuel. A process was designed and fabricated to pretreat the waste vegetable oil obtained from local restaurant by means of dewatering and filtration to remove water and solid contaminants, respectively. Waste oil and *J. curcas* oil were converted to their methyl esters through a two-step catalytic reaction. Several blends of the produced methyl esters with Jet A-1 were prepared and characterized to determine the most suitable ratio based on the jet fuel specifications. The characterizations confirm that the jet biofuel with 10 and 20% methyl ester contents have comparable properties with the commercial available aviation fuel. Production of jet biofuel from waste vegetable and jatropha oil can be an alternative to reduce the amount of waste oil being disposed, to address the problems of energy and food self-sufficiency and to produce a clean fuel.

Keywords

Jet biofuel; Waste vegetable oil; *Jatropha curcas*; Methyl esters



10.3 20th MSMBB Scientific Meeting and MSMBB 25th Anniversary, 26-27 June, 2013, Research Management and Innovation Complex (RMIC), University of Malaya, Malaysia.

Bioethanol production from mixed lignocellulosic substrates using cellulolytic termite gut bacteria and yeast

Oke, M.A.; Philip, K.; Ajam, N.

Energy insecurity and global warming associated with use of fossil fuels have led to intense efforts towards sustainable production of biofuels such as bioethanol. Utilization of biomass for the production of biofuels has been fraught with challenges such as fluctuating feedstock supply, high cost of feedstock handling, and other logistic problems. Most studies on lignocellulosic ethanol production have been based on single biomass feedstocks. Mixed biomass feedstock approach to the utilization of lignocellulosic biomass for ethanol production has the potential to overcome the challenges of biomass utilization, positively improve the bioethanol production process and generally boost the biorefinery concept. Oil palm biomass and wood wastes account for the greater portion of wastes generated annually in Malaysia and their accumulation is a serious environmental problem. This study aims to investigate the potential of mixed lignocellulosic biomass (oil palm frond and saw dust) as substrate for bioethanol production. Cellulolytic bacteria have been isolated from the gut of dry wood termites collected from infested wood. Screening of the isolates for cellulase production using cellulose hydrolytic capacity values on CMC agar plates and identification of the isolates.

Keywords

Mixed biomass feedstock, Lignocellulose, Bioethanol, Cellulase, Bacteria, SSF, Direct microbial conversion



10.4 Renewable and Sustainable Energy Reviews, 18. pp. 23-30. ISSN 13640321

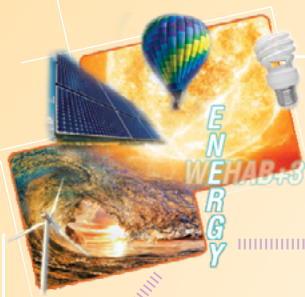
Curbing global warming with phase change materials for energy storage

Anisur, M.R.; Mahfuz, M.H.; Kibria, M.A.; Saidur, R.; Metselaar, I.H.S.C.; Mahlia, T.M.I.

The application of thermal energy storage (TES) system with phase change material (PCM) is an effective way for energy conservation and greenhouse gas (GHG) emission reduction. Global warming is increasing along with the energy consumption. Many researchers are concerned about this present global environmental problem for fossil-fuel burning. Thermal energy storage system with phase change material is observed as a potential candidate for mitigating this problem. This paper emphasizes the opportunities for energy savings and greenhouse-gas emissions reduction with the implementation of PCM in TES systems. For instance, about 3.43% of CO₂ emission by 2020 could be reduced through the application of PCM in building and solar thermal power systems. Similarly, energy conservation and GHGs emission reduction by other PCM applications for thermal comfort of vehicles, transport refrigeration, engine cold start, greenhouse and waste heat management are also presented. In addition, some present investigations on the performance improvement of the phase change materials are addressed.

Keywords

Energy saving, Fossil fuel consumption, Greenhouse gas emission, Phase change material, Thermal energy storage.



10.5 International Journal of Renewable Energy Resources (2013)

Feasibility Study of Installing the Microhydro Power Plant at Richang Waterfall and Ruangchori Khal in Bangladesh

Control and make use of micro hydro resources and decentralization of micro hydro schemes are particularly charming option in counter area without restraining the ecosystem. Although many researchers have carried out studies on different potential location of micro hydro resources in Bangladesh, two potential sites which are Ruandchori Khal and Richang Waterfall in the Chittagong region of Bangladesh have been selected to install the micro hydro power plants which were not investigated by other researchers as far as we know. To do this study flow rate and head of the water have been measured throughout the year 2010 from the month January to August which covers the dry season to full rainy season of Bangladesh These A detail feasibility study of installing the micro hydro power plant (MHP) in those sites has been presented in this paper.

Keywords

Bangladesh; Micro hydro power plant(MHP), Richang Waterfall, Ruangchori Khal, Ecosystem



10.6 **Journal of Membrane Science, 421-42. pp. 154-164. ISSN 03767388 (ISSN) (2012)**

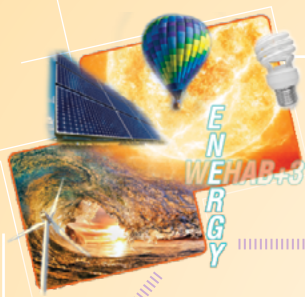
High quality biodiesel obtained through membrane technology

Atadashi, I.M.; Aroua, M.K.; Abdul Aziz, A.R.; Sulaiman, N.M.N.

In this study, a ceramic membrane with a pore size of 0.02 μm was used to purify crude biodiesel to achieve biodiesel product that meet both ASTM D6751 and EN 14241 standards specifications. The membrane system was successfully developed and used for the purification process. Process operating parameters such as transmembrane pressure, flow rate and temperature were investigated. Application of central composite design (CCD) coupled with Response Surface Methodology (RSM) was found to provide clear understanding of the interaction between various process parameters. Thus, the process operating parameters were then optimized. The optimum conditions obtained were transmembrane pressure, 2 bar, temperature, 40 $^{\circ}\text{C}$ and flow rate, 150 L/min with corresponding permeate flux of 9.08 ($\text{kg}/\text{m}^2 \text{h}$). At these optimum conditions, the values of free glycerol (0.007 wt%) and potassium (0.297 mg/L) were all below ASTM standard specifications for biodiesel fuel. In addition the physical properties of biodiesel at the optimum conditions met both ASTM D6751 and EN 14214. This work showed that with ceramic membrane of pore size 0.02 μm , biodiesel with high qualities that meet the stringent standards specifications more than those currently in application can be achieved.

Keywords

Ceramic membrane; Palm oil; Biodiesel; Permeate flux; Optimization



10.7 International Journal of Renewable Energy Research Vol 3, No 4 (2013)

Hybrid Renewable Energy System for Sustainable Future of Bangladesh

Md Meganur Rhaman

Bangladesh is the 7th largest population (164.4 Million) and 12th density of population (1034/km²) country in the world. Bangladesh is one of the most electric deprived countries. Electric energy protection is performed of decreasing the quantity of energy used in day by day. Bangladesh is a developing country, so their demand of electricity increases tremendously. Energy preservation is the result of financial capital increase of the country and also increases the environmental values. Normally maximum electric energy generated by fossil fuel, gas, coal etc, which is created air and water pollution and also negative impact on global calamity. That's why the peoples are focus on power generation system. Non renewable energy source like fuel, gas, coal are limited and it is important to reserve this sources for our future generation. There is large prospective for renewable energy source in Bangladesh, currently their contribution to the electric supply remaining insignificant compare to our total supply. The aim of this research is developed an alternative energy generation technology such as hybrid system of renewable energy for sustainable future. When Hybrid systems are used in remote areas, there will be coupled with diesel generators for system reliability. In this proposal, I analyze wind-diesel generator-battery, wind-Photovoltaic (PV)-diesel generator-battery, Photovoltaic (PV)-diesel generator-battery hybrid system in the rural and isolated island areas of Bangladesh.

Keywords

Bangladesh, Gridline, HOMER, Hybrid System, Photovoltaic, Solar cell



10.8 Renewable & Sustainable Energy Reviews, 18. pp. 528-542. ISSN 1364-0321 (2013)

Investigating possible wind energy potential to meet the power shortage in Karachi

Aman, M.M.; Jasmon, G.B.; Ghufuran, A.; Bakar, A.H.A.; Mokhlis, H.

Electricity is always considered as an important ingredient for development of a country. Energy deficit affects the growth rate of the country and causes discomfort to the consumer. The power shortage in Karachi, the largest city and economical hub of Pakistan, is highly hampering the progress of the city. Presently the energy deficit in the city is around 328 MW. This paper presents an analytical analysis of incorporation of small residential windmills to reduce the power shortage in Karachi. To estimate the wind energy potential in the city, four years wind data is collected from Pakistan Metrological Department (PMD) at various heights (10 m, 30 m, 50 m, 75 m and 100 m). The statistical calculations on wind data using SPSS software show that the city has an enormous wind potential available. A case study is also carried to show the effect of incorporation of small residential wind mills in power system. The results shows 1678 MW h of energy could be saved if 50% of residential consumers are equipped with small windmills. The paper also discusses the possible resistance in the introduction of small residential windmills in domestic sector. The potential benefits to the utility and consumers are also presented in this paper.

Keywords

Renewable energy, Wind energy potential, Load demand, Karachi



10.9 International Journal of Renewable Energy Resources Volume 22, Issue 1 (2012)

Production of Biogas from Mesophilic Anaerobic Digestion of Kitchen Waste

Ripon Kumar Saha

The study focuses on production of biogas as an alternative energy by using biodegradable wastes (BWs) in view of solving waste management at household level. The research was conducted in Laboratory (IEM department), Khulna University of Engineering and Technology (KUET) in 2012. Biogas refers to a gas made from anaerobic digestion of any type of household waste. While any organic material may be a feedstock for anaerobic digestion, waste organic matter represents a vast potential for sustainable energy production. Food waste in particular is a relatively where daily a large amount of kitchen waste is obtained which can be utilized for better purposes. Project was to create an organic processing facility to create biogas which will be more cost effective, eco-friendly, cut down on landfill waste, generate a high quality renewable fuel and reduce carbon dioxide and methane emission. Overall by creating a biogas reactor on campus in the backyard of our halls will be beneficial. Kitchen (food waste) was collected from different halls of KUET as feedstock for our reactor which works as anaerobic digester system to produce biogas energy. The anaerobic digestion of kitchen waste produces biogas, a valuable energy source and about the composition and quantity of constituents in the biogas produced. If biogas technology were adopted throughout the food service industry, this would significantly advance campus and societal sustainability.

Keywords

Mesophilic anaerobic digestion, Kitchen waste, Biogas, Biomethanization, Methanogenesis.



10.10 International Journal of Renewable Energy Resources Volume 22, Issue 1 (2012)

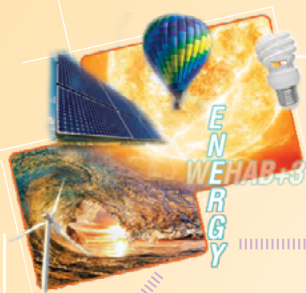
Power Generation from Sea Wave: A Sustainable and Renewable Approach towards Power Crisis

Ripon Kumar Saha

This paper presents a brief overview about the design, benefits, risk, and environmental impact of a sea wave power plant. The intention of this accomplishment is to serve society without hampering environmental ecology. This task is based on the renewable sea wave energy. Burning fossil fuel causes global warming. Again wastes of nuclear power plant are very hazardous. Accident of this plant yields great turn of human lives. The power generation from sea wave has growth a huge potentiality. It requires low initial cost and low maintenance cost respect to the other power generation system. The price of fossil fuel is rising day by day because of its scarcity in nature. As the operating cost of sea wave power plant is low and uses a renewable source of energy, it is possible to produce power at low price. Existing hydrostatic power plant needs dam. This is very harmful for environmental ecology and lives diversity. But this proposed plant does not require any dam or any other hazardous construction and this also reduces the installation cost. However it is reliable, sustainable, environmentally friendly power extraction procedure from sea wave.

Keywords

Renewable energy, Sprocket system, Break-even point, Eco-friendly



10.11 Renewable and Sustainable Energy Reviews, 16 (8). pp. 6268-6284. ISSN 1364-0321 (2012)

Review of offshore energy in Malaysia and floating spar platform for sustainable exploration

Islam, ABM; Jameel, Mohammed; Jumaat, Mohd Zamin; Shirazi, SM; Salman, Firas A

Rapidly rising trends of fuel consumption indicate enormous energy crisis of global proportions in near future. Following the trend, Malaysia's fuel consumption has been increasing by an annual rate of 7.2% since 1990 and has even reached 44.9 Mtoe in 2008. It is forecasted to reach 207.3 Mtoe by the year 2030. Due to serious depletion of reserves in various onshore locations, the exploration process is expanded to offshore deeper waters. Seven sedimentary basins belonging to Malaysia, in South China Sea, show great promise to be excellent sources of hydrocarbons. For deep-sea exploration fixed offshore structures are not feasible. An economical alternative is Spar platforms, which are floating structures ideal for exploration of deep water deposits. In this research, Malaysian experience in offshore hydrocarbon exploration is investigated. Various kinds of operational Spar platforms are censoriously explored and their recent technical developments are reviewed. The study reveals that Malaysia's primary energy requirements were met (in year 2008) with natural gas by 43.4% of the total, crude oil by 38.2%, coal by 15.3% and hydropower by 3.1%; indicating evidently that natural gas and crude oil are still the predominant energy sources. Out of the total energy, around 70% oil and 85% natural gas come from offshore fields. These large figures highlight the necessity to consider economically viable alternatives. Spar platform is an innovative marine structure designed to conduct such deep sea explorations. First commissioned Spar at Kikeh field of Malaysia is testimony to immense potential and possibilities of incorporating Spar platforms in the country's deep reserves for sustainable energy generation. Classic Spar, Truss Spar, Cell Spar and Cell-truss Spar are identified to be well suited for these environments. Since the offshore fields are located at waters with more than 1000 m depth, Spar platforms can be successfully installed at these Malaysian deep water fields.

Keywords

Energy reserve, Oil and natural gas exploration, Malaysian deep water, Sedimentary basins, Offshore floating structures, Spar platform



10.12 Malaysian Journal of Science Volume 31, Issue 1 (2012)

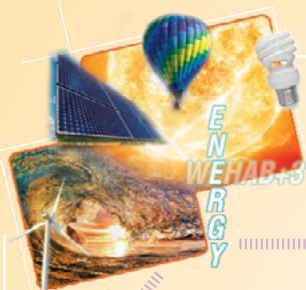
Well trap structures and bulk-nano environment luminescence centers in $\text{CaZnGe}_2\text{O}_6:\text{Tb}^{3+}$ long afterglow phosphor

Boon, Kuan Woo, Yang, Li, Singh, Surinder P.

A long afterglow phosphor $\text{CaZnGe}_2\text{O}_6:\text{Tb}^{3+}$ has been prepared by using organic coated luminescence ZnO nanopowder through a high temperature solid-state reaction route. This new $\text{CaZnGe}_2\text{O}_6:\text{Tb}^{3+}$ long afterglow phosphor sample emits the Tb^{3+} green fluorescence 543 nm emission corresponding to $5 D_4 \rightarrow 7 F_5$ transition under UVA 350 nm illumination. The organic coated luminescence ZnO nanopowder serves to construct shallow well trap for the Tb^{3+} dopant and to minimize electron leakage of well traps. By adjusting the mass ratio of both the bulk ZnO powder (<1000 nm size) and the organic coated luminescence ZnO nanopowder (5-10 nm size), depth of well traps that dictate luminescence and afterglow properties could be controlled. The optimized long afterglow phosphor sample was found to be made of 70% gm-weight of bulk ZnO powder and 50% gm-weight of organic coated luminescence ZnO nanopowder or $\text{CaZn}_{0.83}\text{Ge}_2\text{O}_6:\text{Tb}^{3+}$ phase compound that exhibit afterglow longevity of longer than 3 hours. Therefore, phosphorescence effect is best explained based upon well trap structures model and structure lattice defects play an important role in influencing persistent luminescence phenomena.

Keywords

Afterglow phosphor, Phosphorescence, Well trap structure



11.0

Universiti Malaysia Perlis

11.1

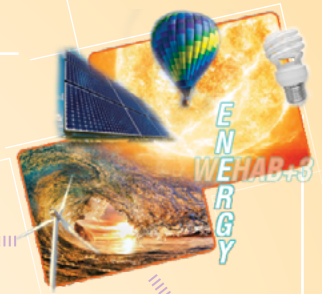
Current Applied Physics, Volume 13, Issue 9, November 2013, Pages 1894–1898

Photovoltaic characteristics of hybrid MEH-PPV-nanoparticles compound*A.H. Reshak, M.M. Shahimin, N. Juhari, R. Vairavan*

Organic solar cell research has vastly developed in recent years. These organic solar cells however are still limited to low power conversion efficiencies. This has led to the generation of photovoltaic cells based on hybrid nanoparticle-organic polymer materials. The hybrid solar cell has the potential of bridging the efficiency gap which is present in organic and inorganic semiconductor materials. This paper focuses on characterization of fabricated hybrid active layer consisting of organic polymer infused with semiconductor nanoparticles. The active layer was deposited on the substrate using the spin coating technique. Materials used in the active layer are poly (2-methoxy, 5-(2-ethyl hexyloxy) p-phenyl vinylene) MEH-PPV, cadmium telluride (CdTe) and cadmium sulphide (CdS). The fabricated solar cells with active layer of MEH-PPV only were found to have a power conversion efficiency of 0.1% for 1 W, hybrid cell with active layer of MEH-PPV/CdTe has power conversion efficiency of 0.15% for 1 W and hybrid cell with active layer of MEH-PPV/CdTe/CdS has power conversion efficiency of 0.18% for 1 W.

Keywords

Hybrid solar cells, Nanoparticles, MEH-PPV, CdTe, CdS



11.2 Energy Procedia, Volume 14, 2012, Pages 1503–1508, 2nd International Conference on Advances in Energy Engineering (ICAEE) 2011, Published by Elsevier Ltd

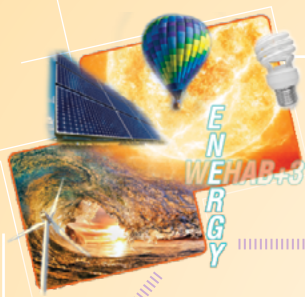
Potential of solar energy harvesting in Ulu Pauh, Perlis, Malaysia using solar radiation – Analysis studies

A.N. Syafawati, I. Daut, M. Irwanto, Z. Farhana, N. Razliana, Z. Arizadayana, S.S. Shema

This paper presents analysis studies of solar energy harvesting potential in Ulu Pauh, Perlis, Malaysia which located at 6.462°N, 100.351°E. Solar radiation is radiant energy received from the sun, from both direct and diffuse or reflected sunlight. In average of the year, Perlis able to receive about half day of solar radiation regardless the reflectivity. Perlis is northern state of Peninsular Malaysia and known as hottest state in Malaysia with the average 12 hours of sunlight received per day. The discussion in this paper also includes several factor and parameter in the solar energy collecting potential analysis. The analysis studies had updated for last six month in year 2011. The potential of receiving solar radiation at 6.462°N, 100.351°E is compared to 6.431°N, 100.185°E with support by recorded data using Davis Vantage Pro2 Weather Station. All the data used in this paper are live record for the past six month which used for ongoing research on solar and wind energy.

Keywords

Solar energy, Energy harvesting, Solar radiation



11.3

Applied Surface Science, Volume 257, Issue 14, 1 May 2011, Pages 6112–6117, Published Elsevier B.V.

New optical features to enhance solar cell performance based on porous silicon surfaces

Asmiet Ramizy, Z. Hassan, Khalid Omar, Y. Al-Douri, M.A. Mahdi

Electrochemical etching is used to fabricate porous silicon (PS) surfaces for both sides of the Si wafer. The effect of PS on performance of Si solar cells is investigated and the reflected mirrors are manipulated to enhance solar cell efficiency. The process is promising for solar cell manufacturing due to its simplicity, lower cost and suitability for mass production. The PS surface has discrete pores and short-branched pores on the polished wafer side. In contrast, the etched backside of the wafer has smaller pore size, with random pores. PS formed on both sides has lower reflectivity value compared with results in other works. Solar cell efficiency is increased to 15.4% with PS formed on both sides compared with the unetched sample and other results. Using empirical models, the optical properties of the refractive index and the optical dielectric constant are investigated. The porous surface texturing properties could enhance and increase the conversion efficiency of porous Si solar cells. The obtained results are in agreement with experimental and other data.

Keywords

Porous silicon, Solar cell, Crystalline silicon, Refractive index



11.4 Energy Procedia, Volume 18, 2012, Pages 1428 – 1433, Terragreen 2012: Clean Energy Solutions for Sustainable Environment (CESSE), Published by Elsevier Ltd.

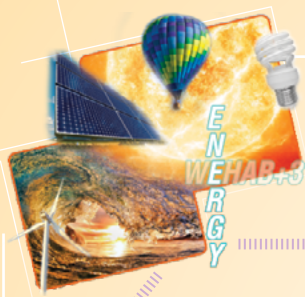
A study on the wind as renewable energy in Perlis, northern Malaysia

I.Daut, A.R.N. Razliana, Y.M. Irwan, Z. Farhana

This paper represented analysis of wind speed and study of vertical axis wind turbine. There are two type vertical axis wind turbine that had been discussed on this paper that are Darrieus type and Savonius type wind turbine. The wind speed data is recorded using Davis Vantage Pro2 Weather station. A few calculations has been done to get output power from the wind to shows the possibilities and potentialities of wind energy whether it can be develop in Perlis.

Keywords

Wind speed, Vertical axis wind turbine



11.5 Energy Procedia, Volume 18, 2012, Pages 1421–1427, Terragreen 2012: Clean Energy Solutions for Sustainable Environment (CESSE)

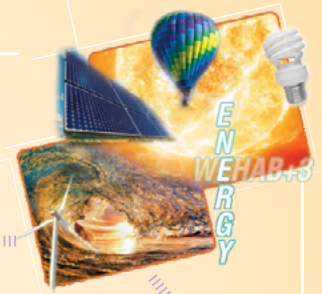
Analysis of solar irradiance and solar energy in Perlis, northern of peninsular Malaysia

I. Daut, Farhana Zainuddin, Y.M. Irwan, A.R.N. Razliana

A photovoltaic (PV) systems output depends on the environmental parameters such as solar irradiance. The main priority in photovoltaic panels is electricity production. The aim of the presents work is to analyze the solar radiation received in Perlis, Northern of Peninsular Malaysia. The characteristic of solar irradiance is recorded per minutes for a month using Davis Vantage Pro2 Weather Station. The objective of this study is to analyze the electrical characteristic and relationships of solar irradiance and solar energy to the output of PV module respectively.

Keywords

Solar irradiance, PV module, Electrical characteristic



11.6

Energy Procedia, Volume 36, 2013, Pages 444–453, TerraGreen 13 International Conference 2013 - Advancements in Renewable Energy and Clean Environment

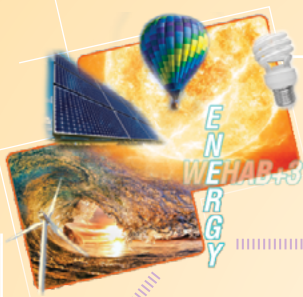
Solar powered air conditioning system

I. Daut, M. Adzrie, M. Irwanto, P. Ibrahim, M. Fitra

The development of renewable energy is on the rise worldwide because of the growing demand on energy, high oil prices, and concerns of environmental impacts. In recent years, progress on solar-powered air conditioning has increased as nowadays, air conditioning system is almost a must in every building if we want to have a good indoor comfort inside the building. Therefore, this paper focuses in the design and construction of a direct current (DC) air conditioning system integrated with photovoltaic (PV) system which consists of PV panels, solar charger, inverter and batteries. The air conditioning system can be operated on solar and can be used in non-electrified areas. As we all known, solar energy is cost effective, renewable and environmentally friendly.

Keywords

Solar, Direct current, Air conditioning system



11.7

Procedia Engineering, Volume 50, 2012, Pages 957–965, International Conference on Advances Science and Contemporary Engineering 2012, Published by Elsevier Ltd.

Fabrication of nanotitanium dioxide solar cells without dye-sensitized

I. Daut, M. Fitra, M. Irwanto, N. Gomesh, Y.M. Irwan

In this paper has been successfully created a nanotitanium dioxide solar cell without dye sensitized which is used to convert solar energy into electrical energy. In general, manufacturing technology in the Journal of DSSC is relatively quite cheap, easy and does not require large and expensive equipment, especially if done without the use of dye sensitized will be cheaper. With this paper can be a guide to encourage the students - lower school students, high school to find out how to make solar cells and can make it at school and can even be made at home.

Keywords

Nanotitanium dioxide, Solar cells



11.8 Solar Energy, Volume 85, Issue 11, November 2011, Pages 2871–2880, Published by Elsevier Ltd.

Combination of hargreaves method and linear regression as a new method to estimate solar radiation in Perlis, northern Malaysia

I. Daut, M. Irwanto, Y.M. Irwan, N. Gomesh, N.S. Ahmad

The best way to obtain the solar radiation data of a particular place of interest (POI) is to measure at the specific site continuously and accurately over the long term. However, due to financial, maintenance, calibration requirement of the measuring equipment or institutional limitations, these data are absent, incomplete or inaccessible in most areas of the world. Based on meteorological data from Chuping Station, Perlis which is at Northern Malaysia, there were several missing data of solar radiation for the year 2007 and 2008. This paper presents a new method to estimate the solar radiation which is a combination of Hargreaves method and linear regression. Normally, both regression coefficients, a and b of the linear regression are found based on the measured data, but using the proposed method, both regression coefficients based on the Hargreaves method with the correlated parameter, x is the difference of daily temperature. This paper also presents the basic knowledge of Hargreaves method before the proposed method is implemented. As validation, those solar radiation data that are measured by Chuping Station for the year 2006 and by Electrical Energy and Industrial Electronic System (EEIES) Cluster Station for the month of March–June 2011 and their estimated solar radiation data are compared and analyzed using coefficient of residual mass (CRM), root mean squared error (RMSE), Nash–Sutcliffe equation (NSE) and percentage error (e). The statistical analysis of the average monthly measured solar radiation data for the past 26 years (1979–2006) is compared with the estimated solar radiation data for 3 years (2006–2008). The proposed method result shows that the value of CRM is closer to zero which indicates that the proposed method is perfectly estimated, the values of RMSE are low value, this indicates that the method performs well, the value of NSE is closer to 1 which indicates that the estimated solar radiation match perfectly with the measured data taken for the past 26 years, the value of e is closer to zero which indicates that the proposed method is acceptable and applicable.

Keywords

Solar radiation, Temperature, Hargreaves method, Linear regression, Statistic analysis



11.9

Energy Procedia, Volume 18, 2012, Pages 1372–1381, Terragreen 2012: Clean Energy Solutions for Sustainable Environment (CESSE), Published by Elsevier Ltd.

Smart smoke ventilation and power generation (SSVPG)

I. Daut, N. Gomesh, M. Irwanto, Y.M. Irwan, Y. Yanawati, S. Nor Shafiqin

Awareness towards green energy are on the hike and proven by many product being manufactured or pre-required to be assembled as energy saving devices mainly to save consumer from spending more on utility billing. This paper proposes the idea of “Smart smoke ventilation and power generation (SSVPG)” mainly due to emergency situation such as fire outbreaks. The SSVPG can also be used in many places that require smoke ventilation or even to reduce the room temperature as many conventional ventilation system (CVS) do. The difference is SSVPG works automatically by the usage of sensors that detects the smoke/temperature. It automatically spins the exhaust fan and mechanically rotating the AC generator which is coupled together with the exhaust fan and then charges the battery. The innovation of this product is, it does not rely on the utility supply as it is also hook up with a solar panel which also charges the battery, Secondly, it generates energy as the exhaust fan mechanically rotates. Thirdly, an energy loop back feature is introduced to this system which will supply for the ventilator fan. Another major innovation is towards interfacing this device with an in house production of generator. This generator is produced by proper design on stator as well as rotor to reduce the losses. A comparison is made between the SSVPG and the CVS and result shows that the SSVPG saves 172.8kWh/year of utility supply which is used by CVS. This amount of energy can save RM 3.14 from monthly utility bill and a total of RM 37.67 per year. In fact this product can generate 175 Watt of power from generator(75W) and solar panel(100W) that can be used either to supply other household appliances and/or to loop back to supply the fans motor. The innovation of this system is essential for future production of other equipment by using the loopback power method and turning most equipment into a stand alone system.

Keywords

Smart smoke ventilation and power generation (SSVPG), Conventional ventilation system (CVS), Energy and power



11.10 Energy Procedia, Volume 36, 2013, Pages 341–348, TerraGreen 13 International Conference 2013 - Advancements in Renewable Energy and Clean Environment

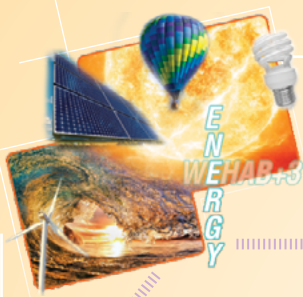
Dye solar cell using Syzigium Oleina organic dye

M. Fitra, I. Daut, N. Gomesh, M. Irwanto, Y.M. Irwan

Dye sensitized solar cell (DSSC) is another type of solar cell that utilise the use of a Dye as to absorb more sun rays on solar cells and to direct solar irradiance in it as to circulate electron process like in a conventional diode. The components used to build a DSSC can be divided into 4 parts from making the substrate in this case the TiO_2 as the anode and Carbon as the cathode, soaking it in Dye which act as absorption mechanism, adding of electrolyte and finally assembling them as a unit of solar cell. The process of solar absorption works as the photons from the sun molecular works similarly as in photosynthesis of green leaves. This paper proposed the use of Syzigium Oleina fruit as dye. Syzigium Oleina is a genus of flowering plants that belongs to the myrtle family, Myrtaceae. The genus comprises about 1100 species, and has a native range that extends from Africa and Madagascar through southern Asia east through the Pacific. The usage of Syzigium Oleina as Dye compared to blueberries shows higher solar irradiance absorption and can be used as alternative of other types of organic berries.

Keywords

Syzigium oleina, Dye, Solar cells, DSSC



11.11 *Procedia Engineering*, Volume 56, 2013, Pages 829–834, 5th BSME International Conference on Thermal Engineering © 2012 The authors, Published by Elsevier Ltd.

Investigation of a portable standing wave thermoacoustic heat engine

M.G. Normah, A.R. Irfan, K.S. Koh, A. Manet, Ab.M. Zaki

Increasing the efficiency and effectiveness of energy systems remains as one of the critical issues today with depleting energy resources and increasing energy demand. Utilization of alternative fuels and utilization of waste heat has also become a major research area. This study reports an investigation on a development of a portable thermoacoustic heat engine that converts energy from a combustion process into acoustic power. The prime mover operates with a temperature gradient imposed on a celcor ceramic stack which then induced pressure oscillations. The system consists of a 42-cm long stainless steel alloy 304 tube with a diameter of 50 mm open at one end. A propane torch is used to model a potential heat source from biomass combustion. No hot heat exchanger is required while copper plates are used as the ambient heat exchanger. At 500°C, thermoacoustic effects and pressure oscillations have been observed with a calculated power of 50 W at the stack. The system which operates at atmospheric pressure with air as the working fluid indicates the potential in utilizing the heat produced from biomass combustion that is widely applied in the rural areas.

Keywords

Thermoacoustic heat engine, Energy system, Biomass combustion, Acoustic power



11.12 Solar Energy, Volume 86, Issue 9, September 2012, Pages 2263–2272, Published by Elsevier Ltd.

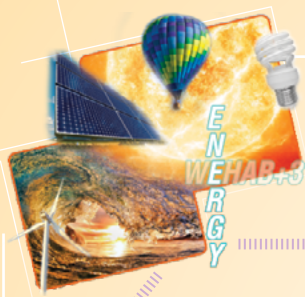
Optimising PCM thermal storage systems for maximum energy storage effectiveness

N.A.M. Amin, M. Belusko, F. Bruno, M. Liu

A new performance parameter for PCM thermal storage systems, the energy storage effectiveness, is defined. This parameter can be used to optimise the design of any PCM thermal storage system to maximise the use of the thermal storage media. The paper presents results of a parametric study using an experimentally validated numerical model for PCM encapsulated in plates. The results are used to calculate the energy storage effectiveness which is ultimately used to optimise the useful energy that can be stored in the PCM thermal storage system. The energy storage effectiveness is also used to compare the useable storage capacity of the PCM relative to a sensible energy storage system.

Keywords

Phase change material, Energy storage effectiveness, Thermal energy storage



11.13 Energy Procedia, Volume 36, 2013, Pages 303–312, TerraGreen 13 International Conference 2013 - Advancements in Renewable Energy and Clean Environment

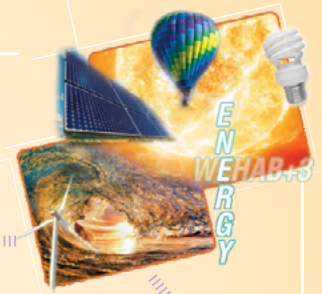
Study on Malaysian's perspective towards renewable energy mainly on solar energy

N. Gomesh, I. Daut, M. Irwanto, Y.M. Irwan, M. Fitra

Malaysia, despite being known as the suppliers for oil and natural gas in the world is having a hard time fulfilling the huge demand of domestic and international energy sector. The nation's oil production has been gradually decrementing since reaching a peak of 862,000bbl/d in 2004 due to mature reservoirs. Alternative cost as well as the maintenance that remains increasing yearly while the supply of fuels are depleting is making it hard for Malaysia to be able to sustain its oil development. This has become an important issue for the government to establish energy in the most economically worthy to ensure the sustainability in its development. This paper presents a review on Malaysian's perspective on renewable energy mainly in the solar energy sector by conducting a survey study. The survey focuses on the level of understanding Malaysian has towards renewable energy, the level of acceptance towards solar energy, the future prospect of solar energy as well as the financial perspective on solar energy in Malaysia. Study shows that renewable energy mainly in the area of solar energy receives warm welcome from many Malaysian as well as a demand for change in the conventional energy method. Malaysian is also ecologically concern as well as ready for any policies that has a solving mechanism in this energy crisis.

Keywords

Solar, Renewable energy, Malaysia FIT, Oil



11.14 **Procedia Engineering, Volume 41, 2012, Pages 1228–1234, International Symposium on Robotics and Intelligent Sensors 2012 (IRIS 2012), Published by Elsevier Ltd.**

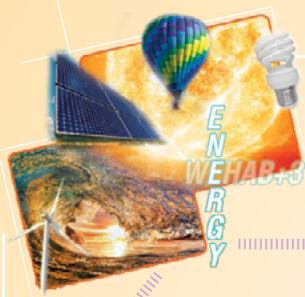
Vibration energy harvesting using single and comb-shaped piezoelectric beam structures: modeling and simulation

N.H. Diyana, Asan G.A. Muthalif, M.N. Fakhzan, A.N. Nordin

Of late, many have shown great interests in the area of energy harvesting or energy scavenging. Researchers have been venturing into methods that can generate acceptable level of voltage since decades ago. In line with the spirit of green technology, energy harvesting will be a major contributor towards saving our environment in near future. Vibration energy harvesting, specifically, is getting more and more attention nowadays. With the abundant sources, this type of energy harvesting can generate desired voltage to power any low power devices and wireless sensor; and subsequently high power devices in the future. In this research, unimorph piezoelectric energy harvester is chosen to harvest wideband mechanical energy. The derivation of the mathematical modelling is based on the Euler-Bernoulli beam theory. MATLAB and COMSOL Multiphysics software are used to study the influence of the structure in generating output voltage due to base excitations. Finally, the results of the frequency response are displayed in the form of voltage within frequency range of 0 to 3500 Hz, at which the comb-shaped piezoelectric beam structure shows better performance as there exist more natural frequencies in the specified range of frequency.

Keywords

Unimorph, Piezoelectric, Vibration energy harvesting, Optimized piezoelectecric structure, Comb-shaped structure, COMSOL



11.15 Renewable and Sustainable Energy Reviews, Volume 16, Issue 6, August 2012, Pages 4047–4055

A review on existing and future energy sources for electrical power generation in Malaysia

Rosnazri Ali, Ismail Daut, Soib Taib

As the electricity demand is affected by population growth, Malaysia towards an industrialized nation is considering the options for future energy sources for its power generation. Besides the conventional four-fuel mix, the five-fuel mix strategy under several national policies are introduced to diversify and expanding the resources to incorporate renewable energy and nuclear. In view of Malaysia will become a net energy importer by 2020, the increase in alternative energy shares at least will provide stable energy security, more economical and greener environment. In this paper, present and future energy sources are discussed to emphasis on the constraints and barriers facing Malaysia towards energy security and sustainability. Several preferences on future energy sources are under serious consideration where renewable energy (RE) is becoming one of the popular choices as Malaysia recognizes the potential of RE as sustainable and greener option.

Keywords

Energy demand, Fuel-mix strategy, Renewable energy, Energy efficiency



11.16 Renewable and Sustainable Energy Reviews, Volume 15, Issue 2, February 2011, Pages 897–904

Current perspective of the renewable energy development in Malaysia

Salsabila Ahmad, Mohd Zainal Abidin Ab Kadir, Suhaidi Shafie

It is estimated that oil reserves will not last very much longer; thus, a switch to alternative energy solutions is crucial. The Malaysian government has already prepared to face the situation decades before. Many policies have been implemented, as well as programmes and initiative. Now, Malaysia is waiting for the ultimate solutions, the Malaysian Fit-in Tariff (FiT), which is scheduled to be implemented second quarter of 2011. This paper presents the main sources of alternative renewable energy in Malaysia and its potential as well as the main reasons Malaysia is turning to alternative energy solutions; to fully utilize its renewable energy (RE) resources, fulfill the energy demand in the future and to reduce carbon emissions. This paper also discusses the steps taken by the government in preparation for FiT and overcoming the barriers in RE development.

Keywords

Renewable energy, Energy demand, Energy policy, Fit-in tariff



12.0

Universiti Malaysia Sabah

12.1

Renewable Energy, Volume 59, November 2013, Pages 23-29

Transesterification of palm oil using KF and NaNO₃ catalysts supported on spherical millimetric γ -Al₂O₃*Aminul Islam, Yun Hui Taufiq-Yap, Chi-Ming Chu, Pogaku Ravindra, Eng-Seng Chan*

The use of spherical millimetric gamma-alumina (γ -Al₂O₃) as a catalyst support for the production of biodiesel from palm oil is demonstrated. The catalyst support was produced using a dripping method, and KF and NaNO₃ catalysts were loaded on the support using the impregnation method. X-ray diffraction (XRD) analysis showed the formation of Na₂O and NaAlO₂ phases on the NaNO₃/ γ -Al₂O₃ catalyst and the formation of K₂O and KAlF₄ on the KF/ γ -Al₂O₃ catalyst, which were possibly the active sites for the transesterification reaction. The highest number and strength of basic sites generated from the solid phase reaction of the KF/ γ -Al₂O₃ catalyst loaded with 0.24 g KF/g γ -Al₂O₃ and the NaNO₃/ γ -Al₂O₃ catalyst loaded with 0.30 g NaNO₃/g γ -Al₂O₃ were confirmed by temperature programmed desorption of CO₂ (CO₂-TPD) analysis. The nitrogen adsorption-desorption isotherms also revealed a mesoporous structure of the catalysts. The biodiesel yield was comparable to that produced from smaller catalysts, and this result indicated the potential of the macrospherical catalysts.

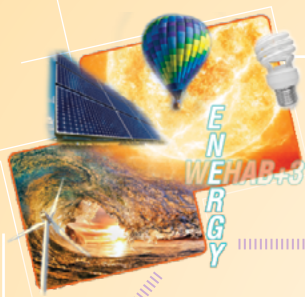


12.2 Energy Policy, Volume 39, Issue 11, November 2011, Pages 7244-7256

Examining the Small Renewable Energy Power (SREP) Program in Malaysia

Benjamin K. Sovacool, Ira Martina Drupady

The Small Renewable Energy Power (SREP) Program was the premier policy mechanism implemented by the national government to promote small-scale renewable electricity in Malaysia from 2001 to 2010. However, it managed meet less than 3 percent of its original goal by 2005. This study investigates what happened. More specifically, using a qualitative semi-structured interview approach with data presented in a narrative format, it answers the following five questions: (1) What are the primary energy policy and security challenges facing Malaysia? (2) What were the drivers behind the SREP in Malaysia? (3) What were the major benefits arising from the SREP? (4) What were the significant challenges to implementation? (5) What lessons or insights does the SREP offer for the study of energy policy design and implementation more generally? We find that the SREP failed to achieve its targets due to capacity caps, a lengthy approval process, lack of monitoring, exclusion of stakeholders, and few (if any) pre-feasibility studies. Other factors explaining its poor performance include opposition from the national utility Tenaga Nasional Berhad and electricity tariffs unmatched with true production costs.



12.3 Renewable Energy, Volume 40, Issue 1, April 2012, Pages 113-129

Energy security and hydropower development in Malaysia: The drivers and challenges facing the Sarawak Corridor of Renewable Energy (SCORE)

Benjamin K. Sovacool, L.C. Bulan

This article investigates the drivers and challenges associated with the Sarawak Corridor of Renewable Energy in Malaysia, or SCORE, on the island of Borneo. SCORE constitutes a multi-hundred billion dollar infrastructure development plan in Sarawak, one aiming to achieve US\$105 billion of investment and to build 20,000 MW of hydroelectric dams along a 320 km corridor crisscrossing 70,000 square kilometers. Based largely on primary data collected through site visits, original field research in Sarawak, and more than eighty research interviews, the article identifies the genesis of SCORE, its expected benefits, and challenges with implementation encountered to date. The article begins by describing its research methods and then summarizes four sets of anticipated benefits discussed by respondents associated with SCORE: industrialization, energy security, equitable development, and spillover effects. It then dives into a longer discussion of the technical, economic, political, legal and regulatory, social, and environmental challenges facing the project. The article concludes by offering implications for those wishing to promote other large-scale, energy infrastructure projects throughout the world.

Keywords

Malaysia, Hydroelectricity, Borneo



12.4 Nuclear Engineering and Design, Volume 249, August 2012, Pages 125-131

Effect of cold inflow on chimney height of natural draft cooling towers

Chi-Ming Chu, Md. Mizanur Rahman, Sivakumar Kumaresan

Temperature and pressure drop data obtained from an air-cooled heat exchanger model with cross-sectional flow areas of 0.56 m^2 , 1.00 m^2 and 2.25 m^2 operating under natural convection are presented that indicate significant cold inflow, resulting in the reduction of effective chimney height. Cold inflows encountered in actual applications where the Froude number is typically 0.2, may not be as severe as described in this paper, which was of the order of 10^{-6} – 10^{-4} . Additional tests on smaller scale models appeared to favor the explanation that the occurrence of cold inflow in the air-cooled heat exchanger model was primarily due to the relative ease in either drawing cold air from inlet or from outlet, and to a lesser extent the Froude number of the chimney or the critical velocity estimated by formula. A CFD study will bring much understanding of the phenomenon for the different situations.



12.5

Renewable and Sustainable Energy Reviews, Volume 16, Issue 7, September 2012, Pages 5232-5244

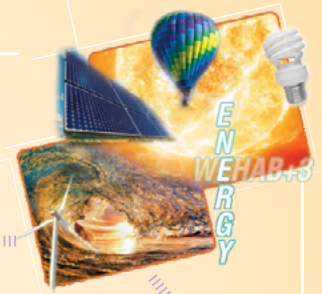
A review on existing and future energy sources for electrical power generation in Malaysia

Firdaus Muhammad-Sukki, Abu Bakar Munir, Roberto Ramirez-Iniguez, Siti Hawa Abu-Bakar, Siti Hajar Mohd Yasin, Scott G. McMeekin, Brian G. Stewart

As the electricity demand is affected by population growth, Malaysia towards an industrialized nation is considering the options for future energy sources for its power generation. Besides the conventional four-fuel mix, the five-fuel mix strategy under several national policies are introduced to diversify and expanding the resources to incorporate renewable energy and nuclear. In view of Malaysia will become a net energy importer by 2020, the increase in alternative energy shares at least will provide stable energy security, more economical and greener environment. In this paper, present and future energy sources are discussed to emphasis on the constraints and barriers facing Malaysia towards energy security and sustainability. Several preferences on future energy sources are under serious consideration where renewable energy (RE) is becoming one of the popular choices as Malaysia recognizes the potential of RE as sustainable and greener option.

Keywords

Energy demand; Fuel-mix strategy; Renewable energy; Energy efficiency



12.6

Renewable and Sustainable Energy Reviews, Volume 15, Issue 9, December 2011, Pages 4780-4787

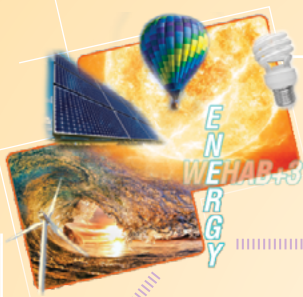
Renewable energy policies and initiatives for a sustainable energy future in Malaysia

Haslenda Hashim, Wai Shin Ho

Effective policies and incentive on renewable energy (RE) is critical to promote low carbon economy and society in the future. RE was first introduced in the country's energy mix through the Fifth-Fuel Policy which was formulated under the Eighth Malaysia Plan (2001–2005) to reduce dependency on fossil fuel and to address the rising global concern on climate change. This paper addresses the RE progress and achievement over the past 10 years, and discusses the key policies for RE programmes, funding, schemes, and incentives that has been introduced by the government of Malaysia to develop and promote the utilisation of RE. The recent RE mechanisms under the Tenth Malaysia Plan (2011–2015) will also be highlighted.

Keywords

Renewable energy (RE), Malaysia, RE policies, RE programmes, RE incentives, RE funding and schemes



12.7 Renewable Energy, Volume 36, Issue 1, January 2011, Pages 9-15

Estimation of exterior vertical daylight for the humid tropic of Kota Kinabalu city in East Malaysia

Harimi Djamila, Chu Chi Ming, Sivakumar Kumaresan

In tropical regions natural daylight has been a fundamental factor in building design. It is the most efficient way of lighting a building in the daytime and has a great potential for energy conservation in buildings. In Malaysia there are a limited available data of measured illuminance which is the case of several regions in the tropics. Using established models it is possible to predict the luminous efficacy and then estimate the monthly mean hourly exterior illuminance. In this study two different models were chosen. The Perez and Du Mortier–Perraudeau–Page–Littlefair models were selected for the prediction of hourly exterior horizontal illuminance for the city of Kota Kinabalu in East Malaysia. Comparison between the two models were made. The vertical hourly illuminance was predicted also using Perez approach. The potentiality of daylight in four orientations was discussed. This study highlights the importance of Sunpath diagram on daylight illuminance during the conceptual design stage. The results in this study is hoped to contribute further insight into the potentiality of daylighting of tropical sky.

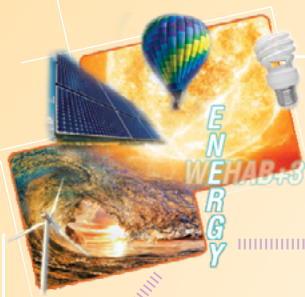


12.8 Renewable and Sustainable Energy Reviews, Volume 23, July 2013, Pages 169-178

Ocean renewable energy in Malaysia: The potential of the Straits of Malacca

Heap-Yih Chong, Wei-Haur Lam

Based on the fact that PV systems are clean, environment friendly and secure energy sources, PV system installation has played an important role worldwide. However, the drawback of PV system is the high capital cost as compared to conventional energy sources. Currently, many research works are carried out focusing on optimization of PV systems so that the number of PV modules, capacity of storage battery, capacity of inverter, wind turbine capacity as well as diesel generator size optimally selected. In this paper, the current status of research on PV systems size optimization is reviewed taking into account standalone PV systems, hybrid PV/diesel generator systems, hybrid PV/wind systems, hybrid PV/wind/diesel generator systems as well as grid connected systems. In addition, size optimization techniques for the inverter in PV systems are reviewed. The outcome of this paper shows that the optimization of PV system is strongly depends on meteorological variables such as solar energy, ambient temperature and wind speed. Furthermore, the numerical methods are the mostly used methods. Meanwhile the artificial intelligence techniques have been employed recently to improve the process of PV system size optimization.



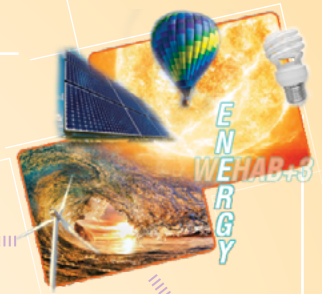
12.9

Microelectronics Journal, Volume 43, Issue 7, July 2012, Pages 484-491

Increasing the bandwidth of the width-split piezoelectric energy harvester

Jedol Dayou, W.Y.H. Liew, Man-Sang Chow

A new method to maximize the output power of a piezoelectric energy harvesting system has been previously proposed by the authors. This can be achieved by reducing the mechanical damping through folding a given piezoelectric material equally and splitting it into smaller width. Experimental results have shown that the power harvested increases when the number of fold increases but with the trade off the optimal operating frequency range, which is referred as the bandwidth. This paper aims to improve the bandwidth by modifying the natural frequency of each split piezoelectric material and connecting them in parallel. Experimental results show that the bandwidth increases as the difference between the natural frequency of the reduced-width piezoelectric materials increases. Although these results are with trade off in reducing output power gain, the gain in the bandwidth per unit output power reduction is still increasing. This shows that the maximum output power of the harvesting system can be ensured with the width-splitting method and the bandwidth of the output can be widened by increasing the difference between the natural frequencies of the participating piezoelectric elements. This maximization method with wideband feature can be implemented at microscopic stage to be incorporated in the microelectronics devices such as MEMS.

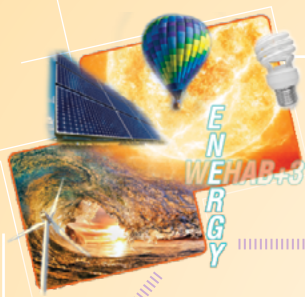


12.10 Renewable and Sustainable Energy Reviews, Volume 16, Issue 5, June 2012, Pages 3206-3219

A review on the pattern of electricity generation and emission in Indonesia from 1987 to 2009

M.H. Hasan, W.K. Muzammil, T.M.I. Mahlia, A. Jannifar, I. Hasanuddin

The level of energy demand plays a fundamental role in today's society. It is a vital input in supporting the physical and social development of a country, as well as national economic growth. Looking at the energy demand scenario in present time, the global energy consumption is likely to grow faster than the population growth across the world. Like any other energy sectors, electricity demand has significantly increased in Indonesia over the past years. Currently, there are six types of power plants in the country. The main sources of electrical energy are generated using the gas turbines, steam turbines, combined cycles, geothermal, diesel engine and hydro-powers. Most of Indonesia's power plants are using fossil fuel for electricity generation. Substantial growth in domestic energy demand, however, would be a major challenge for Indonesia's energy supply sector in the future. Over the past decade, thermal power plants generated about 86.69% of electricity and about 13.31% was generated by renewable energy such as hydro-power and geothermal in 2009. The purpose of this study is to chronicle and show a clear view of 23 years trend of Indonesia's electricity generation industry. Furthermore, the capacity of power generation installed and electricity generation from 1987 to 2009 has been gathered for this study. The total pollutant emissions and emission per unit electricity generation for each type of power plants have been also calculated using emission factors. Also, the pattern of electricity generation and emission has been presented. The results show that the implementation and contribution of combined cycle power plants should be increased together with renewable energy and natural gas which are recommended to reduce greenhouse gas emission.



12.11 Energy Conversion and Management, Volume 76, December 2013, Pages 801-810

Appraising the viability of wind energy conversion system in the Peninsular Malaysia

*Mudathir Funsho Akorede, Muhd Ikram Mohd Rashid, Mohd Herwan Sulaiman,
Norainon Binti Mohamed, Suliana Binti Ab Ghani*

To harvest the wind energy resource for power production, it is crucially important to carry out a preliminary study to understand the site-specific nature of wind at the intended site. Such knowledge is required to estimate the performance of a wind energy project in the area. This study investigates the wind energy potential for production of electric power in the Peninsular Malaysia. Wind speed data of six selected sites across the country collected over a period of 10–20 years are employed for the study. A statistical analysis of the wind speeds is carried out using the Weibull distribution model. Six identified commercially available wind turbines with rated capacity ranging from 20 kW to 1500 kW, with different speed parameters are simulated at the selected locations. Of the six sites evaluated in this paper, it is revealed that Mersing, having the highest monthly average wind speed and consequently the most viable, produces an average power density of 57.58 W/m² with a capacity factor of only 4.39%. This is equivalent to 378 MW h energy production per annum at a levelised cost of 22 cents per kW h. This study also shows that the standard deviation of the average monthly wind speeds is a better factor than the average annual wind speed for ranking of selected sites in terms of annual energy production. Overall, the results obtained from this investigation show that large-scale wind energy is not viable in Malaysia due to weak wind regimes; however, small-scale wind energy system may be economically viable in a few regions most especially when the recently launched feed-in tariff in the country is extended to wind energy.

Keywords

Mean wind speed, Wind turbine, Weibull distribution function, Wind power density, Capacity factor, Wind turbine availability



12.12 Renewable and Sustainable Energy Reviews, Volume 16, Issue 8, October 2012, Pages 6128-6141

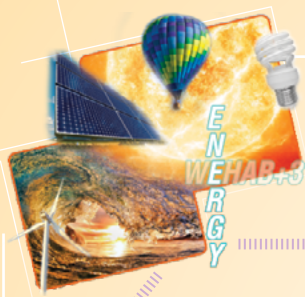
Energy and fuel consumption forecast by retrofitting absorption cooling in Malaysia from 2012 to 2025

M. Shekarchian, M. Moghavvemi, F. Motasemi, F. Zarifi, T.M. Mahlia

Electricity demand in residential and commercial sectors has increased steadily over the past 50 years in Malaysia. The bulk of which is being consumed by air conditioning systems. Absorption cooling systems can be a reasonable alternative to have conditioned spaces in the country. The fuel consumption to produce electricity for cooling purposes in residential and commercial sectors has been forecasted from 2012 to 2025. The paper also investigates the effect of applying five different scenarios on energy and fuel consumption by retrofitting absorption chillers instead of conventional cooling systems. This study found that the consumption of natural gas will be raised by increase in utilized absorption chillers however, the consumption of different fuels such as coal, diesel and fuel oil will decrease in thermal power plants.

Keywords

Air conditioning; Absorption thermal system; Compression thermal system; Energy saving; Fuel consumption; Malaysia



12.13 Energy Procedia, Volume 36, 2013, Pages 303-312

Study on Malaysian's Perspective Towards Renewable Energy Mainly on Solar Energy

N. Gomesh, Daut, M. Irwanto, Y.M. Irwan, M. Fitra

Malaysia, despite being known as the suppliers for oil and natural gas in the world is having a hard time fulfilling the huge demand of domestic and international energy sector. The nation's oil production has been gradually decrementing since reaching a peak of 862,000bbl/d in 2004 due to mature reservoirs. Alternative Cost as well as the maintenance that remains increasing yearly while the supply of fuels are depleting is making it hard for Malaysia to be able to sustain its oil development. This has become an important issue for the government to establish energy in the most economically worthy to ensure the sustainability in its development. This paper presents a review on Malaysian's perspective on renewable energy mainly in the solar energy sector by conducting a survey study. The survey focuses on the level of understanding Malaysian has towards renewable energy, the level of acceptance towards solar energy, the future prospect of solar energy as well as the financial perspective on solar energy in Malaysia. Study shows that renewable energy mainly in the area of solar energy receives warm welcome from many Malaysian as well as a demand for change in the conventional energy method. Malaysian is also ecologically concern as well as ready for any policies that has a solving mechanism in this energy crisis.

Keywords

Solar, Renewable Energy, Malaysia FIT, Oil

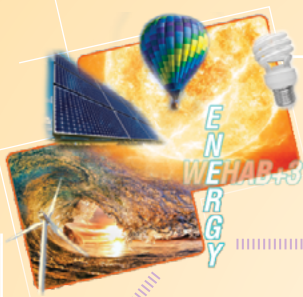


12.14 Renewable and Sustainable Energy Reviews, Volume 21, May 2013, Pages 694-702

Potential applications of wastes from energy generation particularly biochar in Malaysia

*Nur Zalikha Rebitanim, Wan Azlina Wan Ab Karim Ghani, Nur Akmal Rebitanim,
Mohamad Amran Mohd Salleh*

In Malaysia, abundant agricultural wastes are generated yearly. Therefore it is beneficial to discover new ways to utilize the wastes and employ the carbon source in different industries. Biochar are produced through many heat treatments such as combustion, gasification and pyrolysis for energy generation. The characteristics of these stable carbons such as the physical properties, chemical composition, surface area and surface chemistry determine the effectiveness of the carbon in different applications. Biochar has the ability to retain carbon and this condition is advantageous to prevent the release of carbon back to the atmosphere in the form of carbon dioxide. Application of biochar to soil helps to improve soil fertility and raise agricultural productivity. Biochar also has the ability to reduce carbon dioxide in the flue gas system. There have only been a few studies that discuss on the potential applications of this agriculture waste. The biochar's potential application as carbon sequester for soil application, energy production and dye sorption is being explored in this paper.



12.15 Renewable and Sustainable Energy Reviews, Volume 16, Issue 8, October 2012, Pages 6476-6487

An analysis of wind power density derived from several wind speed density functions: The regional assessment on wind power in Malaysia

N. Masseran, A.M. Razali, K. Ibrahim

In wind turbine design and site planning, the probability distribution of wind speed becomes critically important in estimating energy production. The utilization of accurate distribution will minimize the uncertainty in wind resource estimates, and consequently, it will improve the result in the site assessment phase of planning. In general, different region will have different wind regime. Hence, it is reasonable that different wind speed distribution will be found for different region. In this study, the features of wind power density based on the dependency of the suitable wind speed density have been obtained analytically using transformation technique. Since the wind power density has been obtained, the mean power density which is referred as an important indices related to the estimation of potential wind energy have been obtained by using the concept of raw moment and Monte Carlo approach. An analysis of semivariogram indicates the lack of spatial correlation of the wind power in Malaysia. The map of the mean power density over Malaysia indicates that several regions such as northeast, northwest and southeast region of Peninsular Malaysia and southern region of Sabah are found as the best region to be further investigated in the future for the wind energy development.

Keywords

Wind power; Wind speed density function; Wind power density function; Semivariogram; Spatial correlation; Spatial estimation



12.16 Applied Energy, Volume 112, December 2013, Pages 737-746

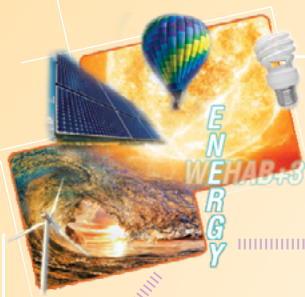
Evaluation of geothermal energy in desalination by vacuum membrane distillation

Rosalam Sarbatly, Chel-Ken Chiam

This paper presents the energy evaluation of the cross-flow vacuum membrane distillation (VMD) for three types of lab-fabricated polyvinylidene fluoride (PVDF) membranes and the commercial Westran S PVDF membrane. Membranes with the effective area 23.5 cm² are tested with distilled water and geothermal water as the feed solutions. Results show that the membrane porosity controlled the flux through the fabricated membranes and the commercial membrane. The commercial membrane with porosity of approximately 76.5%, which was the most porous among the tested membranes, gave the highest flux at 9.28 kg/m² h under the optimum conditions of 33.2 L/h feed flow rate and 30 kPa downstream pressure. The corresponding specific energy consumption was 66.03 kW/kg h⁻¹ when distilled water was examined. Heating energy of 87–89 kW/kg h⁻¹, which is approximately 95% of the total energy consumption, could be saved when the warm geothermal water is fed directly into the VMD system. The water produced meets the drinking water quality with the TDS varying between 102 and 119 ppm, thus the geothermal water desalination using the VMD system to produce the drinking water is satisfactory. An economic analysis for a 20,000 m³/d VMD desalination plant finds that the water production costs are \$0.50/m³ and \$1.22/m³ respectively for the plant operated with and without geothermal energy (GE). Compare to the plant without GE utilisation, the water production costs of the plant operated with GE are less than \$0.50/m³ that is at least \$0.72/m³ or approximately 59% in cost saving when the water fluxes are larger than 6.6 kg/m² h. The specific membrane cost reduced from \$0.058/m³ to \$0.035/m³ when the membrane life extended from 3 to 5 years.

Keywords

Geothermal energy, Desalination, PVDF membrane, Vacuum membrane distillation, Economic analysis



12.17 Energy Procedia, Volume 36, 2013, Pages 492-501A

New Technique of Photovoltaic/Wind Hybrid System in Perlis

Y.M. Irwan, Daut, Safwati, M. Irwanto, N. Gomesh, M. Fitra

The increment of energy costs and decreasing prices of turbines generator and photovoltaic (PV) panels caused photovoltaic/wind hybrid system (PWHS) utilization is becoming popular. This paper presents a new topology of PWHS. It consists of two main parts: the cooling system for photovoltaic module and the combination method of Savonius and Darrieus for wind turbine. The PWHS is installed in front of Centre of Excellence for Renewable Energy (CERE), University Malaysia Perlis, Northern Malaysia. The main energy source of this system is gain from PV array and wind power generation. It is well known that the power and efficiency of photovoltaic (PV) module usually falls at the rate of $\sim 0.5\%/^{\circ}\text{C}$ and $\sim 0.05\%/^{\circ}\text{C}$ respectively as increase of ambient temperature. The electrical efficiency of PV cell depends on its operating temperature during absorption of solar radiation. For this reason, an active PV cooling system was design using the DC brushless fan with inlet/outlet manifold for uniform airflow distribution. It was attached at the back of the PV panel. Where else, the improvement of wind is using Vertical Axis Hybrid Wind Turbine (VAWT) through the combination method of Savonius and Darrieus types. From the results, it shows that the improvement of PWHS give the big advantages in term of supply the energy in Perlis.

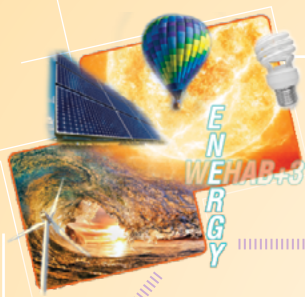


12.18 Renewable and Sustainable Energy Reviews, Volume 15, Issue 9, December 2011, Pages 4521-4536

Second-generation bioethanol as a sustainable energy source in Malaysia transportation sector: Status, potential and future prospects

Ying Ying Tye, Keat Teong Lee, Wan Nadiah Wan Abdullah, Cheu Peng Leh

The energy crisis has become a crucial issue. The rapid depletion of the fossil fuels has driven the world to utilize renewable energy (RE) sources. To develop RE industries, the Malaysian government has been continuously reviewing its energy policy and undertaking intensive efforts to ensure long-term reliability in the energy supply. The most attractive and practical choice to replace fossil fuels as the main energy source is biofuels, which are mostly in liquid form. In Malaysia, the transportation sector has become the main driver for increasing the liquid fuel demand. This study outlines the importance of second-generation bioethanol as a potential energy source for the Malaysia transportation sector and its future development perspectives. In this work, it is shown that Malaysia has consistently promoted the RE industry in its energy policy, over non-renewable conventional energy resources with their negative impact to the environment. In Malaysia, which has a significant amount of agricultural activities, agricultural wastes have become a very promising alternative source for second-generation bioethanol (SGB) production. It is estimated that the biomass availability and its potential energy generated are 50,919 dry kton/year and 13,343 kton/year, respectively. The estimated energy generated from biomass can contribute approximately 21.5% of the national energy requirement. In addition, the key drivers for Malaysia to move towards sustainable energy sources, such as SGB, are discussed. SGB can contribute to energy security and help to reduce CO₂ emissions in Malaysia. SGB is also economically feasible. Furthermore, the Malaysian market for bioethanol is potentially much larger than the market for biodiesel, because a much larger portion of the vehicle fleet runs on gasoline. Hence, implementing and promoting second-generation bioethanol effectively is definitely a strategic move for Malaysia to become a self-sufficient country in the future.



12.19 Renewable and Sustainable Energy Reviews, Volume 16, Issue 8, October 2012, Pages 5879-5889A

Review on electricity generation based on biomass residue in Malaysia

S.M. Shafie, T.M.I. Mahlia, H.H. Masjuki, A. Ahmad-Yazid

Nowadays, biomass is considered as one of the main sources of energy for both developed and developing countries. Malaysia with a large amount of biomass residues as a source of electricity generation is considered as one of the potential countries in this field. This study aims to analyze the potential of recovering energy from major source of biomass residue in Malaysia. For this purpose, the agricultural crop residues and industrial crop waste are investigated. These will contribute substantially to harness a sustainable resource management system in Malaysia to reduce the major disposal problem of biomass residue. The effective use of the waste can supply the required fuel for future electricity generation.

Keywords

Biomass, Renewable energy, Agriculture residue Malaysia



12.20 Renewable and Sustainable Energy Reviews, Volume 15, Issue 9, December 2011, Pages 4370-4377

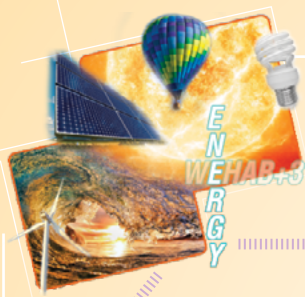
Current energy usage and sustainable energy in Malaysia: A review

S.M. Shafie, T.M.I. Mahlia, H.H. Masjuki, A. Andriyana

Malaysia has a good mix of energy resources like oil, natural gas, coal and renewable energies such as biomass, solar and hydro. In spite of this plenty of resources, the country is dependent on fossil fuel for industrial and transportation sector. In 2009, 94.5% of electricity is generated by using fossil fuel such as natural gas, coal, diesel oil and fuel oil. Until now, Malaysia stills a net energy exporter. Concerns about energy security, the fluctuation of crude oil price and climate change are driving significant changes in how energy and electricity specifically, is generated, transmitted and consumed in Malaysia. In this regard, renewable energy resources are becoming attractive for sustainable energy development in Malaysia. There is because renewable sources of energy are abundant in Malaysia, the significant ones being biomass and solar. This article presents a review of present energy situation and energy policies for the energy sector in Malaysia. Investigation of various renewable energy and examine the energy and environmental issues associated with this energy. The review of current usage of renewable energy sources and also its potential implementation are evaluated to provide solution for the national.

Keywords

Sustainable energy, Renewable energy, Fossil fuel, Wind energy, Solar energy



12.21 Renewable and Sustainable Energy Reviews, Volume 16, Issue 5, June 2012, Pages 2864-2869

A review of solar energy modeling techniques

Tamer Khatib, Azah Mohamed, K. Sopian

Solar radiation data provide information on how much of the sun's energy strikes a surface at a location on the earth during a particular time period. These data are needed for effective research in solar-energy utilization. Due to the cost of and difficulty in solar radiation measurements and these data are not readily available, alternative ways of generating these data are needed. In this paper, a review is made on the solar energy modeling techniques which are classified based on the nature of the modeling technique. Linear, nonlinear, artificial intelligence models for solar energy prediction have been considered in this review. The outcome of the review showed that the sunshine ratio, ambient temperature and relative humidity are the most correlated coefficients to solar energy.

Keywords

Second-generation bioethanol, Renewable energy, Sustainable energy, Biomass, Malaysia transportation sector, Energy policy



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Universiti Malaysia Sarawak

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Source of the Document Proceedings - 2012 20th International Conference on Electrical Machines, ICEM 2012, Article number 6349850: 115-121© 2012 IEEE.

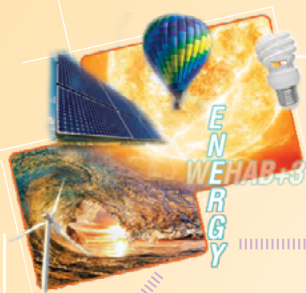
Comparison of permanent magnet generators for a very low speed renewable energy application

Dorrell D.G., Ngu S.S., Cossar C.

This paper describes the design of a very low speed direct-drive brushless permanent magnet generator for use in a Bristol cylinder device which is used for generation of electrical energy from sea waves. It studies both air-gap wound and slotted stator types of machine. It studies the design of a scaled down machine using air-gap windings then scales the machine up to obtain a full-scale generator. A comparison is made to a slotted alternative. The performance is studied in steady state terms.

Keywords

Bristol cylinder, Brushless permanent magnet generator, Direct drive, Low speed, Renewable energy



13.2 **Advanced Materials Research, Volume 701, 2013, Pages 249-253, 2013 3rd International Conference on Key Engineering Materials, ICKEM 2013**

Energy efficient microwave irradiation of sago bark waste (SBW) for bioethanol production

Kannan, T.S., Ahmed, A.S., Ani, F.N.

The energy efficiency of microwave irradiation for bioethanol production from sago bark waste (SBW) was studied. The maximum sugar yield of 62.6 % was reached at the biomass loading 20% (w/w). The high ethanol yield of 60.2% theoretical yield, ethanol concentration 30.67 g/l was achieved by diluted sulfuric acid supported microwave irradiation with 40% (w/w) biomass loading at 60 h fermentation. The energy consumption of microwave irradiation to produce 1 g sugar and 1 g ethanol was calculated separately. The lowest energy consumption was noticed while biomass loading and energy input were fixed at 40% (w/w) and 33 kJ (1100 W for 30 s) respectively, and it is amounted to 1.27 and 1.76 kJ to produce 1 g of sugar after enzymatic hydrolysis and 1 g ethanol after fermentation, individually. Usually, 1 g ethanol can produce approximately 27 kJ of energy, and therefore, the energy input for the microwave pretreatment was only 7% of the energy output. The microwave irradiation technique established for SBW to produce ethanol succeeded in 80% energy savings for producing 1 g ethanol compared to rape straw by microwave pretreatment previously reported.

Keywords

Bioethanol, Energy efficiency, Microwave irradiation, Sago bark waste (sbw)



13.3

ARPN Journal of Engineering and Applied Sciences, Volume 8, Issue 12, December 2013 © 2006-2013 Asian Research Publishing Network (ARPN)

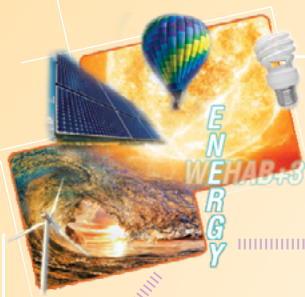
The status of wind resource assessment (wra) techniques, wind energy potential and utilisation in Malaysia and other countries

Lawan S.M., Abidin W.A.W.Z., Chai W.Y., Baharun A., Masri T.

Current dependency on finite reserves fossil fuels and adverse environmental effects of conventional power system created new dimension interest in renewable energy sources toward building a sustainable and reliable energy in the near future. Wind energy is renewable and considered as one of the safest, cleanest and fastest growing forms of renewable energy in the world. Generation of electrical energy from wind can only be possible where there is considerable wind resource exists. For this reasons an accurate wind resource evaluation is a vital tool for harnessing energy content in a wind. This paper is critically reviews different techniques used in wind resource assessment, prospects and challenges of utilizing wind energy in some developed and developing countries; however recent progress and development of wind energy potential and utilizations in the countries neighboring Malaysia are discussed. Several recent wind energy potential studies, areas that are suitable for exploitation of wind energy for electrical power generation as well as the current situation of wind energy utilization in Malaysia and possible recommendations were presented.

Keywords

Malaysia, Renewable energy, Wind energy, Wind energy potential, Wind energy utilization, Wind resources assessment



13.4 Energy and Buildings, Volume 67, December 2013, Pages 70–78

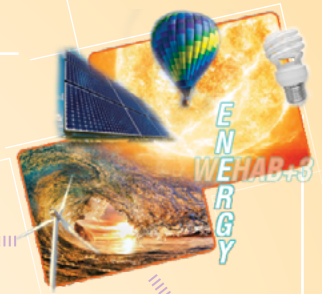
Electricity cost saving comparison due to tariff change and ice thermal storage (ITS) usage based on a hybrid centrifugal-ITS system for buildings: A university district cooling perspective

Mohammad Omar Abdullah, Lim Pai Yii, Ervina Junaidi, Ghazali Tambi, Mohd Asrul Mustapha

In this paper, the case study of a district cooling system of a university located in a South East Asia region (lat: 01°29'; long: 110°20'E) is presented. In general, the university has high peak ambient temperature of around 32–35 °C coupled with high humidity of about 85% during afternoon period. The total electricity charge for the Universiti Malaysia Sarawak Campus is very high amounting to more than \$314,911 per month. In this paper, a few district cooling schemes are investigated to provide “what-if analysis” and in order to minimize the overall electricity charges. Few scenarios designed for the application of centrifugal with and without ice-thermal storage (ITS) systems on the buildings were investigated. It was found that, due to the local tariff status, marginally saving can be achieved in the range of 0.08–3.13% if a new tariff is adopted; and a total of further saving of 1.26–2.43% if ITS is operated. This marginally saving is mainly due to the local tariff conditions and lower local temperature range (ΔT) which are less favorable as compared with those reported in the literature elsewhere.

Keywords

Electricity charge, Cost saving, District cooling system, Tariff structure, Ice thermal storage



13.5 World Applied Sciences Journal, Volume 22, Issue 9, 2013, Pages 1252-1261, IDOSI Publications

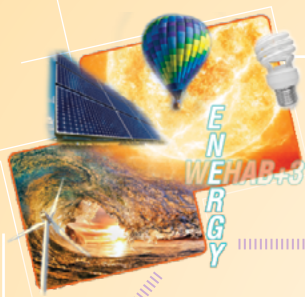
Mapping of tidal stream energy resources in the coastline of Sarawak

Rigit A.R.H., Jakhrani A.Q., Kamboh S.A., Kong W.H., Samo K.A.

Tidal energy is one of the most predictable and reliable source of renewable energy. The kinetic energy from tidal streams can be used for generation of electrical power. The purpose of this study was to draw the mapping of extractable tidal stream energy resources in Sarawak coastline. The tidal stream speed and corresponding power densities were computed through empirical equations. The mapping of potential locations was made by weighting of different elements required for the selection of suitable sites. It was found from the study that only a single site of Pulau Triso at Batang Lupar fulfilled the criteria of the required tidal stream speed and the clearance of shallow-draft oceangoing vessels. Off Kuala Igan met only the clearance requirements of all types of oceangoing vessels and the tidal stream speed were found to be lower than set limits. Other examined sites could not accomplish any criterion set for the site selection. It was concluded that the only practicable site for the extraction of tidal stream energy was Pulau Triso at Batang Lupar among the examined locations in Sarawak coastline. However, only shallow-draft oceangoing vessels could pass through the proposed site due to its lower water depth.

Keywords

Tidal streams power, Tidal stream, Turbines ocean energy, Mapping of tidal energy resources



13.6

World Applied Sciences Journal, Volume 22, Issue 9, 2013, Pages 1241-1251, IDOSI Publications

Development of an indirect solar dryer with biomass backup burner for drying pepper berries

Rigit A.R.H., Jakhrani A.Q., Kamboh S.A., Tiong Kie P.L.

The use of solar drying in recent years becomes popular for increasing the quality of agricultural crops especially in developing countries. A wide range of solar dryers is available with various characteristics for drying of crops and food products. A prototype indirect solar dryer with a biomass backup burner was designed and developed for the use of small scale rural farmers to dry their harvested pepper berries. The traditional direct sun drying was only dependent on the availability of solar radiation. It was taking 5-7 days for whole drying process. The results of proposed solar dryer were found to be encouraging. The developed solar dryer took shorter drying time with 11 hours of day time solar radiation and 6 hours of night time with biomass burning. The chemical properties of the dried pepper berries were also found to be within the standards set by American Seed Trade Association.

Keywords

Biomass backup burner, Crop drying, Indirect natural convectional solar dryer, Pepper berries, Solar dryer modeling



14.0

Universiti Teknikal Malaysia Melaka

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ECS Journal of Solid State Science and Technology, Volume 2, Issue 10, 2013 © The Electrochemical Society

Development of high performance electrochemical capacitor: A systematic review of electrode fabrication technique based on different carbon materials

Abdul Manaf N.S., Amin Bistamam M.S., Azam M.A.

Increasing demand for energy requirement has attracted considerable attention among researchers to develop efficient energy storage device. Among energy storage devices, electrochemical capacitor (EC) has great potential for its capability to deliver more power than batteries and store more energy than conventional capacitors. The electrode or active material is the most crucial factor in determining the device properties. Recently, carbon based materials play significant roles as electrode materials and possesses remarkably significant achievements toward the development of sustainable energy storage applications. Electrode fabrication technique is another important factor to be considered. Hence, this article reviews the electrode fabrication techniques for EC based on different types of carbon as electrode materials, and their EC performances measured by techniques such as cyclic voltammetry and charge discharge characteristics are also discussed.



14.2 Ionics, Volume 19, 2013, Pages 1455–1476 © 2013 Springer-Verlag Berlin Heidelberg.

Aligned carbon nanotube from catalytic chemical vapor deposition technique for energy storage device: A review

Azam M.A., Manaf N.S.A., Talib E., Bistamam M.S.A.

Carbon nanomaterial especially carbon nanotube (CNT) possesses remarkably significant achievements towards the development of sustainable energy storage applications. This article reviews aligned CNTs grown from chemical vapor deposition (CVD) technique as electrode material in batteries and electrochemical capacitors. As compared to the entangled CNTs, aligned or well-organized CNTs have advantages in specific surface area and ion accessibility in which more electrolyte ions can access to CNT surfaces for better charge storage performance. CVD known as the most popular technique to produce CNTs enables the use of various substrates and CNT can grow in a variety of forms, such as powder, films, aligned or entangled. Also, CVD is a simple and economic technique, and has good controllability of direction and CNT dimension. High purity of as-grown CNTs is also another beauty of the CVD technique. The current trend and performance of devices utilizing CNTs as electrode material is also extensively discussed.

Keywords

Aligned carbon nanotubes, Catalytic chemical vapor deposition, Electrochemical capacitor, Battery, Electrochemical performance



14.3 Przegląd Elektrotechniczny, R. 89 NR 8/2013, ISSN 0033-2097

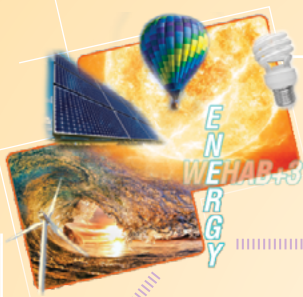
Renewable energy technologies and hybrid electric vehicle challenges

Azidin F.A., Hannan M.A., Mohamed A.

This paper introduces the utilization of selected renewable energy technologies such as solar cell, battery, proton exchange membrane (PEM) fuel cell (FC) and super-capacitors (SCs) in the electrical vehicle industry. Combination of multiple energy resources is imperative to balance the different characteristic of each resource. Concomitantly, the need of an efficient energy management system arises within the industry. Thus, existing system from past and present undergoing research papers are summarized to give a compact overview on the technology and know-how technique to readers.

Keywords

Hybrid electric vehicle, Solar cell, Battery, Fuel cell, Super-capacitors



14.4 **Procedia Engineering, Volume 53, 2013, Pages 208-216, ISSN 1877-7058
© 2013 The Authors. Published by Elsevier**

Techno-economic analysis of LED lighting: A case study in UTeM's faculty building

Gan C.K., Sapar A.F., Mun Y.C., Chong K.E.

This paper examines the feasibility of adopting LED lamp in replacing the conventional fluorescent lamp. Analysis and comparison have been carried out on the two lighting systems in terms of electrical and photometrical performance. A case study on UTeM's also been presented, which focuses on the economic evaluation. In addition, various lighting energy saving strategies have been proposed. The economic benefits of the respective energy saving measures have been successfully quantified. The study suggests that LED tubes has great potential to replace fluorescent lamps, mainly driven by the cost savings.

Keywords

Component, Lighting system, LED tubes, Fluorescent lamps



14.5 International Review on Modeling and Simulations (I.RE.MO.S.), Vol. 6 (4), August 2013, ISSN 1974-9821

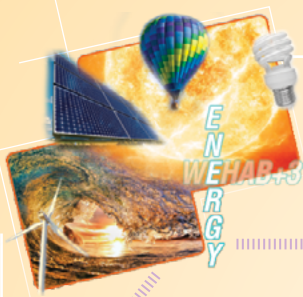
Losses reduction and voltage improvement using optimum capacitor allocation by PSO in power distribution networks

Hasan I.J., Gan C.K., Shamshiri M., Bugis I.B., Ab Ghani M.R.

Capacitor installation is one of the common methods of the reactive power compensation in power distribution networks. In this paper, the optimum capacitor placement and sizing has been executed in the distribution network in terms of power losses minimization and voltage profile improvement. The maximum and minimum bus voltage and maximum possible capacitor size are the constraints of optimum capacitor placement and sizing problem which considered as a penalty factor in the objective function. In order to solve the obtained objective function, the Particle Swarm Optimization (PSO) is utilized to find the best possible capacitor placement and size. The OpenDSS engine is utilized to solve the power flow through Matlab coding interface. To validate the functionality of the proposed method, the IEEE 13 node and IEEE 123 node test systems are implemented. In both cases, the optimum capacitor allocation has been applied by the proposed PSO to find the best possible capacitor location and size. The result shows that the proposed algorithm is more cost effective and has lower power losses compare to the IEEE standard case. In addition, the voltage profile has been improved.

Keywords

Capacitor allocation, Distribution networks, PSO, OpenDSS



14.6 **Advanced Materials Research, Volume 748, 2013, Pages 1125-1129**

Design and development of low cost certified green building for non residential existing building (NREB)

Kassim A.M., Jamri M.S., Othman M.N., Rashid M.Z.A., Ismail S.J.S.

The Green Building Index (GBI) is one of rating tool which are provides a prospect for building developers and owners for designing and constructing a green and sustainable buildings. The proposed low cost GBI buildings provide many advantages such as energy savings, water savings, a healthier indoor environment, and better connectivity to public transport. Besides, adoption of recycling and greenery for the projects and can reduce the impact on the environment. However, the implementation to certify as Green Building Index has a lot of concerns such as cost constraint, know how constraints and etc. Therefore, in this paper, the design and development of low cost certified green building by fulfilling the Green Building Index (GBI) is proposed in order to ease the development of green building to have better life for human and environment in this world in term of energy efficiency performances.

Keywords

Green building index, Non-residential existing building, Low cost



14.7 Renewable and Sustainable Energy Reviews, Volume 28, December 2013, Pages 483–493

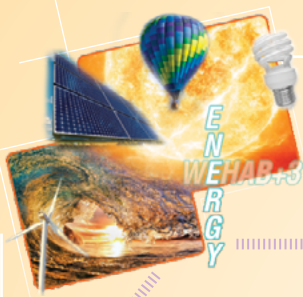
A review of islanding detection techniques for renewable distributed generation systems

Khamis A., Shareef H., Bizkevelci E., Khatib T.

Islanding detection of distributed generations (DGs) is one of the most important aspects of interconnecting DGs to the distribution system. Islanding detection techniques can generally be classified as remote methods, which are associated with islanding detection on the utility sides, and local methods, which are associated with islanding detection on the DG side. This paper presents a survey of various islanding detection techniques and their advantages and disadvantages. The paper focused on islanding detection using a conventional and intelligent technique. A summary table that compares and contrasts the existing methods is also presented.

Keywords

Islanding detection, Renewable distributed generation, Distributed generation (DG)



14.8 Saudi International Electronics, Communications and Photonics Conference, SIEPC 2013: 1-4, 27-30 April 2013 ©2013 IEEE.

Energy audit application for building of small and medium enterprise

Maricar N.M., Othman M.H.

The excessive use of energy in residential, commercial and industrial buildings and equipment used necessitate the decision maker to always question on how the energy used is being efficient. More emphasize of works will be put into industrial sectors due to the competitive of producing better products with lesser cost. The small percentage of energy use reduction relates to the product cost and profit margins. Therefore, it is important to the energy auditor of an industry or enterprise to have a systematic method to audit the company/factory and energy used by the equipment to produce the practical actions needed in reducing the energy usage and improves the comfort and product quality. This paper describes application of energy audit to help decision maker in using the energy more efficiently.

Keywords

Energy audit, Energy consumption, Graphical user interface, Interdisciplinary application



14.9

Journal of Semiconductor Technology and Science, Volume 13, Issue 6, December 2013

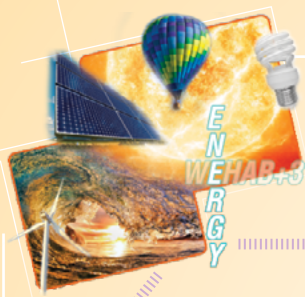
An overview of nanonet based dye-sensitized solar cell (DSSC) in solar cloth

Othman M.A., Ahmad B.H., Amat N.F.

This technical paper contains the information of the Dye-Sensitized Solar Cells (DSSC) working principal where diffusion mechanism acts as electron transport to absorb the sunlight energy to generate the electrical energy. DSSC is photo electrochemical cell that implements the application of photosynthesis process. The performance of electron transport in DSSC has been reviewed in order to enhance the performance and efficiency of electron transport. The improvement of the electron transport also discussed in this paper.

Keywords

DSSC, Electron transport, Diffusion mechanism



14.10 Applied Mechanics and Materials, Volume 315, 2013, Pages 788-792
© (2013) Trans Tech Publications, Switzerland

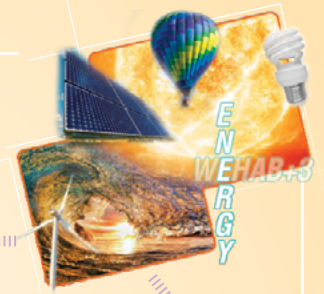
An experimental study of different thermal boxes heated by solar thermal radiation for hot water system at night

Yuhazri M.Y., Kamarul A.M., Sihombing H., Yahaya S.H., Izamshah R.

This research is related to thermal efficient water heating system, specifically to improve the water heating system that exists nowadays. The goal of this research is to improve the current water heating system by using solar heat as the energy source to heat the water. The focus is to improve the thermal efficiency by adding different thermal boxes as the absorber bed. By implementing the black body and radiation concept, the air trapped in the box is heated. The trapped air then increases the collisions between the molecules and directly increases the temperature inside the box, higher than the outside environment. Based on night experimental results revealed steel thermal box is better to be used for tropical weather like Malaysia.

Keywords

Thermal efficiency, Water heating, Thermal boxes, Solar night



14.11 *Procedia Engineering*, Volume 53, 2013, Pages 645–649 ©2013 The Authors. Published by Elsevier Ltd.

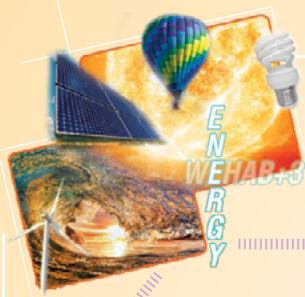
Greenhouse gas reduction by utilization of cold LNG boil-off gas

Zakaria M.S., Osman K., Abdullah H.

This paper present the analysis of utilization the cryogenic temperature of Boil off Gas (BOG) from Liquefied Natural Gas (LNG) to flow air inside insulation space of LNG. Three Dimensional geometry of the tank are model in Computational Fluid Dynamic (CFD) ANSYS Fluent software package using steady state and K-Epsilon turbulence model. Result shows that almost 60% of BOG can be prevented from flared to the atmosphere thus will reduce Greenhouse Gas (GHG) emission and pollution.

Keywords

LNG, Emission, CFD, Heat transfer, Cyrogenic



14.12 Applied Mechanics and Materials Volume 393, 2013, Pages 839-844 © (2013) Trans Tech Publications, Switzerland

Computational simulation of boil-off gas formation inside liquefied natural gas tank using evaporation model in ANSYS fluent

Zakaria M.S., Osman K., Saadun M.N.A., Manaf M.Z.A., Mohd Hanafi M.H.

Research on the waste energy and emission has been quite intensive recently. The formation, venting and flared the Boil-off gas (BOG) considered as one of the contribution to the Greenhouse Gas (GHG) emission nowadays. The current model or method appearing in the literature is unable to analyze the real behavior of the vapor inside Liquefied Natural Gas (LNG) tank and unable to accurately estimate the amount of boil-off gas formation. In this paper, evaporation model is used to estimate LNG Boil-Off rate (BOR) inside LNG tank. Using User Define Function (UDF) hooked to the software ANSYS Fluent. The application enable drag law and alternative heat transfer coefficient to be included. Three dimensional membrane type LNG cargos are simulated with selected boundary condition located in the United States Gulf Coast based on average weather conditions. The result shows that the value of BOR agrees well with the previous study done with another model and with International Marine organization (IMO) standard which is less than 0.15% weight per day. The results also enable us to visualize the LNG evaporation behaviors inside LNG tanks.

Keywords

User define function (UDF), ANSYS fluent, Liquefied natural gas (LNG), Boil-off gas(BOG), Evaporation model, Greenhouse gas (GHG)



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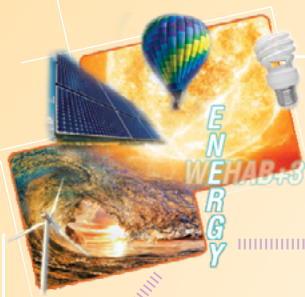
JST Vol. 21 (2) Jul. 2013 Article ID: JST-ED05-2012 Invited Paper: Systems Informatics and Analysis of Biomass Feedstock Production

Shastri Y. N., Hansen A. C., Rodríguez L. F. and Ting K. C.

Sustainable biomass feedstock production is critical for the success of a regional bioenergy system. Low energy and mass densities, seasonal availability, distributed supply, and lack of an established value chain for the feedstock create unique challenges that require an integrated systems approach. We have, therefore, developed a Concurrent Science, Engineering and Technology (ConSEnT) platform integrating informatics, modelling and analysis, as well as decision support for biomass feedstock production. An optimization model (BioFeed) and an agent-based model, which are supported by an informatics database and made accessible through a web-based decision support system, have been developed. This article summarizes the recent advances in this subject area by our research team.

Keywords

Biomass feedstock, Bioenergy, Systems analysis, Modelling, Informatics, Decision support



15.2 JST Vol. 21 (2) Jul. 2013 Article ID: JST-0398-2012

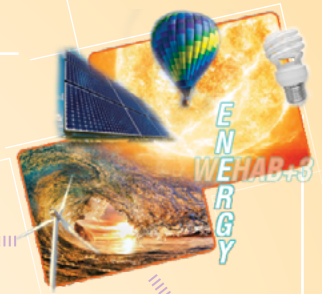
Harnessing Energy from Electromagnetic Field: Practical Implementation Integrating Coil Antenna and IC Load

Syahrizal Salleh and Zulkifli Abd Majid

An AC to DC voltage rectifier and its respective regulator were designed and integrated on a 0.25 μ m CMOS process. Its input impedance was measured along with the regulated DC output. Input impedance of a series of rectangular coil microstrip antenna on FR4 PCB with outer dimension of 78mm x 41mm was measured. The positive reactance of the antenna was matched at resonance with negative reactance of the integrated rectifier and regulator with addition of external capacitor. Relationship between incidental electromagnetic field in A/m at the coil microstrip antenna all the way to the rectified DC voltage at the output of the regulator is presented. In the context of wireless power transfer, this work focuses on the remote unit that absorbs electromagnetic field generated by another system and converts the energy into DC supply voltage for remote device

Keywords

Inductive coupling, Wireless power, Green energy, Regenerative energy



15.3 JSSH Vol. 21 (1) Mar. 2013 Article ID: JSSH-0342-2011

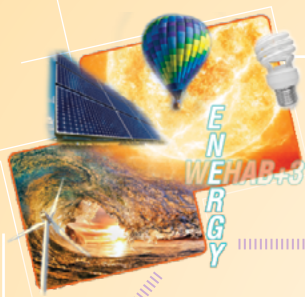
Factors Affecting the Willingness to Pay for Renewable Energy amongst Eastern Malaysian Households: A Case Study

Aini, M. S. and Goh Mang Ling, M.

Energy choices that are made today will greatly influence the climate of tomorrow. In addition to reducing emission of greenhouse gases, renewable energy sources will also enhance future energy security. In this vein, a study utilizing a cross-sectional research design was conducted to examine the factors affecting the willingness to pay for renewable energy (RE) among households in Malaysia. A self-administered questionnaire was used as a tool for data collection. The mean age of the respondents was 42 years, with both genders equally represented. The results indicated that that majority of the respondents were concerned about the environment and showed a positive attitude towards it. Nonetheless, there were differences in the levels of awareness and knowledge with respect to different types of RE. Age and RE awareness were found to have significant relationships with the willingness to pay for renewable energy. The results also indicated that higher educated consumers were more willing to pay for renewable energy, whereas no gender differences were observed. Strengthening support and ultimately adoption of RE products and services have to be intensified as the willingness to pay for RE by the respondents was found to be modest.

Keywords

Renewable energy, Household, Environment, Attitude, Willingness to pay



15.4 JST Vol. 20 (1) Jan. 2012 Article ID: JST-0278-2011

New Vane-Type Wind Turbine of High Efficiency

R. Usubamatov, A. Y. Qasim and Z. M. Zain

Wind energy has often been touted as one of the most reliable sources of renewable energy that should be used for people. Today, wind energy (mainly by propeller type wind turbines) produces less than one percent of the total energy used worldwide. Practically, a standard three-blade propellers efficiency of use of the wind energy is around twenty percents and this is due to its design and shape that use the wind lift force and a rotating turbine. In addition, these turbines are quite expensive due to the complex aerodynamic shape of the propellers which are made of composite materials. The new world boom for wind turbines obliges inventors to create new wind turbine designs that have high efficiency and are better than any known design. This paper proposes the new patented invention of the vane-type wind turbine which uses wind energy more efficiently and is only dependent on the acting area of the vanes. The vane wind turbine was designed to increase the output of a wind turbine that uses kinetic energy of the wind. Due to its high efficiency, simple construction and technology, the vane wind turbine can be used universally, apart from the fact that it is made from cheap materials. The new design of the vane-type wind turbine has quite small sizes than the propeller type one of same output power.

Keywords

Wind turbine, Vane



15.5 JST Vol. 20 (2) Jul. 2012 Article ID: JST-0238-2010

Numerical Simulation on the Reflection Characterisation and Performance of a Solar Collector - A Case Study of UPM Solar Bowl

Ng, K. M., Adam, N. M. and Azmi, B. Z.

A numerical simulation of UPM Solar Bowl is presented in this paper. The numerical analysis considered a general model of solar bowl, which was divided into three modules: (a) reflection characterisation of the bowl, (b) solar flux density along the receiver, and (c) radiation contour mapping of the receiver. The governing equations are resolved in a segregated manner using Matlab programming environment. The influence of the tropical clear sky irradiance on the collector was numerically studied, whereas the collector performance in time domain was also quantified. Single reflection is a major element in thermal concentration. It was observed that solar flux density of collector substantially deteriorated during off-solar noon hour, in which during 08:00 and 16:00 under clear sky of tropics, the percentage reduction of flux density is over 82% at all points of the receiver. The simulated radiation contour mapping of the receiver supports the finding. Other results of the UPM Solar Bowl simulation model are also shown and discussed.

Keywords

Numerical simulation, Reflection characterisation, Collector performance, Time domain, UPM Solar Bowl



15.6 JST Vol. 21 (2) Jul. 2013 Article ID: JST-0402-2012

Electricity Generation from Citronella Bagasse (CB) Using Dual Chamber Microbial Fuel Cell

*Nik Azmi Nik Mahmood, Mohd Nazlee Faisal Md Ghazali,
Kamarul'Asri Ibrahim and Nur Muhammad ElQarni Md Norodin*

The aim of this project is to produce electricity from citronella biomass using isolated microbes from wastewater as biocatalyst in a dual chamber microbial fuel cell (MFC). MFC is one such system that not only reduced biomass, which contains mostly waste products but can also liberate electricity from them. MFC system is well-established and using lignocellulosic biomass as fuel is one step to future energy generation. Trials of MFC experiments have been conducted but using citronella bagasse (CB) as fuel source. Furthermore, pre-treatment of the biomass was done using NaOH pre-treatment and effluent treatment wastewater from a palm edible oil company as a source for microorganism. The end results indicate that bioelectricity production from CB is possible though very low yield in the present MFC.

Keywords

Microbial fuel cell, Citronella bagasse, Bioelectricity



15.7 JST Vol. 20 (1) Jan. 2012 Article ID: JST-0219-2010

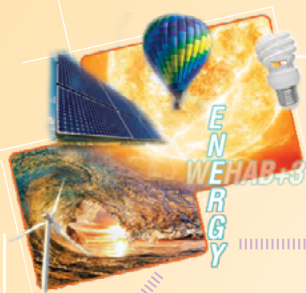
Factors Affecting the Cold Flow Behaviour of Biodiesel and Methods for Improvement – A Review

Odeigah Edith

Biodiesel is an attractive renewable energy source, which is suitable as a substitute to the non-renewable petroleum diesel. However, it is plagued by its relatively bad cold flow behaviour. In this review, the factors affecting the cold flow of biodiesel, vis-à-vis the contradicting requirement of good cold flow and good ignition properties, are discussed. Fuel filter plugging, and crystallization of biodiesel are considered, together with the cold flow properties such as Pour Point (PP), Cloud Point (CP), Cold Filter Plugging Point (CFPP) and Low Temperature Filterability Test (LTFT). In addition, various methods used to improve the cold flow of biodiesel are also presented, with a special emphasis laid on the effects of these methods in reducing the Cloud Point. Strategies to improve cold flow, and yet maintaining the good ignition quality of biodiesel, are also proposed. As far as the cold flow of biodiesel is concerned, desirable attributes of its esters are short, unsaturated and branched carbon chains. However, these desirable attributes present opposing properties in terms of ignition quality and oxidation stability. This is because esters with short, unsaturated and branched carbon chains possess very good cold flow but poor ignition quality and oxidation stability. The target is therefore to produce biodiesel with good cold flow, sufficient ignition quality, and good oxidation stability. This target proves to be quite difficult and is a major problem in biodiesel research. New frontiers in this research might be the design of the new cold flow improvers that is similar to those used in the petroleum diesel but is tailored for biodiesel. Genetic modifications of the existing feedstock are also desirable but the food uses of this particular feedstock should always be taken into consideration.

Keywords

Biodiesel, Cold flow properties, Pour point, Cloud point, Cold filter plugging point and low temperature filterability test



15.8 JST Vol. 21 (2) Jul. 2013 Article ID: JST-0401-2012

Palm Oil Transesterification Processing to Biodiesel Using a Combine of Ultrasonic and Chemical Catalyst

Supranto, S.

A combination of ultrasonic and chemical catalyst affects to the transesterification reaction rate of palm oil conversion to biodiesel is investigated in a 5 Liter capacity reactor equipped with the heater and temperature controller and the 42 Hz ultrasonic generator of 35 watt with process parameters of (a) reaction temperature, (b) methanol to palm oil ratio, (c) and the amount of chemical catalyst and (d) duration of the ultrasonic activation. The result shows that by combining the ultrasonic and chemical catalyst in the palm oil transesterification processing increases the chemical reaction rate, the higher the frequency of the ultrasonic activation used, the higher the biodiesel conversion. The transesterification operating process condition of 60 to 70°C, Methanol to palm oil ratio of 5, reaction duration time of 60 minute, and catalyst activation of 30 minute, using a 42 KHz , 35 watt ultrasonic, may be applied to produce biodiesel with a conversion as high as 94% for palm oil feed stock and 91% for coconut oil feedstock

Keywords

Biodiesel, Palm oil, Transesterification, Ultrasonic, Chemical catalyst



15.9 JST Vol. 20 (1) Jan. 2012 Article ID: JST-0277-2011

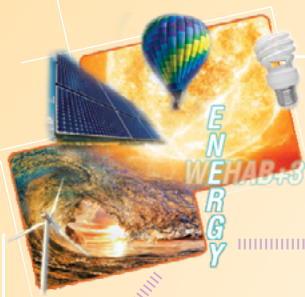
Synthesis of *Jatropha curcas*-based Methyl Ester and Ethyl Ester as Biodiesel Feedstocks

*Azhari Muhammad Syam, Robiah Yunus,
Tinia Idaty Mohd. Ghazi and Thomas Choong Shean Yaw*

Research on the use of *Jatropha curcas* triglycerides as biodiesel feedstock has received worldwide attention due to its inherent characteristics. Unlike palm oil, *J. curcas* oil is not edible, and thus, it will not disturb the food supply. However, to the researchers' experiences with the synthesis of *J. curcas*, oil-based biodiesel has shown that the fuel characteristics depend largely on the type of alcohol used as the excess reactants. Transesterification reaction is chosen for this process with sodium methoxide as the catalyst. Comparison studies on the yield of esters using methanol and ethanol, as well as the impacts on the reaction rate are discussed. The effects of reaction time and molar ratio on the reaction conversion are also examined. The determination of reaction yield is based on the conversion of triglycerides into alkyl esters as the main product. The findings are described as follows: the highest percentage yield of product is attained at 96% for methanol as an excess reactant, and this is 90% when ethanol is used. The optimum conditions of parameters are achieved at 6:1 molar ratio of alcohol to triglycerides, 50 min of reaction time and reaction temperature of 65°C for methanol and 75°C for ethanol. The biodiesel properties of both ester fuels were determined according to the existing standards for biodiesel and compared to the characteristics of diesel fuel.

Keywords

Jatropha curcas triglycerides, Methyl ester, Ethyl ester, Catalyst



15.10 JTAS Vol. 35 (2) May. 2012 Article ID: JTAS-0295-2010

Design of an Object-oriented Framework for Modelling the Partitioning of Captured Solar Radiation and Evapotranspiration in Intercropping Systems

C. B. S. Teh and T. R. Wheeler

x-library is a C++ object-oriented framework for modelling the partitioning of captured solar radiation and evapotranspiration in intercropping systems. The design and analysis of the x-library are done to ensure that the soil-plant-atmosphere system is categorised into classes, such as weather, microclimate, intercrop, crop, canopy, leaf, roots, soil, heat, and radiation. Meanwhile, x-library implements two kinds of solar radiation models; namely, one-dimensional (1-D), and two-dimensional (2-D) model, where irradiance varies in one dimension (vertical) and in two dimensions (vertical and horizontal), respectively. Radiation partitioning is based on weighting criteria so that a crop having the larger leaf area index and extinction coefficient would have greater share of captured radiation. Evapotranspiration partitioning is calculated using the Shuttleworth- Wallace equation. Model comparisons with a field experiment showed an overall good agreement between the simulated and measured solar radiation and transpiration values. A graphical user interface front-end for the x-library known as the x-model was also developed, primarily for non-modellers and non-programmers.

Keywords

Intercrop, Model, Object-oriented, Reusability



15.11 JTAS Vol. 35 (1) Feb. 2012 Article ID: JTAS-0246-2010

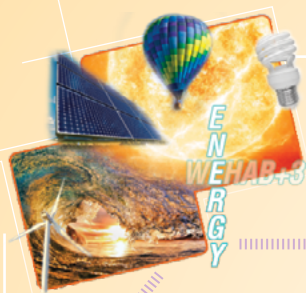
Utilization of Glucose Recovered by Phase Separation System from Acid-hydrolysed Oil Palm Empty Fruit Bunch for Bioethanol Production

Mohd Huzairi Mohd Zainudin, Nor'Aini Abdul Rahman, Suraini Abd-Aziz,
Masamitsu Funaoka, Takanori Shinano, Yoshihito Shirai,
Minato Wakisaka, and Mohd Ali Hassan

Oil palm empty fruit bunch (OPEFB) is one the most abundant lignocellulosic wastes produced throughout the year in the palm oil industry. A new process of separating lignocellulose components after acid hydrolysis (known as phase separation system) has been previously developed, by which lignin and carbohydrate can be completely and rapidly separated in 60 minutes between 25 and 30°C. In this process, cellulose is completely hydrolyzed to oligosaccharides and remains in the acid phase. The maximum glucose yield of 53.8% was obtained by hydrolysis, with 4% acid after autoclaving at 121°C for 5 minutes. This work focused on the separation of monosaccharide (glucose) from cellulose fraction, which was subsequently used as a substrate for ethanol production. For this purpose, different types of nitrogen sources were evaluated, with yeast extract as the best nitrogen source (93% of theoretical yield) as compared to palm oil mill effluent (POME) and sludge powder for the growth of acid tolerant *Saccharomyces cerevisiae* ATCC 26602. Batch and repeated batch fermentation of *S. cerevisiae* ATCC 26602 using OPEFB hydrolysate gave 0.46 g glucose g ethanol⁻¹, representing 87% of theoretical yield with a productivity of about 0.82 g l⁻¹ h⁻¹ and 0.48 g glucose g ethanol⁻¹, representing 89% of theoretical yield with productivity of about 2.79 g l⁻¹ h⁻¹, respectively.

Keywords

Bioethanol, Oil palm empty fruit bunch, Phase separation system, Acid hydrolysis, Glucose



15.12 JTAS Vol. 35 (4) Nov. 2012 Article ID: JTAS-0244-2010

Floral Biology, Flowering Behaviour and Fruit Set Development of *Jatropha curcas* L. in Malaysia

Noor Camellia, N. A., Thohirah, L. A., and Abdullah, N. A. P.

This paper describes the flowering behaviour of *Jatropha curcas* cultivated under Malaysian tropical climate. Investigation was carried out by observing the floral morphology, flowering sequence of pistillates, floral anthesis time, flower daily anthesis, flowering and fruiting plant behaviour, flower sex and fruit set ratio. Floral reproductive organs were examined using Scanning Electron Microscope (SEM). *Jatropha* is monoecious and it produces individual flowers in a dichasial cyme. Each *Jatropha* inflorescence has at least six compound cymes. The male flower anthesis started the earliest at 12.00 am and once again at 6.10 am to 6.46 am. The female flower anthesis commenced at 6.35 am to 8.25 am. The male flowers opened for a period of 8 to 11 days, while the female flowers opened for only 3 to 4 days. The reading of the male to the female flower ratio was taken twice, 22:1 in December 2008 and 27:1 in April 2009. The flower to fruit ratios were 6:5 (January 2009) and 2:1 (May 2009). Numerically, 0-10 female flowers and 25-215 male flowers are produced in the same inflorescence. In this study, the terminal stem of *Jatropha* bore fruits profusely in January, May and August 2009. Meanwhile, the development of the floral meristem consists of three stages which include a vegetative stage, a transition from vegetative to floral stage and development of flower parts. The meristem was in the transition stage at day 6. Although all sepals and a petal were developed at day 18, the presence of reproductive organs developing at this particular stage was not detected. Flower and fruit development took approximately 3 months to complete the full cycle, i.e. from the initiated floral bud stage until fruit maturity.

Keywords

Anthesis, Floral phenology, Reproductive, Protandry, Pistillate, Dichasial cyme



15.13 JST Vol. 20 (1) Jan. 2012 Article ID: JST-0275-2011

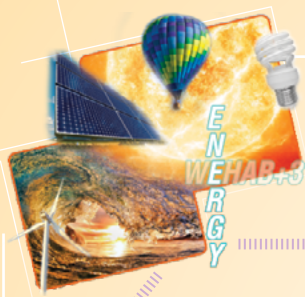
Catalytic Gasification of Empty Fruit Bunch for Enhanced Production of Hydrogen Rich Fuel Gas

Mohammed M. A. A., Salmiaton A., Wan Azlina W. A. K. G., Mohamad Amran M. S., Omar R., Taufiq-Yap Y. H. and Fakhru'l-Razi A.

Oil palm is widely grown in Malaysia. There has been interest in the utilization of oil palm biomass for production of environmental friendly biofuels. The gasification of empty fruit bunches (EFB), a waste of the palm oil industry, was investigated in this study to effectively and economically convert low value and highly distribution solid biomass to a uniform gaseous mixture mainly hydrogen (H_2). The effects of temperature, equivalence ratio (ER) and catalyst adding on the yields and distribution of hydrogen rich gas products were also investigated. The main gas species generated, as identified by GC, were H_2 , CO, CO_2 , CH_4 and trace amounts of C_2H_4 and C_2H_6 . With temperature increasing from 700 to 1000 °C, the total gas yield was enhanced greatly and reached the maximum value (~ 90 wt. %) at 1000°C with a big portion of H_2 (38.02 vol. %) and CO (36.36 vol. %). Equivalence ratio (ER) showed a significant influence on the upgrading of hydrogen production and product distribution. The optimum ER (0.25) was found to attain a higher H_2 yield (27.42 vol. %) at 850°C. The effect of adding catalysts (Malaysian dolomite1, P1), Malaysian dolomite2 (GML), NaOH, NaCl, CaO, ZnO, NiO) as a primary catalyst on gas product yield was investigated, and it was found that adding dolomite showed the greatest effect with the maximum H_2 yield achieved (28.18 vol.%) at 850°C.

Keywords

Biomass, Hydrogen, Gasification, Catalyst adding



15.14 JST Vol. 21 (2) Jul. 2013 Article ID: JST-0405-2012

Responsive Façades: Parametric Control of Moveable Tilings

Sambit Datta and Michael Hobbs

The challenge of developing adaptive, responsive low-energy architecture requires new knowledge about the complex and dynamic interaction between envelope architecture, optimization between competing environmental performance metrics (light, heat and wind indices) and local climate variables. Advances in modeling the geometry of building envelopes and control technologies for adaptive buildings now permit the sophisticated evaluation of alternative envelope configurations for a set of performance criteria. This paper reports on a study of the parametric control of a building envelope based on moveable facade components, acting as a shading device to reduce thermal gain within the building. This is investigated using two alternative tiling strategies, a hexagonal tiling and a pentagonal tiling, considering the component design, support structure and control methods.

Keywords

Responsive envelopes, Moveable façade components, Parametric modelling, Tiling geometry



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16.1 **Journal of Physical Science, Vol. 24(1), 75–93, 2013**

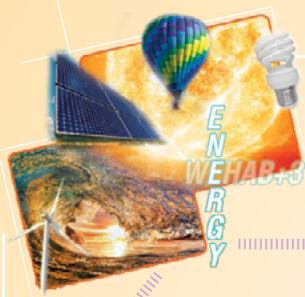
Solar Drying System for Drying Empty Fruit Bunches

Fauziah Sulaiman, Nurhayati Abdullah and Zalila Aliasak

In this paper, the drying characteristic of Empty Fruit Bunches (EFB) of oil palm is presented. The EFB, a waste of oil palm processing was used as the test sample and dried using a solar drying system that was built. The system used was comprised of six double-pass solar collectors with porous media in the second channel, which were connected in a series of three collectors in two banks and a drying chamber. Two conditions of the EFB sample were considered in the drying test; treated and untreated. A simple water washing treatment was used to treat the first sample to reduce its ash content whereas the second sample was untreated in its original condition. The EFB samples were dried until equilibrium moisture content below 10 mf wt% was reached, a condition required to achieve a number of purposes in energy applications and storage of biomass material. From the results obtained, it was found that the samples were successfully dried from an initial moisture content of 170.68 mf wt% to final moisture content of 3.85 mf wt% for the untreated sample and from 376.14 mf wt% to 4.36 mf wt% for the treated sample in 66 hours of solar drying.

Keywords

Solar drying, EFB, Moisture content, Ash content



16.2 International Energy Journal: Vol.1, No.2, December 2000

Plant Based Energy Potential and Biomass Utilization

Lim, K.O., Z.A.Zainal, G.A.Quadir, M.Z Abdullah

The paper assesses the energy productivity of the major plantation crops in Malaysia as well as the status of bioenergy utilization in the country. Of the crops studied and under present local cultivation practices, oil palms and cocoa trees stand out as good trappers of solar energy while paddy plants are the least efficient. Recently Malaysia consumes roughly 2097.8 million GJ of energy per year. Of this amount 14% are contributed by biomass. However of the total amount of biowastes generated in the country roughly 24.5% are utilized for energy purposes while the rest are wasted. They are either left to rot or simply burnt as a means of disposal. If all of these unutilized biomass can be harnessed for use as energy, then the contribution of biomass to the nation's energy consumption can be raised to about 59%, a figure that is indeed attractive and therefore should be given serious attention.



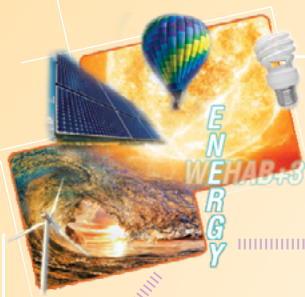
16.3

ASEAN Journal on Science and Technology for Development; 17; 1-16 Vol 17 No 2 (2000)

Energy Potential and Utilisation of Plantation Crops In Malaysia

Lim, K. O.; Alauddin, Z. A. Z.; Quadir, G. A.; Abdullah, M. Z.

The major plantation crops currently cultivated in Malaysia are studied and their energy productivities are reported in the paper with reference to the concept of energy plantations. Further, the status of bioenergy utilisation from various available biomasses is also discussed. It is found that 14% of Malaysia's annual energy consumption is provided by roughly 24.5% of the total biomass. It is highlighted that this figure can be raised to about 59%, if all the unutilised biomass is harnessed for use as energy.



16.4 Energy Exploration & Exploitation, 2009

Viability of Biomass Fueled Steam Turbine Cogeneration with Power Export for An Asian Plywood Industry

Mujeebu, M. Abdul ,Abdullah, M.Z. , Ashok, S.

Cogeneration is proved to be one of the promising energy management techniques, which offers an efficient method of producing electricity and useful thermal energy from a common source. In the present study the economic and technical feasibility of implementing steam turbine based on cogeneration in a plywood industry at south India with power export is analyzed. On the basis of "Heat to Power Ratio", it is found that steam turbine cogeneration is the best option. Detailed thermal analysis shows that the cogeneration system with waste wood as fuel can improve the energy efficiency by 41%. The economic evaluation shows that the revenue from power export and sale of excess waste wood can provide almost 100% saving in the annual operating cost compared to the existing facility. The additional investment incurred is expected to be paid back within 2 years.



16.5 Biomass and Bioenergy 24 (2003) 487 – 494

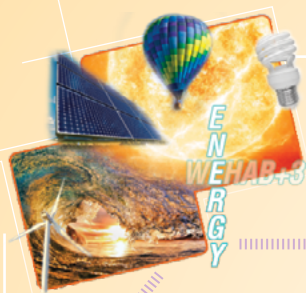
Analysis of Cold Low Utilization Test Results for Various Biomass Fuels

M.Z. Abdullah, Z. Husain, S.L. Yin Pong

A systematic theoretical and experimental study was conducted to obtain hydrodynamic properties such as particle size diameter, bulk density, utilizing velocity, etc. for locally available biomass residue fuels in Malaysia like rice husk, sawdust, peanut shell, coconut shell, palm 5ber as well as coal and bottom ash. The tests were carried out in a cold low utilization bed chamber of internal diameter 60mm with air as utilizing medium. The height of the chamber could be raised up to 630mm by 5ve separate cylindrical rings. Bed-pressure drop was measured as a function of super5cial air velocity over a range of bed heights for each individual type of particle. The data were used to determine minimum utilization velocity, which could be used to compare with theoretical values. The particle size of biomass residue fuel was classi5ed according to Gildart's distribution diagram. The results show that Gildart's particle size (B) for sawdust, coal bottom ash, coconut shell have good utilizing properties compared to rice husk, type (D)or palm 5ber, type (A). The bulk density and voidage are found to be main factors contributing to utilizing quality of the bed.

Keywords

Biomass residue fuel; Coal bottom ash; Fluidizing velocity



16.6 Journal of Physical Science, Vol. 22(1), 1–24, 2011

Characterisation of Oil Palm Empty Fruit Bunches for Fuel Application

N. Abdullah, F. Sulaiman and H. Gerhauser

This study was an attempt to produce bio-oil from empty fruit bunches (EFB) of oil palm waste using fast pyrolysis technology. A 150 g/h fluidised bed bench scale fast pyrolysis unit operating at atmospheric pressure was used to obtain the pyrolysis liquid. A comparison of the elemental composition of unwashed and washed feedstock was made in this study. With the five methods of treatment being considered, elements such as Al, P, Cl, Ti, Fe and Cu were removed during the washing. However, Na, S and K decreased with the reduction of the ash content of the feedstock. The properties of the liquid product were analysed and compared with wood derived bio-oil and petroleum fuels. The liquids produced had high acid content, with a High Heating Value (HHV) of about 50% of conventional petroleum fuel. The char content was in the range of 0.2–2.0%. The composition and particle size distribution of the washed and unwashed feedstock were determined, and the thermal degradation behaviour was analysed by thermogravimetric analysis (TGA). The product yield for washed EFB was similar to that of low ash wood, while the product yield for unwashed EFB was much closer to that of higher ash feedstock. The pyrolysis liquids derived from unwashed EFB were found to be in both an aqueous and an organic phase, which presents challenges for their commercial application as a fuel. Some possibilities of upgrading were also discussed in this work.

Keywords

Empty fruit bunches, Fast pyrolysis, Bio-oil, Ash, Washed feedstock, TGA



16.7 Journal of Physical Science, Vol. 21(1), 67–77, 2010

A Perspective of Oil Palm and Its Wastes

Sulaiman, F., Abdullah, N., Gerhauser, H and Shariff, A.

Palm oil and related products represent the second largest export of Malaysia. Malaysia's palm oil production in 2005 is projected to reach approximately 15 million tonnes (301,000 barrels per day) compared to its petroleum production in 2004, estimated at 43 million tonnes (855,000 barrels per day), of which 16 million tonnes (321,000 barrels per day) were exported. This paper describes the planting of oil palms; the production of oil palm products and yields of fresh fruit bunches (FFB), crude palm oil and palm kernel from 1976 to 2006. The utilisation of oil palm waste is also discussed with its potential use as fertiliser, fuel and bio-oil"

Keywords

Empty fruit bunches, Oil palm wastes, Oil palm mill, Bio-oil



16.8 Biomass and Bioenergy, Volume 35, Issue 9, October 2011, Pages 3775–3786

An Outlook of Malaysian Energy, Oil Palm Industry and Its Utilization of Wastes as Useful Resources

Sulaiman, F., Abdullah, N., Gerhauser, H and Shariff, A.

Malaysia has an abundance of energy resources, both renewable and non-renewable. The largest non-renewable energy resource found in Malaysia is oil, and second, is natural gas, primarily liquefied natural gas. The production and consumption of oil, gas and coal in Malaysia are given in this paper. The energy demand and supply by source are also shown in relation to the country's fuel diversification policy. In order to reduce the overall dependence on a single source of energy, efforts were undertaken to encourage the utilization of renewable resources. Forest residue and oil palm biomass are found to be potentially of highest energy value and considered as the main renewable energy option for Malaysia. Palm oil and related products represent the second largest export of Malaysia. The total oil palm planted area in Malaysia has increased significantly in recent years. This paper gives a detailed representation of oil palm planted and produced together with its yield from the year 1976 onwards. The large amounts of available forest and palm oil residues resulting from the harvest can be utilized for energy generation and other by-products in a manner that also addresses environmental concerns related to current waste disposal methods.

Keywords

Energy; Renewable energy; Oil palm; Oil palm wastes; Fast pyrolysis



16.9

Biomass and Bioenergy Volume 22, Issue 6, June 2002, Pages 505–509

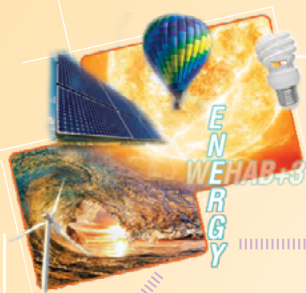
Briquetting of Palm Fibre and Shell from the Processing Of Palm Nuts to Palm Oil

Z .Husain, Z. Zainac, Z.Abdullah

Malaysia is the major producer of palm oil in the world. It produces 8.5 million tonnes per year (View the MathML source) of palm oil from View the MathML source of fresh fruit bunches. Palm oil production generates large amounts of process residues such as fibre (View the MathML source), shell (View the MathML source), and empty fruit bunches (View the MathML source). A large fraction of the fibre and much of the shell are used as fuel to generate process steam and electricity in the palm processing mill itself. However, much is wasted by pile burning in the open air with attendant air pollution, dumped in areas adjacent to the mill, or utilized as manure in the palm oil plantation. In this paper, an attempt has been made to convert these residues into solid fuel. The palm shell and fibre is densified into briquettes of diameter 40, 50 and View the MathML source under moderate pressure of 5–View the MathML source in a hydraulic press. Experiments are carried out to determine density, durability, impact and compressive strength of the briquettes. The heating value, burning characteristics, ash and moisture content are other objects of the study. A relationship between press pressure and the briquette density has been established. The produced briquettes have densities between 1100 and View the MathML source. The briquettes properties are quite good with good resistance to mechanical disintegration, and will withstand wetting. The gross calorific value is about View the MathML source (maf), and the ash content is about 6% and the equilibrium moisture content is about 12%. Further work is required to acquire complete understanding of the densification process before good quality and durable briquettes could be made free from cracks.

Keywords

Briquettes; Palm oil residues; Palm shell; Palm fibre; Densification; Mechanical properties



16.10 Biomass and Bioenergy 22 (2002) 505 – 509

Briquetting of Palm Fibre and Shell from the Processing of Palm Nuts to Palm Oil

Z. Husain , Z. Zainac, Z. Abdullah

Malaysia is the major producer of palm oil in the world. It produces 8.5 million tonnes per year ($8.5 \times 10^6 \text{ t y}^{-1}$) of palm oil from $38.6 \times 10^6 \text{ t y}^{-1}$ of fresh fruit bunches. Palm oil production generates large amounts of process residues such as bre ($5.4 \times 10^6 \text{ t y}^{-1}$), shell ($2.3 \times 10^6 \text{ t y}^{-1}$), and empty fruit bunches ($8.8 \times 10^6 \text{ t y}^{-1}$). A large fraction of the bre and much of the shell are used as fuel to generate process steam and electricity in the palm processing mill itself. However, much is wasted by pile burning in the open air with attendant air pollution, dumped in areas adjacent to the mill, or utilized as manure in the palm oil plantation. In this paper, an attempt has been made to convert these residues into solid fuel. The palm shell and fibre is densified into briquettes of diameter 40, 50 and 60 mm under moderate pressure of 5–13.5 MPa in a hydraulic press. Experiments are carried out to determine density, durability, impact and compressive strength of the briquettes. The heating value, burning characteristics, ash and moisture content are other objects of the study. A relationship between press pressure and the briquette density has been established. The produced briquettes have densities between 1100 and 1200 kg m^{-3} . The briquettes properties are quite good with good resistance to mechanical disintegration, and will withstand wetting. The gross calorific value is about 16.4 MJ kg^{-1} (maf), and the ash content is about 6% and the equilibrium moisture content is about 12%. Further work is required to acquire complete understanding of the densification process before good quality and durable briquettes could be made free from cracks.

Keywords

Briquettes; Palm oil residues; Palm shell; Palm fibre; Densification; Mechanical properties



16.11 Biomass and Bioenergy 24 (2003) 117 – 124

Analysis of Biomass-Residue-Based Cogeneration System in Palm Oil Mills

Z.Husain , Z.A. Zainal, M.Z. Abdullah

Palm oil mills in Malaysia operate on cogeneration system using biomass residue as fuel in the boiler. The boiler produces high pressure and temperature steam which expands in a backpressure steam turbine and produces enough electric power for the internal needs of the mill. The exhaust steam from the turbine goes to an accumulator which distributes the steam to various processes in the mill. The study was made on seven palm oil mills in the Perak state in Malaysia. The primary objectives of the study are to determine boiler and turbine efficiencies, energy utilization factor, oil extraction rate and heat/power ratio for various palm oil mills working under similar conditions and adopting same processes. The palm oil industry is one of those rare industries where very little attempt is made to save energy. The energy balance in a typical palm oil mill is far from optimum and there is considerable scope for improvement. Bench-marking is necessary for the components in the mill. Energy-use bench-marking can give an overview of energy performance of the mills. The calculations were done to get net gain in power when back pressure turbine is replaced by a condensing turbine. It was found that the boiler and turbine have low thermal efficiencies compared to conventional ones used in power plants due to non-homogeneity and non-uniform quality of the fuel. The extraction rate was around 0.188. The use of condensing turbine increase the power output by 60% and the utilization factor was found to be 65% for the cogeneration system.

Keywords

Biomass; Shell; Fiber; Fresh fruit bunch; Empty fruit bunch; Palm oil mill; CHP (combined heat and power)



16.12 International Journal of Electrochemical Science; Dec2012, Vol. 7 Issue 12, p13093

Effect of Thickness on Boron-Doped Silicon Thin Film Deposited Onto Silver-Aluminium Back Contact-Coated Plastic Substrate by Screen Printing

Ali, M. K. M., Ibrahim, K., Mkawi, E. M., Salhin, A.

This paper investigates the effect of thickness on the properties of p-type polycrystalline Si thin film deposited onto silver-aluminium back contact-coated polyethylene terephthalate (PET) substrate. In the fabrication, the substrate was coated using screen printing technology, and boric acid (0.1 g/l) was used as the boron-doping source. Three different weights of boron-doped Si powder were dissolved in 40 ml polyethylene glycol to create Si pastes with different viscosities. These pastes were used to print three different thicknesses of p-type Si thin film on Ag-Al alloy-coated PET substrates. Different techniques were employed to analyze the effects of varying thicknesses on the properties of Si thin layers. X-ray diffraction (XRD) was used to determine the crystallite size (D) and stress in the Si thin film. Surface morphology and roughness were studied by scanning electron microscopy (SEM) and atomic force microscopy (AFM). The thin film component elements were detected using EDX attached to an SEM system. The carrier concentration, Hall mobility, and other electrical properties were determined through Hall Effect measurements. The optical band gap was determined from the UV-visible absorbance spectrum, and the results indicate that band gap energy is proportional to the thickness of the Si layer.

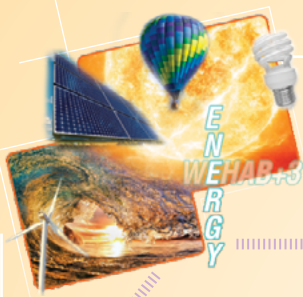


16.13 *Microelectronics International*, Vol. 27 Iss: 2, pp.117 - 120

The Effect of Porosity on the Properties of Silicon Solar Cell

Asmiet Ramizy, Wisam J. Aziz, Z. Hassan, Khalid Omar, K. Ibrahim

Purpose – The purpose of this paper is to describe how fabricate solar cell based-on porous silicon (PS) prepared by electrochemical etching process is fabricated and the effect of porosity layer on the solar cell performance is investigated. **Design/methodology/approach** – The techniques used include SiO_2 thermal oxidation, ZnO/TiO_2 sputtering deposition and PS prepared by electrochemical etching. Surface morphology and structural properties of porous Si were characterized by using scanning electron microscopy. Photoluminescence and Raman spectroscopy measurements were also performed at room temperature. Current-voltage measurements of the fabricated solar cell were taken under $80\text{mW}/\text{cm}^2$ illumination conditions. Optical reflectance was obtained by using optical reflectometer (Filmetrics-F20). **Findings** – Pore diameter and microstructure are dependent on anodization condition such as HF: ethanol concentration, duration time, temperature, and current density. On other hand, a much more homogeneous and uniform distribution of pores is obtained when compared with other wafer prepared with different electrolyte composition. **Originality/value** – PS is found to be an excellent anti-reflection coating against incident light when it is compared with another anti-reflection coating and exhibits good light-trapping of a wide wavelength spectrum which produce high efficiency solar cells (11.23 per cent).



16.14 International Rio3 Congress, World Climate and Energy Event, Rio de Janeiro, 1-5 December 2003

Designing a Solar Thermal Cylindrical Parabolic Trough Concentrator by Simulation

Balbir Singh Mahinder Singh, Fauziah Sulaiman

The focus on renewable energy in Malaysia gained momentum with the active involvement of the government and the private sector. This move can potentially help in diversifying the country's energy options besides relying on oil, natural gas, coal and hydropower. The scope of this paper is to look at the designing procedures of a solar thermal cylindrical parabolic trough concentrator (CPTC) by simulation. The designing effort starts off with the selection of certain parameters such as the aperture area and the diameter of the receiver to obtain the geometric concentration. Concentration ratios can be theoretically very high with the imaging concentrators of precise optical elements and continuous tracking, in the range of 10 to 40 000. A thorough analysis is necessary, where the optical precision and proper thermal analysis must be carried out to evaluate the performance of a CPTC. The results will clearly show that there must be an equilibrium achieved between the increasing thermal losses with the increasing aperture area, and the increasing optical losses with the decreasing aperture area for the optimization of the long-term performance of the CPTC.



16.15 World Academy of Science, Engineering and Technology, 72, 2012

A Simulated Design and Analysis of a Solar Thermal Parabolic Trough Concentrator

Fauziah Sulaiman, Nurhayati Abdullah, and Balbir Singh Mahinder Singh

In recent years Malaysia has included renewable energy as an alternative fuel to help in diversifying the country's energy reliance on oil, natural gas, coal and hydropower with biomass and solar energy gaining priority. The scope of this paper is to look at the designing procedures and analysis of a solar thermal parabolic trough concentrator by simulation utilizing meteorological data in several parts of Malaysia. Parameters which include the aperture area, the diameter of the receiver and the working fluid may be varied to optimize the design. Aperture area is determined by considering the width and the length of the concentrator whereas the geometric concentration ratio (CR) is obtained by considering the width and diameter of the receiver. Three types of working fluid are investigated. Theoretically, concentration ratios can be very high in the range of 10 to 40 000 depending on the optical elements used and continuous tracking of the sun. However, a thorough analysis is essential as discussed in this paper where optical precision and thermal analysis must be carried out to evaluate the performance of the parabolic trough concentrator as the theoretical CR is not the only factor that should be considered.

Keywords

Parabolic trough concentrator, Concentration ratio, Intercept factor, Efficiency



16.16 2010 International Conference on Enabling Science and Nanotechnology (ESciNano); 12/2010

Nanotexturing of Silicon Solar Cells Using Acids

I M Hamammu, K Ibrahim

Two-dimensional plasmonic nanosurface for photovoltaics J. Appl. Phys. 110, 114313 (2011) Solid state photovoltaic cells based on localized surface plasmon-induced charge separation Appl. Phys. Lett. 99, 182110 (2011), Extension of the spectral responsivity of the photocurrent in solution-processed small molecule composite via a charge transfer excitation APL: Org. Electron. Photonics 4, 229 (2011) Self-assembled plasmonic electrodes for high-performance organic photovoltaic cells APL: Org

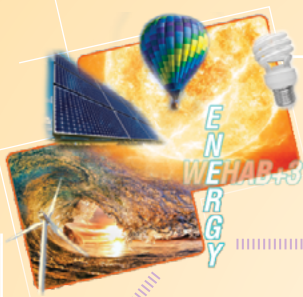


16.17 Journal of Materials Science February 2012, Volume 47, Issue 4, pp 1972-1976

Comparative Study of The Properties Of ZnO Thin Films Deposited On Poly Propylene Carbonate (PPC) And Glass Substrates

N. N. Jandow, H. Abu Hassan, F. K. Yam, K. Ibrahim

In this study, we report a comparative study of the structural, morphological, and optical properties of the deposited ZnO thin films on Poly Propylene Carbonate (PPC) and glass substrates by direct current (DC) sputtering technique. X-ray diffraction (XRD) spectra of the films on PPC and glass substrates show mainly the ZnO (002) diffraction peaks at $2\theta = 34.1$ and 34.3° with full width at half maximum (FWHM) of 0.31 and 0.34° , respectively. Scanning electron microscopy (SEM) images show that both ZnO thin films have smooth surface. Photoluminescence (PL) spectra show two peaks, the first intense peak was found in the UV region. The second weak peak was observed in the visible region. The transmission and absorption spectra of the ZnO thin films deposited on both substrates showed that the films have good transmission in the visible region and a good absorption in the UV region. The optical energy gap (E_g) values of the deposited ZnO thin films on PPC plastic and glass substrates were derived from absorption measurements and it found to be 3.38 and 3.40 eV, respectively.



16.18 AIP Conference Proceedings; 5/20/2008, Vol. 1017 Issue 1, p154

Simulation of Single Channel Length Vertical Silicon Mosfet

Ooi, P. K., Ibrahim, K.

Vertical MOSFET has been introduced in the last few decades. As planar devices become smaller and smaller, vertical MOS transistor is one of the solutions for surpassing the short channel effects and pattern transfer. Thus, it is a promising approach to achieve channel lengths between 100 nm and 25 nm. In this work, we simulate sub-100 nm single channel length vertical silicon MOSFET. The simulations are done with using ATHENA, DEVEDIT and ATLAS from SILVACO International. Input and output electrical characteristics of the vertical MOS transistors are investigated. The short channel effects of the vertical MOSFETs are explored. Due to the structure is not symmetry, source at top and bottom is also considered. The results also compared with experimental results from other researcher.

Keywords

METAL oxide semiconductor field-effect transistors; SEMICONDUCTORS; FIELD-effect transistors; METAL oxide semiconductors; SILICON



16.19 **Electronic Materials Letters June 2012, Volume 8, Issue 3, pp 263-268**

Properties of Ag Layered In Te/Cd Stack Prepared By Stacked Elemental Layer Method

Shanmugan Subramani, Mutharasu Devarajan, Kamarulazizi Ibrahim

Ag layered Te/Cd stack thin films (<1 μm thick) were prepared by the Stacked Elemental Layer (SEL) method. The XRD results revealed that the synthesized films had a polycrystalline nature. The synthesized films were preferentially oriented with (111) directions with a cubic phase. Structural studies evidenced the formation of Ag related alloys at high annealing temperatures as a result of thermal diffusion in elemental stack. Optical and photo-resistivity studies revealed the influence of Ag on the CdTe lattice at high annealing temperatures. Surface morphology and the influence of Ag atoms on surface roughness are also presented.

Keywords

Thin film, Stacked Elemental Layer method, Image analysis, XRD, CdTe



16.20 ISSN 1392–1320 Materials Science (Medžiagotyra). Vol. 18, No. 2. 2012

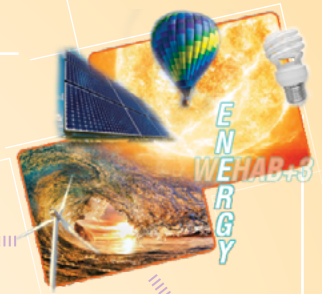
Optical Properties and Surface Morphology of Zinc Telluride Thin Films Prepared by Stacked Elemental Layer Method

Subramani Shanmugan, Devarajan Mutharasu

ZnTe thin films were prepared by Stacking of elemental (Zn and Te) layers (SEL) followed by inert gas annealing. The optical parameters were calculated from the transmission spectra. The bandgap of the annealed samples was found between 1.95 eV and 2.06 eV. The change in film thickness after annealing was observed using cross sectional SEM image of the annealed samples. The surface morphology of the annealed Te/Zn stack was also analyzed and observed as very smooth, compact and dense surface. The prepared film was Zn rich evidenced by EDAX. The observed result encourages in pursuing the SEL method for the preparation of compound semiconductor from II-VI group materials.

Keywords

Thin films, ZnTe, Stacked Elemental Layer, Optical properties, Surface properties



16.21 Indian Journal of Marine Sciences; 38, 3; 346-351

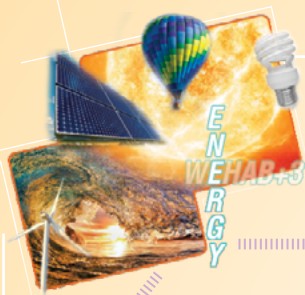
CFD Simulation of Cooperative AUV Motion

Muhamad Husaini, Zahurin Samad, Mohd Rizal Arshad

Cooperative AUV performance and efficiency is directly related to its power efficiency. The power consumption for this type of underwater vehicle is influenced by its motion needed because most of the power is spent for thruster to produce thrust. Drag force is known as main contribution to resist the body motion. In this paper, the behaviour of this force is study by using Computational fluid dynamic approach (CFD). Two position arrangement of cooperative AUV was chosen to study the drag variation. First, the distance effect between two AUV was studied to represent the basic position arrangement of cooperative AUV. Second position arrangement is studied to look at the effect of different position arrangement. The comparison between distance and position arrangement was discuss in detail in this paper. The study show that the distance behind the leading AUV does not give much effect to drag force, but the position arrangement show significant important to drag force.

Keywords

Cooperative AUV, CFD, Hydrodynamic coefficient



16.22 Chinese Journal of Physics Vol. 48, NO. 2 APRIL 2010

α Decay of Superheavy Nuclei Using The Projection Operator Method

Sohail A. Khan, M. Z. Mat Jafri, and K. L. Low

The projection operator method was applied to the recently produced superheavy elements ranging from $Z = 106$ to 118 . Woods-Saxon potentials were used with conditions on the number of nodes in the alpha particle relative motion. The optical potential was required to have a sharp boundary. Spectroscopic factors, lifetimes, and reduced widths were extracted. Values for spectroscopic factors obtained are in the range found earlier for heavy alpha emitter nuclei. The lifetimes in all cases except one are somewhat smaller than the experimental values. The squares of the reduced widths for the great majority of nuclei were found to have values less than 100 eV. It is suggested that the density distribution of the superheavy nuclei departs from the usual and has a smaller radii.



16.23 World Renewable Energy Congress 7th, World Renewable Energy Congress; 923, 2002

To Determine the Reynolds Number of Saturated Waterflowing in Tubes

Sulaiman, F.; Singh, B.; Singh, M.

Fluid flowing in a tube is commonly used in practice for heating and cooling applications. The flow in a tube can be laminar or turbulent, entirely depending on the flow conditions. It is therefore, useful to know the nature of the flow, especially in evaluating the Nusselt number. Osborn Reynolds, in the 1880's, discovered that the flow depends mainly on the mean flow velocity V ; inner tube diameter D , and the kinematic viscosity ν and this led to the formulation of the Reynolds number, a dimensionless physical quantity. The parameters defining Reynolds number are dependent on temperature, whereby an accurate representation of this number will be critical in the determination of the flow regimes. This problem was solved by obtaining a temperature dependent model, which represented these parameters. The temperature dependent model obtained by using the reciprocal quadratic fit is called the RFACTOR, determined in the temperature range of 0°C to 360°C , and for saturated water.



16.24 <http://eprints.usm.my/8618/> Working Paper. Universiti Sains Malaysia.

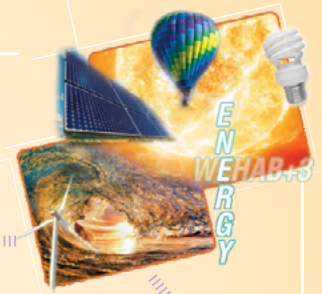
Optimization of Thermodynamic Cycles for Gas Turbines Using Genetic Algorithms

Lee Kor Oon, Parthiban Arunasalam, Ong Kang Eu, G. A. Quadiri, K. N. Seetharamu, P. A. Aswatha Narayana, M. Z. Abdullah, I. A. Azid and Z. A. Zainal Abidin

The Darwin's theory of natural evolution is being used in the last one decade for optimization of many engineering systems in the name of genetic algorithms. In the present paper, genetic algorithms are used for the optimization of the gas turbine cycles. Based on thermodynamic consideration of a gas turbine plant, the pressure ratio is optimized with genetic algorithms for maximum efficiency or maximum net power density. In addition to the pressure ratio, component efficiencies and maximum cycle temperature are treated as independent (decision) variables. The effects of the independent variables on the pressure ratio are also determined. Economics are combined with thermodynamics to formulate a thermo economic optimization problem. The results obtained by genetic algorithms are compared with the numerical results to demonstrate the capability of genetic algorithms in carrying out an optimization of thermodynamic cycles for gas turbines.

Keywords

Gas turbine cycles; Genetic algorithms; Thermodynamic optimization; Thermoeconomic optimization

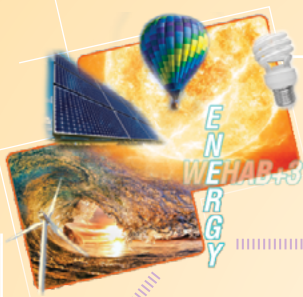


16.25 Computer Science and Information Technology - Spring Conference, 2009.
17-20 April 2009, Singapore. P. 598 – 603. Print ISBN:978-0-7695-3653-8

Improved Illumination Levels and Energy Savings by Uplamping Technology for Office Buildings

Ali, N.A.M. ,Fadzil, S.F.S. , Mallya, B.L

This study introduces a simple solution for uplamping and its energy saving for office lighting in the buildings visited in Gurgaon, Manesar and Noida around the capital of India i.e. Delhi, by discussion with the technical and maintenance staff. Study was carried out to know what is the existing lighting system used, and suggestions of efficient lighting system with support of lighting energy simulation tool i.e. DIALux are given. The selected project as a case study is the Human Resources Developing Institute of Bharat Heavy Electricals Ltd BHEL (office building). The result of the efficient system in the building shows that, uplamping with fluorescent lamps and CFL has achieved in energy saving of 42% and 65% respectively, and increase in lux level by 30% for both.



16.26 434-447. In 3rd International Conference on Built Environment in Developing ICBEDC2009, 2nd-3rd December 2009, School of Housing, Building & Planning, Universiti Sains Malaysia

Daylight Illumination Levels in Varied Room Configurations at the View Condominium, Penang, Malaysia

Adel Abdullah, Syed Fadzil S. F., Al-Tamimi Nedhal A.

Daylight illumination levels in a room depend on the room design and configurations especially in its glazed area and location in the wall surfaces that allows light to penetrate in. The design of the room varies according to the architect and this allow for many shapes and configurations not limited to the simple rectangle only. Daylight entry in these varied rooms can be developed according to the architects intuition and intention. In this paper, daylight illumination levels were measured in three varied room configurations at The View condominiums in Penang, Malaysia. The percentage daylight factors were calculated and analysis of the sky component exposure was carried out for each room. Recommendations were given for day lighting design for rooms in the tropical climate.

Keywords

Daylight factor, Illumination, WFR window to floor ration, Sky component



16.27 Materials Letters Volume 97, 15 April 2013, Pages 24–26

Electrical Characterization of Thermoelectric Generators Based on p-type $\text{Bi}_{0.4}\text{Sb}_{1.6}\text{Se}_{2.4}\text{Te}_{0.6}$ AND n-type $\text{Bi}_2\text{Se}_{0.6}\text{Te}_{2.4}$ Bulk Thermoelectric Materials

A. Kadhim, A. Hmooda, H. Abu Hassan

In this study, we fabricated two thermoelectric (TE) generation (TEG) devices based on p- $\text{Bi}_{0.4}\text{Sb}_{1.6}\text{Se}_{2.4}\text{Te}_{0.6}$ and n- $\text{Bi}_2\text{Se}_{0.6}\text{Te}_{2.4}$ bulk TE materials. The overall dimensions of these devices, which comprise 9 ($D1$)-and 18($D2$)-couples of legs connected and attached to alumina substrates by Ag paste–Cu plate–Ag paste electrodes, are 50 mm \times 25 mm and 50 mm \times 50 mm, respectively. The open-circuit voltage (V_{oc}) and the maximum output power (P_{max}) were estimated in terms of the temperature difference (ΔT) between hot (T_H) and cold (T_C) junctions as well as the number of p–n couples of the TEG devices. The significance of the resistances, including the internal resistance (R_{in}) and contact resistance (R_c) between legs and electrodes, are discussed. P_{max} obtained with the D_2 device was 273 mW under thermal conditions of $T_H=523$ K and $\Delta T=184$ K.

Keywords

Contacts; Semiconductors; Powder technology; Solidification



16.28 Measurement Volume 46, Issue 8, October 2013, Pages 2473–2480

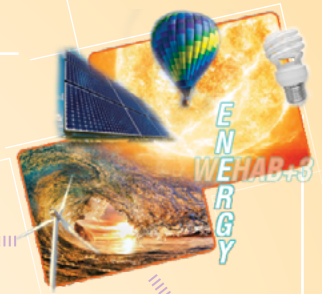
Thermal Sensors Based on $p\text{-Pb}_{0.925}\text{Yb}_{0.075}\text{Te}:\text{Te}$ and $n\text{-Pb}_{0.925}\text{Yb}_{0.075}\text{Se}_{0.2}\text{Te}_{0.8}$ Thin Films Grown Using Thermal Evaporation Method

A. Hmooda, A. Kadhim, H. Abu Hassan

We utilize $p\text{-Pb}_{0.925}\text{Yb}_{0.075}\text{Te}:\text{Te}$ and $n\text{-Pb}_{0.925}\text{Yb}_{0.075}\text{Se}_{0.2}\text{Te}_{0.8}$ ingots in a standard solid-state microwave synthesis route to fabricate thermally evaporated thin films. The nanostructure and composition of the films were studied through X-ray diffraction (XRD), field emission scanning electron microscopy (FESEM), and energy dispersive X-ray spectroscopy (EDX). The Seebeck coefficient and electrical conductivity were measured at a temperature range of 298–523 K. The micro-thermoelectric devices were composed of 20 pairs and 10 pairs of $p\text{-Pb}_{0.925}\text{Yb}_{0.075}\text{Te}:\text{Te}$ and $n\text{-Pb}_{0.925}\text{Yb}_{0.075}\text{Se}_{0.2}\text{Te}_{0.8}$ thin films on glass substrates, respectively. The dimensions of the thin films thermoelectric generators which comprised of 10-pair were 12 mm × 10 mm, whereas, 20-pair were 23 mm × 20 mm, respectively of legs connected through aluminum electrodes. The serial 20-pair $p\text{-}n$ thermocouples generated a maximum output open-circuit voltage of 275.3 mV and a maximum output power of 54.37 nW at a temperature difference of $\Delta T = 162$ K; the values are 109.4 mV and 16.68 nW at $\Delta T = 162$ K for the 10-pair thermocouples, respectively.

Keywords

Thin films; Thermal evaporation method; Thermoelectric generators



16.29 Journal of Sustainable Development Vol. 3, No. 4; December 2010 (www.ccsenet.org/jsd)

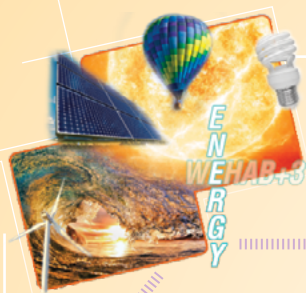
An Assessment of Thermal Comfort and Users' Perceptions of Landscape Gardens in A High-Rise Office Building

Aldrin Abdullah, Nooriati Taib, Sharifah Fairuz Syed Fadzil, Foong Swee Yeek

There is a great need to reduce energy consumption in high-rise office buildings due to escalating environmental problems such as Urban Heat Island effect and global warming. The creation of landscape spaces in high-rise buildings today is not only for reducing building heat but to provide views and psychological get-away spaces for its occupants. This paper focuses on thermal comfort and users' perception of three different landscape gardens in a 21-storey high-rise office building in Penang, Malaysia. The four parameters of thermal comfort that were measured are: air temperature, wind velocity, humidity, and solar radiation. In addition, a questionnaire survey was conducted to evaluate occupants' perceptions of comfort, use of the garden space and landscape preference. The findings from the field measurement reveal significant differences in all four thermal comfort parameters measured in the three landscape gardens. However, users only perceived lighting and wind velocity to be different."

Keywords

High-rise buildings, Sky court gardens, Green roofs, Thermal comfort and Landscape gardens



- 16.30** Materials Science Forum 756, ISESCO Conference on Nanomaterials and Applications 2012. Selected, peer reviewed papers from the 3rd ISESCO International Workshop and Conference on Nanotechnology 2012 (IWCN 2012), December 5-7, 2012, Bangi, Selangor, Malaysia. Pg.259

Fabrication and Characterization of $Pb_{1-x}Yb_xSe_{0.2}Te$ Based Alloy Thin Films Thermoelectric Generators Grown Using Thermal Evaporation Method

Arshad Hmood, Arej Kadhim, Haslan Abu Hassan

In the current work p - $Pb_{0.925}Yb_{0.075}Te:Te$ and n - $Pb_{0.925}Yb_{0.075}Se_{0.2}Te_{0.8}$ powders synthesized by solid-state microwave route were used to fabricating thermally evaporated thin films. The micro-thermoelectric devices were composed of 20-pairs and 10-pairs p - $Pb_{0.925}Yb_{0.075}Te:Te$ and n - $Pb_{0.925}Yb_{0.075}Se_{0.2}Te_{0.8}$ thin films on glass substrates. Overall size of the thin films thermoelectric generators which consist of 20-pairs and 10-pairs of legs connected by aluminium electrodes were 23 mm×20 mm and 12 mm×10 mm, respectively. The 20-pairs p - n thermocouples in series device generated output maximum open-circuit voltage of 275.3 mV and a maximum output power up to 54.4 nW at temperature difference $\Delta T=162$ K, and 109.4 mV and 16.7 nW at $\Delta T=162$ K, for 10-pairs, respectively.



16.31 **Microelectronics International 27/2 (2010) 117–120 q Emerald Group Publishing Limited [ISSN 1356-5362]**

The Effect of Porosity on the Properties of Silicon Solar Cell

Asmiet Ramizy, Wisam J. Aziz, Z. Hassan, Khalid Omar and K. Ibrahim

Purpose – The purpose of this paper is to describe how fabricate solar cell based-on porous silicon (PS) prepared by electrochemical etching process is fabricated and the effect of porosity layer on the solar cell performance is investigated. **Design/methodology/approach** – The techniques used include SiO₂ thermal oxidation, ZnO/TiO₂ sputtering deposition and PS prepared by electrochemical etching. Surface morphology and structural properties of porous Si were characterized by using scanning electron microscopy. Photoluminescence and Raman spectroscopy measurements were also performed at room temperature. Current-voltage measurements of the fabricated solar cell were taken under 80 mW/cm² illumination conditions. Optical reflectance was obtained by using optical reflectometer (Filmetrics-F20). **Findings** – Pore diameter and microstructure are dependent on anodization condition such as HF: ethanol concentration, duration time, temperature, and current density. On other hand, a much more homogeneous and uniform distribution of pores is obtained when compared with other wafer prepared with different electrolyte composition. **Originality/value** – PS is found to be an excellent anti-reflection coating against incident light when it is compared with another anti-reflection coating and exhibits good light-trapping of a wide wavelength spectrum which produce high efficiency solar cells (11.23 per cent)."

Keywords

Silicon, Porosity, Coatings, Solar power



16.32 AIP Conference Proceedings; May2013, Vol. 1528 Issue 1, p461

Nano-Fiber Diameters as Liquid Concentration Sensors

Chyad, Radhi M.; Mat Jafri, Mohd Zubir; Ibrahim, Kamarulazizi

Manufacturing technologies of nano-fiber sensors offer a number of approved properties of optical fiber sensors utilized in various sensory applications. The nano-fiber sensor is utilized to sense the difference in the concentration of D-glucose in double-distilled deionized water and to measure the refractive index (RI) of a sugar solution. Our proposed method exhibited satisfactory capability based on bimolecular interactions in the biological system. The response of the nano-fiber sensors indicates a different kind of interaction among various groups of AAs. These results can be interpreted in terms of solute-solute and solute-solvent interactions and the structure making or breaking ability of solutes in the given solution. This study utilized spectra photonics to measure the transmission of light through different concentrations of sugar solution, employing cell chamber and nano-optical fibers as sensors.



16.33 Int. J. Electrochem. Sci., 8 (2013) 359 - 368

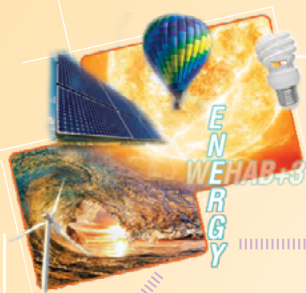
Dependence of Copper Concentration on the Properties of $\text{Cu}_2\text{ZnSnS}_4$ Thin Films Prepared By Electrochemical Method

E.M. Mkawi , K. Ibrahim , M. K. M. Ali and Abdussalam Salhin Mohamed

Quaternary $\text{Cu}_2\text{ZnSnS}_4$ (CZTS) thin films were fabricated as solar cell absorber layers via sequential electrodeposition method using a flexible copper plate as substrate. The CZTS thin films were grown with different copper salt concentrations and sulfurized in elemental sulfur vapor. The morphological, structural, compositional, and electrical properties of the films were investigated using X-ray diffraction, scanning electron microscopy, and energy dispersive X-ray spectroscopy, as well as by Raman scattering and Hall effect measurements. The results showed that the CZTS properties depend on the copper concentration in the precursor. The XRD patterns of the precursor showed the preferred orientation of the (112), (220), and (312) phases. The thin film showed a p-type conductivity, with a carrier concentration between $9.56 \times 10^{16} \text{ cm}^{-2}$ and $3.66 \times 10^{17} \text{ cm}^{-2}$, depending on the composition of the precursor mixture.

Keywords

$\text{Cu}_2\text{ZnSnS}_4$; Thin film; Copper concentration; Electrochemical



16.34 Superlattices and Microstructures 52 (2012) 782–792

Low Cost Anisotropic Etching of Monocrystalline Si (100): Optimization Using Response Surface Methodology

Khuram Ali , Sohail Aziz Khan, Mohd Zubir Mat Jafri

Reduced surface reflectance and enhanced light trapping is required by any high efficiency solar cell. Anisotropic etching was done on silicon (100) by using tetramethyl ammonium hydroxide TMAH, $(\text{CH}_3)_4\text{NOH}$, solution at 85 °C. Process variables considered were solution concentration and time proposed by response surface methodology (RSM). An effective surface texture was resulted with reflectance less than 8% without antireflection coating. The antireflection mechanism was also correlated with the etch rate of Si. Optimized values predicted by RSM for time and TMAH concentration were 5 min and 3.50% respectively. The technique and optimization of parameters by using response surface methodology (RSM) could be valuable in the texturization process for high-efficiency Si solar cells.

Keywords

Tetramethyl ammonium hydroxide, Optimized surface texturing, Response surface methodology, Silicon solar cells



16.35 <http://eprints.usm.my/8618/> Working Paper. Universiti Sains Malaysia.2009

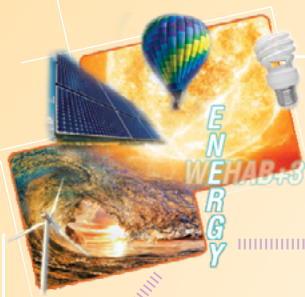
Optimization of Thermodynamic Cycles for Gas Turbines Using Genetic Algorithms

Lee Kor Oon, Parthiban Arunasalam, Ong Kang Eu, G. A. Quadiri, K. N. Seetharamu, P. A. Aswatha Narayana, M. Z. Abdullah, I. A. Azid, and Z. A. Zainal Abidin

The Darwin's theory of natural evolution is being used in the last one decade for optimization of many engineering systems in the name of genetic algorithms. In the present paper, genetic algorithms are used for the optimization of the gas turbine cycles. Based on thermodynamic consideration of a gas turbine plant, the pressure ratio is optimized with genetic algorithms for maximum efficiency or maximum net power density. In addition to the pressure ratio, component efficiencies and maximum cycle temperature are treated as independent (decision) variables. The effects of the independent variables on the pressure ratio are also determined. Economics are combined with thermodynamics to formulate a thermoeconomic optimization problem. The results obtained by genetic algorithms are compared with the numerical results to demonstrate the capability of genetic algorithms in carrying out an optimization of thermodynamic cycles for gas turbines.

Keywords

Gas turbine cycles; Genetic algorithms; Thermodynamic optimization; Thermoeconomic optimization



16.36 Energy Sources, Part A, 33:724–734, 2011 Copyright © Taylor & Francis Group

Husk-Fueled Steam Turbine Cogeneration for a Rice Mill with Power Export—A Case Study

M. A. Mujeebu, M. Z. Abdullah and S. Ashok

Utilization of the husk-fueled cogeneration system to meet the requirement of thermal and electrical needs enhances the energy efficiency and production capacity of rice mills. This will not only result in considerable savings but also leads to a sustainable supply of electricity and additional revenue from the surplus electricity generated from saved rice husk. This article presents a case study that was conducted in a South Indian rice mill in order to study the technical and economic feasibility of implementing a steam turbine-based cogeneration with an option for power export. In the proposed scheme, the existing boiler will be replaced by a new one of higher capacity. By means of a steam turbine topping cycle, electricity is generated and the turbine exhaust steam is utilized for heating applications. It has been found that the introduction of cogeneration will enhance the rice production by a minimum of 30 tons per day. Furthermore, the proposed system in its full time operation could yield an annual savings of about INR 4 million (\$0.12 m) compared to the existing facility and the additional investment would be paid back within a period of three years.

Keywords

Husk to paddy ratio, Power export, Rice mill, Steam turbine cogeneration



16.37 Isı Bilimi ve Tekniği Dergisi, 33, 1, 55-61, 2013 J. of Thermal Science and Technology
©2013 TIBTD Printed in Turkey ISSN 1300-3615

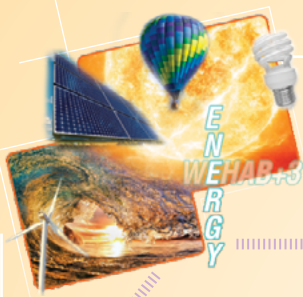
Experiment and Simulation to Develop Clean Porous Medium Surface Combustor Using LPG

Musthafa Abdul Mujeebu, Mohammad Zulkifly Abdullah and Mohammed Zuber

This paper presents the development, characterization and numerical simulation of compact premixed LPG burner based on surface combustion in porous inert medium. The preheating and reaction zones are made up of Alumina (Al_2O_3) foams of pore sizes 26 ppcm and 8 ppcm, respectively. Experiments are conducted with 0.45 litres per minute (lpm) of LPG fuel, which is found to be the minimum quantity required to produce a sustainable flame when mixed with 4 lpm of air. The temperature distribution within the combustor, flame stability, maximum flame temperature, NO, CO and SO_2 emissions and thermal efficiency are measured and compared with those of conventional LPG stove. It is found that the proposed burner could yield 80% saving in fuel consumption and 75% reduction in NOx emission compared to the conventional one. The CO and SO_2 emissions are also within the permissible limits. The thermal efficiency is estimated to be 71% whereas for the conventional burner is 47%, for a thermal load of 0.62 kW. Effects of porosity and thickness of reaction layer are studied by means of two dimensional simulation using FLUENT software, considering single step reaction and thermal equilibrium between phases. Experimental and numerical findings are found in satisfactory agreement.

Keywords

Porous medium; Surface combustion; Emission; Thermal efficiency



16.38 4th International Conference on Built Environment in Developing Countries (ICBEDC) 2010

Natural Ventilation Effects in Malaysian Houses

*Nedhal Ahmed M. Al-Tamimi , Sharifah Fairuz Syed Fadzil
and Wan Mariah Wan Harun*

Hot and humid region is one of the hardest climates to ameliorate through design. This is due to the high humidity and daytime temperatures that result in high indoor air temperatures exceeding the upper limit of thermal comfort zone. This problem is more noticeable in glazed residential buildings in the Malaysian climate. As a result of an overall poor thermal performance, these glazed buildings have become more dependent on artificial and active means to provide comfortable thermal environment at high energy consumption. An alternative method to overcome this problem is by providing natural ventilation which is an efficient passive method for cooling and is energy efficient. This study aims to overcome the overheating problem in high-rise glazed residential buildings in Malaysia. The main objective of this study is to investigate the improvement in the indoor thermal condition by passive cooling approaches without auxiliary cooling from air conditioning equipments. A field study is carried out in "The View" apartments, Penang, Malaysia, in order to ascertain the environmental performance of these glazed residential buildings. The impact of day-time and night-time natural ventilation as a passive cooling strategy has been investigated, and this is compared with unventilated situations. The results showed significant improvements in indoor environmental performance can reach 80% and 50% in day-time and night-time respectively in cases where natural ventilation have been applied and considered in the building.

Keywords

Natural ventilation, Thermal performance; Sustainable building, Residential building



16.39 3rd International Conference on Built Environment in Developing Countries
2nd-3rd December 2009

The Effect of Orientation and Glazed Area to the Indoor Air Temperature in Unventilated Buildings in Hot-Humid Climate

Nedhal Ahmed M. Al-Tamimi, Sharifah Fairuz Syed Fadzil and Adel Abdullah

Glazed building envelope is becoming an important component of contemporary architecture. Glass allows natural light, offer a visual communication with outdoors, reduce structural load and enhance aesthetic appearance of buildings. With many benefits that the gazing offers the occupants and the designers, it is not free of problems if it is not properly selected. Building envelope and its glazed fenestration represent a major source of unwanted heat, solar gain and thermal discomfort. Moreover glazed curtain walls cause glare problems and increased energy consumption required for cooling systems due to the high internal air temperature. This has resulted in a complete reliance on the mechanical means to manipulate the indoor temperature and finally to achieve the thermal comfort at high energy consumption. Thus, this paper investigates the relationship between glazed window areas in effecting the increase in indoor temperature. The effect of the orientation of the glazing is also investigated. The result shows that, it is possible to minimize the undesirable effect of glazed windows in a given orientation and to secure their beneficial effect by selecting appropriate size and position of the windows according to the local climate condition.

Keywords

Window Wall Ratio (WWR); Window Floor Ratio (WFR); Building orientation; Hot-Humid climate; Glazed building



16.40 Journal of Science & Technology Vol. (15) No. (1) 2010 JST 17

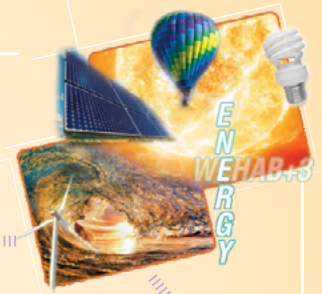
Experimental and Simulation Study for Thermal Performance Analysis in Residential Buildings in Hot-Humid Climate (Comparative Study)

Nedhal Ahmed M. Al-Tamimif, Sharifah Fairuz Syed Fadzilb

Glazed windows cause- intensive overheating due to solar radiation for buildings in hot climates. These glazed windows, according to their apertures also provide for cross ventilation which is necessary for cooling and: improving thermal comfort. Many computerized environmental simulation tools are available to help designers predict the environmental performance of their design at the early stage. The thermal comfort study in this paper involved the use of field measurement and computer simulation tool i.e. Ecotect. Validation of Ecotect is carried out by comparing the computer simulation result with the field measurements of the east room at Fajar Harapan Hostel, USM which has a 50% glazed area to wall ratio. Output data from Ecotect has been compared to fieldwork data in terms of in/outdoor air temperatures and indoor air velocity. The impact of reducing 'the glazed area from VVVVR=50% in the base case to 25% and 00% has been investigated. Results show that field and simulated data compare well with a difference of less than 0.9°C.between fieldwork and simulated indoor air temperatures. Results also show that rooms with a large glazed window area are relatively cool during night time only, and a smaller glazed window area performs well during daytime as well as nighttime.

Keywords

Thermal comfort, Glazed windows, Natural ventilation, Ecotect, Tropical region



16.41 Proceedings of the Tenth International Conference Enhanced Building Operations, Kuwait, October 26-28, 2010

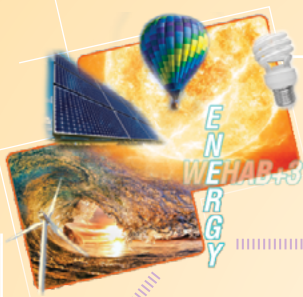
Evaluation on Cooling Energy Load with varied Envelope Design for High-Rise Residential Buildings in Malaysia

Nedhal Ahmed M. Al-Tamimif, Sharifah Fairuz Syed Fadzilb

With the development of the economy in the recent years, Malaysia is maintaining a high economic growth and therefore, its energy consumption-increases dramatically. Residential buildings are characterized by being envelope-load dominated buildings, hence are greatly influenced by the outside climatic conditions. Due to the hot humid climate of Malaysia, air conditioning system accounts for more than 45% of the total electricity used in the residential sector which is required to remove, substantial amount of gained heat due to poor thermal envelope performance. This paper uses Ecotect software to analyze the impact of building envelope design on energy cooling load for residential building in Penang, Malaysia, which include area ratio' of window to floor, exterior Wall thermal- insulation, and several kinds of shading system. This paper describes an integrated passive design approach to reduce the cooling requirement for high-rise apartments through an improved building envelope design. Comparing with the other passive strategies investigated in this paper, the results indicated that exterior wall thermal insulation is the best strategy to decrease both annual cooling energy load and peak. Cooling load which achieved a reduction of 10.2% and 26.3% respectively. However, the other passive strategies applied also have some marginal effect on decreasing the cooling load.

Keywords

Energy; Efficiency; Envelope design; Residential building; Malaysia; Ecotect



16.42 10/2009; In proceeding of: CIB 107 International Symposium on Construction in Developing Economies: Commonalities Among Diversities

The Effect of Glazed Fenestration Area and Natural Ventilation on Thermal Performance in Residential Buildings in Tropical Region

Nedhal Al-Tamimi, Sharifah Firuz; Adel Abdullah

Building orientation is a significant design consideration, mainly with regard to solar radiation and wind. In predominantly hot humid regions like Malaysia which receives sunlight all year around, buildings should be oriented to minimize solar gain and maximize natural ventilation (NV). This paper describes an investigation into the effect of building orientation in view of solar radiation absorptance of exterior wall, varied area ratio of glazed window to wall and the effect of natural ventilation on the thermal performance for residential building in tropical region. The FAJAR BAKTI building (postgraduate student residential building) which is oriented in the east west directions, and a located in USM Campus, Penang. The selected case study are two rooms, the first one is facing east direction while the other faced west. The differences in in/out door air temperature and air velocity of both rooms have been measured from the field directly using the comprehensive datalogger BABUC/M, this data have been analyzed and investigated. The results shows that east windows have more obvious effect on increasing indoor air temperature than west windows, that is applicable for ventilated or unventilated rooms.



16.43 Energy Sources, Part A: Recovery, Utilization, and Environmental Effects Volume 33, Issue 13, 2011

The Development and Performance Analysis of Partially Premixed LPG POROUS Medium Combustor

*R. M. N. Muhad, M. Z. Abdullah, M. Abdul Mujeebu, M. Z. Abu Bakar,
R. Zakaria & A. A. Mohamad*

Porous medium combustion has interesting advantages compared with free flame combustion due to higher burning rates, an increased power dynamic range, extension of the lean flammability limits, and low emissions of pollutants. This article presents the development and testing of a partially premixed porous medium combustor with liquified petroleum gas as fuel. The discrete porous medium is made up of Al_2O_3 spheres, the size of which is optimized by computer simulation. The NO_x and CO emissions are measured for different numbers of porous layers and for different sizes of ceramic spheres, under both steady state and transient conditions of combustion. The data so obtained are plotted and compared with that of free flame combustion. The results show that the burner has good combustion efficiency and significantly lower NO_x and CO emissions compared to the conventional combustor.

Keywords

Discrete porous medium, NO_x and CO emission, Partial-premixed combustion, Porous media



16.44 AIP Conf. Proc. 909, 238 (2007);

Preliminary Study of Cyclic Voltammetry of a Conducting Polymer.

S. Hasiah, K. Ibrahim, H. B. Senin and Faizatul Shima Mohamed

An electroactivity study of active species in a conducting polymer uses the Cyclic Voltammetry (CV) analytical technique. A technique is chosen in which the potential of an electrode is the controlled variable, while the current is the observed variable. Two plates of platinum were used as a counting electrode and a working electrode, respectively. A reference electrode used Ag/AgCl. Polypyrrole (PPy), polythiophene (PT) and poly (3-acetic acid thiophene) (PT3AA) were conducting polymer material synthesized using iron (III) chloride as a catalyst. The effect of a supporting electrolyte of sodium perchlorate anhydrous $\text{NaClO}_4\text{-H}_2\text{O}$ on conducting polymers is also studied.

Keywords

Cyclic voltammetry, Polythiophene, Poly (3-acetic acid thiophene), Polypyrrole and value of cathodic and anodic



16.45 ISSN 1392–1320 Materials Science (Medžiagotyra). Vol. 18, No. 2. 2012

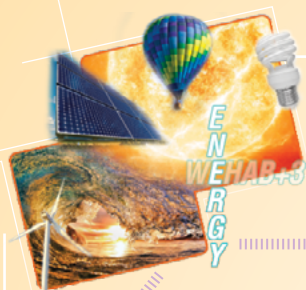
Optical Properties and Surface Morphology of Zinc Telluride Thin Films Prepared By Stacked Elemental Layer Method

Subramani Shanmugan, Devarajan Mutharasu

ZnTe thin films were prepared by Stacking of elemental (Zn and Te) layers (SEL) followed by inert gas annealing. The optical parameters were calculated from the transmission spectra. The band gap of the annealed samples was found between 1.95 eV and 2.06 eV. The change in film thickness after annealing was observed using cross sectional SEM image of the annealed samples. The surface morphology of the annealed Te/Zn stack was also analyzed and observed as very smooth, compact and dense surface. The prepared film was Zn rich evidenced by EDAX. The observed result encourages in pursuing the SEL method for the preparation of compound semiconductor from II-VI group materials.

Keywords

Thin films, ZnTe, Stacked Elemental Layer, Optical properties, Surface properties



16.46 A Multinational Journal Volume 85, Issue 9, 2012

Transition Temperature Model Based on Specific Heat Data of an FeAs-Based Superconductor

T.M. Fayez & K. Ibrahim

In this article, we studied the specific heat data of iron-based superconductors $\text{LaO}_{1-x}\text{F}_x\text{FeAs}$ ($x = 0.1$) and $\text{SmO}_{1-x}\text{F}_x\text{FeAs}$ ($x = 0.13, 0.12, \text{ and } 0.1$). (i) The contribution of phonons in specific heat above T_c depends exponentially on temperature. (ii) The specific heat has different contributions, and they change differently at T_c . This change must be the effect of a physical function on heat capacity. Therefore, transition temperature is defined by thermal parameters. For $\text{LaO}_{0.9}\text{F}_{0.1}\text{FeAs}$ and $\text{SmO}_{0.87}\text{F}_{0.13}\text{FeAs}$, a transition point was evaluated at 22.11 and 26.32 K, respectively. This is in close agreement with the midpoint transition temperatures obtained from dc resistivity and magnetization experiments, where the modified electronic heat capacity led to the approximate value of the transition point in two samples. The jump, $\Delta C/\gamma T_c$, and the electronic and lattice heat capacity coefficients, γ and β , respectively, were evaluated.

Keywords

Electronic specific heat, Oxyprictide superconductor, Phonon specific heat, Superconductivity



16.47 XIII. IOSTE Symposium, The Use of Science and Technology Education for Peace and Sustainable Development., September 21-26, 2008, Kusadasi ,Turkey.

Renewable Energy (RE) and Energy Efficiency (EE) Understanding and Awareness among Secondary School Students and Teachers in Malaysia.

Mohd Yunus, Hashimah and Hashim, Nor Hashimah and Ghazali, Munirah and Ibrahim, Kamarul Azizi and Dinsuhaimi, Mohamad

This study was conducted to find out teachers and secondary students perceptions on their awareness and understanding of Renewable Energy (RE) and Energy Efficiency (EE). Earlier in 2003, a program on Renewable Energy (RE) and Energy Efficiency (EE) has been implemented by the Center for Education, Training and Research for Renewable Energy (RE) and Energy Efficiency (EE) (CETREE), Universiti Sains Malaysia, Penang Malaysia where 1800 teachers had been trained to implement the program. This program consists of modules as complementary resources for teaching energy concept in science subject at the secondary school. These teachers were trained through a series of workshop on how to use modules. In this study, questionnaire was sent to teacher who had undergone the CETREE training and to student who had been taught using these modules. The implication of this study indicate that there are still more effort needed to be undertaken to increase the teachers and students knowledge, attitudes and practice of RE and EE awareness

Keywords

Renewable Energy, Energy Efficiency, Awareness



16.48 ICSAUD 2010. "Issues on Global Energy Crisis and Its Impacts on Design". International Conference. Sustainable Architecture & Urban Design 2010.

Wall Window Ratio (WWR) AND Its Influence on Internal Air Temperatures and Natural Light Level in Glazed Room in the Tropics

*Sharifah Fairuz Syed Fadzil , Nedhai A. Al-Tamimi,
Adel Abdullah and Wan Mariah Wan Harun*

In the tropics, there are no set standards as to the optimum wall window ratio (WWR) for rooms especially in the residential buildings. The compromise needed for the desired views, for the appropriate natural light admittance, for minimizing heat gains inside, is not easily achievable more so when the thermal performance of glass in the building envelope differ significantly in the extreme daytime compared to the cooler night time. Study found that glazing in the daytime is undesirable because the more the glazing area and the higher the WWR the higher the internal air temperatures will be and the higher the difference between T_o and T_i . Study also found that WWR of 60% to 40% to 20% come with an average percentage daylight factor (%DF) 3.7, 2.5 and 1.7 respectively. The WWR 20% is found to be more than adequate for natural lighting requirements for residential and it could be decreased even more to WWR 15 — 10% due to the abundance of natural daylight. In the night time however, heat build-up is found to easily escape to the cooler outdoors with the most glazing i.e. WWR 60% compared with WWR 40% and 20%.

Keywords

WWR Wall window ratio, Glazing, Daylight factor (%DF), Radiation



17.0

Universiti Sains Islam Malaysia

17.1 GUT PATHOGENS Volume: 5 Article Number: 38 Published: DEC 11 2013

Temperature-regulated expression of outer membrane proteins in *Shigella flexneri*

Harikrishnan, Hemavathy; Ismail, Asma; Singh, Kirnpal-Kaur Banga

Background

Bacteria exist widely in a diversity of natural environments. In order to survive adverse conditions such as nutrient depletion, biochemical and biological disturbances, and high temperature, bacteria have developed a wide variety of coping mechanisms. Temperature is one of the most important factors that can enhance the expression of microbial proteins. This study was conducted to investigate how outer membrane proteins (OMPs) of the bacterium *Shigella flexneri* respond to stress, especially during fever when the host's body temperature is elevated.

Methods

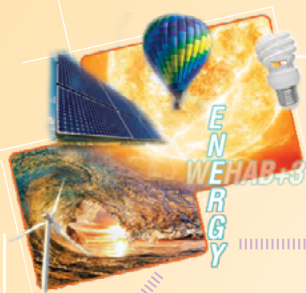
OMPs of *S. flexneri* ATCC 12022 and clinical isolate SH057 were extracted from an overnight culture grown at 37, 38.5, and 40 degrees C. Comparisons of the expressed proteins under the different growth conditions were based on equal numbers of bacterial cells loaded in the SDS-PAGE gels. Separated proteins were stained with Coomassie brilliant blue. Selected proteins showing increased expression at 38.5 and 40 degrees C were characterized by performing MALDI-ToF-ToF.

Results

Different degrees of expression were demonstrated for different proteins expressed at 37 degrees C compared to 38.5 and 40 degrees C. The proteins with molecular sizes of 18.4, 25.6, and 57.0 kDa showed increased expression level at increasing temperature and were identified as Dps, WrbA, and PepA, respectively.

Conclusion

This study revealed that strains of *S. flexneri* respond at the proteomic level during stress caused by elevated temperature by decreasing the expression of proteins, maintaining the level of important proteins, or enhancing the levels of proteins presumably involved in survival and virulence.



17.2 Solid State Science and Technology, Vol. 20, No 1 & 2 (2012) 115-120

Palm oil polyol/ polyurethane shape memory nanocomposites

Zubir, S.A., Ahmad, S., Ali, E.S., 2013

A series of nanoclay reinforced thermoplastic polyurethane with shape memory effect have been successfully synthesized via two-step polymerization process. The polyurethanes are composed of polycaprolactonediol, palm oil polyol, 4,4'-diphenylmethane diisocyanate and 1,4-butanediol. Nanoclay was added in order to improve the overall properties of the pristine polyurethane. Besides, the addition of palm oil polyol is believed to enhance the crosslinking process and further improve the properties. X-ray diffraction result showed that there is a decrease in crystallinity of polyurethane nanocomposites as clay is added. Good shape memory and mechanical properties of resulting polyurethane nanocomposites were obtained in this work.

Keywords

Clay; Palm oil polyol; Polyurethane; Shape fixity; Shape recovery



17.3 Sains Malaysiana 42 (5) , pp. 649-654. 2013

DFT calculation of vibrations in the clusters of zinc and oxygen atoms

Rosli, A.N., Kassim, H.A., Shrivastava, K.N.,

The nanometer size clusters are often present in ZnO. We have calculated the vibrational frequencies of zinc oxide by using the density-functional theory. We synthesized clusters of ZnO starting with ZnO_n and continue with Zn₂O_n, Zn₃O_n and Zn₄O_n with n = 1, 2, 3 and 4. By minimizing the energy of the Schrödinger equation, we found the bond lengths and the vibrational frequencies of each cluster. These calculated data are compared to the experimentally measured Raman spectra of ZnO₄ to identify the clusters which exist in this material. The density-functional theory in the local density approximation (LDA) is used with double numerical basis set. From this calculation, we find that the bond length for the cluster of ZnO₄ with tetrahedral symmetry (Td) is 1.923 Å and the vibrational frequencies are 94.4 cm⁻¹ and 440.4 cm⁻¹ with degeneracy of 3 each. We have made several clusters using zinc and oxygen atoms and have calculated the vibrational frequencies, degeneracies and intensities in each case.

Keywords

Cluster; Density; Functional theory; Raman spectrum; Vibrational frequency; ZnO



17.4 Advanced Materials Research 667 , pp. 99-103. 2013

The raman spectra of nanocomposite clusters of atoms in phosphorous-selenium glassy state

Rosli, A.N., Kassim, H.A., Shrivastava, K.N., Radhika Devi, V.

We make clusters of atoms of the size of less than 1 nanometer by using the density functional theory and from that we obtain the bond lengths corresponding to the minimum energy configuration. We are able to optimize large clusters of atoms and find the vibrational frequencies for each cluster. This calculation provides us with a method to identify the clusters present in an unknown sample of a glass by comparing the experimental Raman frequency with the calculated value. We start with the experimental values of the Raman frequencies of PSe (Phosphorous-Selenium) glass. We calculate the structural parameters of PSe, P₄Se, P₂Se₂, P₄Se₅, PSe₄, P₄Se₃ clusters of atoms and tabulate the vibrational frequencies. We compare the calculated values with those measured. In this way we find the clusters of atoms present in the glass. Sometimes, the same number of atoms can be rearranged in a different symmetry. Hence we learn the symmetries of molecules. We find that certain symmetries are broken due to self-organization in the glassy state. © (2013) Trans Tech Publications, Switzerland.

Keywords

Cluster, Density Functional Theory (DFT), Glass, Raman spectra, Vibrational frequency



17.5

Journal of Applied Polymer Science 128 (1) , pp. 224-229. 2013

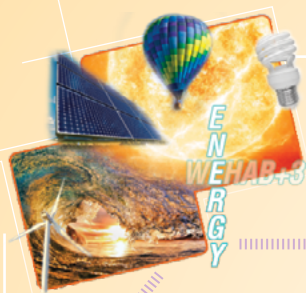
Polypyrrole/graphene composite films synthesized via potentiostatic deposition

Lim, Y.S., Tan, Y.P., Lim, H.N., Tan, W.T., Mahnaz, M.A., Talib, Z.A., Huang, N.M., (...), Yarmo, M.A.

A one-step electrochemical process has been employed to synthesize composite films of polypyrrole/graphene (PPy/GR) by electrochemical polymerization on indium tin oxide (ITO) from an aqueous solution containing pyrrole monomer, graphene oxide (GO) nanosheets and sodium p-toluenesulfonate (NapTS). Thermogravimetric analysis (TGA) confirmed the formation of a composite; the degradation temperature of the new hybrid was between those of PPy and GO. Moreover, the bulbous surface of PPy and the almost transparent tissue-like GO nanosheets were replaced by the new appearance of the composite where the surface was flat but creased. As GO is nonconductive, we deduced that it had been reduced to conducting graphene in the composite film during the electrodeposition process, based on an electrical conductivity study measured with a four-point probe. On average, the electrical conductivity of the PPy/GR composites was twofold higher than that of the pure PPy film, indicating that the incorporation of graphene was able to enhance the conductivity of PPy film.

Keywords

Composite; Conducting polymers; Electrochemistry; Graphene



17.6 **Advanced Materials Research 576 , pp. 236-239. 2012**

Polyurethane/clay shape memory nanocomposites based on palm oil polyol

Zubir, S.A., Ali, E.S., Ahmad, S.H., Zain, N.M., Wai, S.K.

Thermoplastic polyurethane (TPU) nanocomposites were prepared using polycaprolactonediol as the soft segment, 4,4'-diphenylmethane diisocyanate as the hard segment, 1,4-butanediol and palm oil polyol. Nanoclay with certain weight percent (wt%) was reinforced as filler to improve both mechanical and shape memory behavior of the nanocomposites. Palm oil polyol was introduced in order to provide hyperbranched structure for better dispersion of filler in the matrix as well as aiding the crosslinking process. The experimental results showed that the mechanical and shape memory behavior of clay reinforced polyurethane nanocomposites were influenced by clay weight percent in the polymer matrix. TPU with 3 wt% clay showed optimum values of mechanical properties while the shape memory behavior decreases with increasing clay content.

Keywords

Nanoclay, Nanocomposites, Palm oil polyol, Polyurethane, Shape memory



17.7

Advanced Materials Research 548 , pp. 115-118. 2012

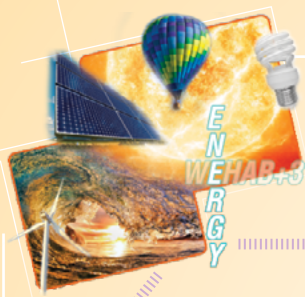
Clay reinforced hyperbranched polyurethane nanocomposites based on palm oil polyol as shape memory materials

Ali, E.S., Zubir, S.A., Ahmad, S.

Reactive nanoclay reinforced hyperbranched polyurethane (HPU) nanocomposites have been synthesized with the introduction of palm oil polyol as part of the precursor. The HPU were prepared in a two-step process using polycaprolactonediol, 4,4'-diphenylmethane diisocyanate and 1,4-butanediol as chain extender. Nanoclay was added with the purpose of improving the properties of the pristine polyurethane. The introduction of palm oil polyol is believed to enhance the mixing process between polymer matrix and filler. Thermal, mechanical and shape memory properties of produced HPU were investigated. The results showed that the crystallinity of HPU nanocomposites decreased with introduction of clay particles and that the mechanical and shape memory properties were enhanced with the addition of small amount of reactive nanoclay (up to 3 wt%).

Keywords

Nanoclay, Nanocomposite, Palm oil polyol, Polyurethane (PU), Shape memory



17.8 Composites Part B: Engineering 43 (7) , pp. 2813-2816. 2012

Bionanocomposite hybrid polyurethane foam reinforced with empty fruit bunch and nanoclay

Ali, E.S., Ahmad, S.

Bionanocomposite hybrid polyurethane (BHPU) foams that exploit the tribute of natural fibers and nanoclay in green PU foam can lead to the new imminent in engaging the nanoclay and natural fibers. PU filled empty fruit bunch (EFB), PU filled silane treated EFB (sEFB) and PU filled organo montmorillonite (oMMT) have been prepared as control, and the hybridization has carried out for , and ratios between EFB/oMMT and sEFB/oMMT. The hybridization of these natural fibers and oMMT permit to retain the strength without compromise the stiffness of BHPU. The hybridization also improves the barrier and thermal properties of these BHPU. Microscopic studies shows that the hybridization of these natural fibers and nanoclay provide initial evidence of the possibilities on the insertion of nanoclay into the natural fibers, thus open the opportunities to exploit this behavior to another hybrid system. © 2012 Elsevier Ltd. All rights reserved.

Keywords

Bionanocomposite hybrid polyurethane; Empty fruit bunch; Organo montmorillonite; Hybridization; Insertio



17.9 **Materials Research Innovations 15 (SUPPL. 2) , pp. S63-S66. 2011**

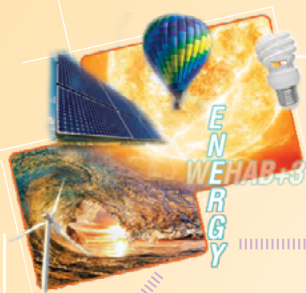
Supercapacitor based on activated carbon and hybrid solid polymer electrolyte

Hashim, M.A., Khair, A.S.A.

The main objective of the present work is to develop a high conducting hybrid solid polymer electrolyte (HSPE) using polyvinyl alcohol as the host polymer and H_3PO_4 as the ionic dopant. Owing to its porous nature, the introduction of a Whatman filter paper helps to increase the electrical conductivity by acting as a support to the electrolyte system. This allows more H_3PO_4 acid to be loaded into the system and thus helps to improve the mechanical strength of the electrolytes. The highest conducting HSPE was obtained at $1.04 \times 10^{-4} \text{ S cm}^{-1}$ for samples containing 70% loading of acid (P30H70-C). Such conductivity is sufficient for application in an electrical double layer capacitor (EDLC). The EDLC was fabricated using the hybrid electrolyte with its activated carbon electrodes soaked in H_3PO_4 . A specific capacitance of 34 F g^{-1} with internal resistance of as low as $1 \Omega \text{ cm}^{-2}$ was obtained when the cell was charged-discharged at 10 mA. The working voltage for this EDLC is 1 V with efficiency ranging between 85 and 97%. © W. S. Maney & Son Ltd. 2011.

Keywords

Supercapacitor, Polymer electrolyte, PVA, H_3PO_4



17.10 **Materials Research Innovations 15 (SUPPL. 2) , pp. S82-S85. 2011**

Conductivity and dielectric behaviour studies of starch/PEO+x wt-%NH₄NO₃ polymer electrolyte

Ramly, K., Isa, M.I.N., Khair, A.S.A.

Polymer blending is used to overcome the disadvantage of pure starch film, and in the present study, starch has been blended with poly(ethylene oxide) (PEO). The X-ray diffraction study shows that starch/PEO with a ratio of 7 : 3 exhibits the least amount of crystallinity, and this was chosen in the preparation of polymer electrolyte. Films of starch/PEO blends were then prepared via solution casting technique, and their properties with different amounts of ammonium nitrate NH₄NO₃ were compared. The highest conductivity at room temperature of $\sim 2.81 \pm 0.46 \times 10^{-7} \text{ S cm}^{-1}$ was achieved with the addition of 35 wt-% NH₄NO₃. Dielectric data were analysed using complex permittivity and complex electrical modulus for the sample with the highest ionic conductivity. The relaxation time τ for these samples was determined, and the plot shows that τ decreases with conductivity of the complexes. The presence of peaks in the imaginary plots shows that the starch/ PEO electrolyte system is an ionic conductor. © W. S. Maney & Son Ltd. 2011.

Keywords

Starch ; PEO ; Conductivity ; Dielectric ; Polymer blending



17.11 Journal of Sensors 2011 , art. no. 754171. 2011

The effect of multilayer gold nanoparticles on the electrochemical response of ammonium ion biosensor based on alanine dehydrogenase enzyme

Ling Ling, T., Ahmad, M., Yook Heng, L., Chee Seng, T.

The use of multilayer of gold nanoparticles (AuNPs) attached on gold electrode surface via thiol chemistry to fabricate an ammonium (NH_4^+) ion biosensor based on alanine dehydrogenase (AlaDH) was investigated. The approach of the study was based on construction of biosensor by direct deposition of AuNPs and 1,8-octanedithiol (C8-DT) onto the gold electrode surface. For the immobilisation of enzyme, 2-mercaptoethanol (2BME) was first covalently attached to AlaDH via ester bonding and then followed by chemically attached the 2BME-modified AlaDH (2BME-AlaDH) moiety onto the AuNPs electrode via the exposed thiol group of 2BME. The resulting biosensor response was examined by means of amperometry for the quantification of NH_4^+ ion. In the absence of enzyme attachment, the use of three layers of AuNPs was found to improve the electrochemistry of the gold electrode when compared with no AuNPs was coated. However, when more than three layers of AuNPs were coated, the electrode response deteriorated due to excessive deposition of C8-DT. When AlaDH was incorporated into the AuNPs modified electrode, a linear response to NH_4^+ ion over the concentration range of 0.1-0.5mM with a detection limit of 0.01mM was obtained. In the absence of AuNPs, the NH_4^+ ion biosensor did not exhibit any good linear response range although the current response was observed to be higher. This work demonstrated that the incorporation of AuNPs could lead to the detection of higher NH_4^+ ion concentration without the need of dilution for high NH_4^+ ion concentration samples with a rapid response time of <1min. Copyright © 2011 Tan Ling Ling et al.



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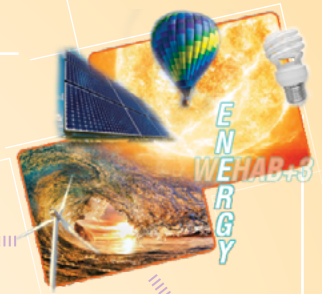
Universiti Teknikal Malaysia

18.1 **Procedia Engineering, 2013**

Techno-economic analysis of LED lighting: A case study in UTeM's faculty building

Gan, C.K., Sapar, A.F., Mun, Y.C., Chong, K.E.

This paper examines the feasibility of adopting LED lamp in replacing the conventional fluorescent lamp. Analysis and comparison have been carried out on the two lighting systems in terms of electrical and photometrical performance. A case study on UTeM's also been presented, which focuses on the economic evaluation. In addition, various lighting energy saving strategies have been proposed. The economic benefits of the respective energy saving measures have been successfully quantified. The study suggests that LED tubes has great potential to replace fluorescent lamps, mainly driven by the cost savings. © 2013 The Authors.



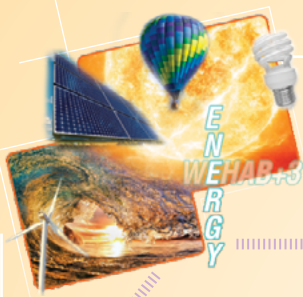
18.2

Journal of Semiconductor Technology and Science, 2013

An overview of nanonet based dye-sensitized solar cell (DSSC) in solar cloth

Othman, M.A., Ahmad, B.H., Amat, N.F.

This technical paper contains the information of the Dye-Sensitized Solar Cells (DSSC) working principal where diffusion mechanism acts as electron transport to absorb the sunlight energy to generate the electrical energy. DSSC is photo electrochemical cell that implements the application of photosynthesis process. The performance of electron transport in DSSC has been reviewed in order to enhance the performance and efficiency of electron transport. The improvement of the electron transport also discussed in this paper.



18.3 **Procedia Engineering, 2013**

Greenhouse gas reduction by utilization of cold LNG boil-off gas

Zakaria, M.S., Osman, K., Abdullah, H.

This paper present the analysis of utilization the cryogenic temperature of Boil off Gas (BOG) from Liquefied Natural Gas (LNG) to flow air inside insulation space of LNG. Three Dimensional geometry of the tank are model in Computational Fluid Dynamic (CFD) ANSYS Fluent software package using steady state and K-Epsilon turbulence model. Result shows that almost 60% of BOG can be prevented from flared to the atmosphere thus will reduce Greenhouse Gas (GHG) emission and pollution. © 2013 The Authors.



18.4 ECS Journal of Solid State Science and Technology, 2013

Development of high performance electrochemical capacitor: A systematic review of electrode fabrication technique based on different carbon materials

Abdul Manaf, N.S., Amin Bistamam, M.S., Azam, M.A.

Increasing demand for energy requirement has attracted considerable attention among researchers to develop efficient energy storage device. Among energy storage devices, electrochemical capacitor (EC) has great potential for its capability to deliver more power than batteries and store more energy than conventional capacitors. The electrode or active material is the most crucial factor in determining the device properties. Recently, carbon based materials play significant roles as electrode materials and possesses remarkably significant achievements toward the development of sustainable energy storage applications. Electrode fabrication technique is another important factor to be considered. Hence, this article reviews the electrode fabrication techniques for EC based on different types of carbon as electrode materials, and their EC performances measured by techniques such as cyclic voltammetry and charge discharge characteristics are also discussed.

© 2013 The Electrochemical Society.



18.5 Ionics, 2013

Aligned carbon nanotube from catalytic chemical vapor deposition technique for energy storage device: A review

Azam, M.A., Manaf, N.S.A., Talib, E., Bistamam, M.S.A.

Carbon nanomaterial especially carbon nanotube (CNT) possesses remarkably significant achievements towards the development of sustainable energy storage applications. This article reviews aligned CNTs grown from chemical vapor deposition (CVD) technique as electrode material in batteries and electrochemical capacitors. As compared to the entangled CNTs, aligned or well-organized CNTs have advantages in specific surface area and ion accessibility in which more electrolyte ions can access to CNT surfaces for better charge storage performance. CVD known as the most popular technique to produce CNTs enables the use of various substrates and CNT can grow in a variety of forms, such as powder, films, aligned or entangled. Also, CVD is a simple and economic technique, and has good controllability of direction and CNT dimension. High purity of as-grown CNTs is also another beauty of the CVD technique. The current trend and performance of devices utilizing CNTs as electrode material is also extensively discussed. © 2013 Springer-Verlag Berlin Heidelberg.



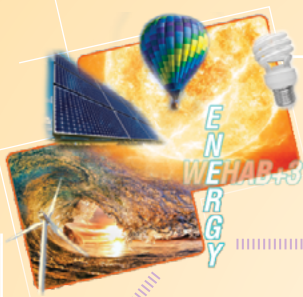
18.6 Applied Mechanics and Materials, 2013

Computational simulation of boil-off gas formation inside liquefied natural gas tank using evaporation model in ANSYS fluent

Zakaria, M.S., Osman, K., Saadun, M.N.A., Manaf, M.Z.A., Mohd Hanafi, M.H.

Research on the waste energy and emission has been quite intensive recently. The formation, venting and flared the Boil-off gas (BOG) considered as one of the contribution to the Greenhouse Gas (GHG) emission nowadays. The current model or method appearing in the literature is unable to analyze the real behavior of the vapor inside Liquefied Natural Gas (LNG) tank and unable to accurately estimate the amount of boil-off gas formation. In this paper, evaporation model is used to estimate LNG Boil-Off rate (BOR) inside LNG tank. Using User Define Function (UDF) hooked to the software ANSYS Fluent. The application enable drag law and alternative heat transfer coefficient to be included. Three dimensional membrane type LNG cargos are simulated with selected boundary condition located in the United States Gulf Coast based on average weather conditions. The result shows that the value of BOR agrees well with the previous study done with another model and with International Marine organization (IMO) standard which is less than 0.15% weight per day. The results also enable us to visualize the LNG evaporation behaviors inside LNG tanks.

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18.7 International Review on Modelling and Simulations, 2013

Losses reduction and voltage improvement using optimum capacitor allocation by PSO in power distribution networks

Hasan, I.J., Gan, C.K., Shamshiri, M., Bugis, I.B., Ab Ghani, M.R.

Capacitor installation is one of the common methods of the reactive power compensation in power distribution networks. In this paper, the optimum capacitor placement and sizing has been executed in the distribution network in terms of power losses minimization and voltage profile improvement. The maximum and minimum bus voltage and maximum possible capacitor size are the constraints of optimum capacitor placement and sizing problem which considered as a penalty factor in the objective function. In order to solve the obtained objective function, the Particle Swarm Optimization (PSO) is utilized to find the best possible capacitor placement and size. The OpenDSS engine is utilized to solve the power flow through Matlab coding interface. To validate the functionality of the proposed method, the IEEE 13 node and IEEE 123 node test systems are implemented. In both cases, the optimum capacitor allocation has been applied by the proposed PSO to find the best possible capacitor location and size. The result shows that the proposed algorithm is more cost effective and has lower power losses compare to the IEEE standard case. In addition, the voltage profile has been improved. © 2013 Praise Worthy Prize S.r.l. - All rights reserved.

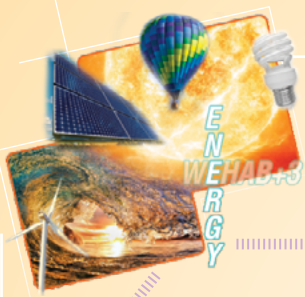


18.8 Advanced Materials Research, 2013

Design and development of low cost certified green building for Non Residential Existing Building (NREB)

Kassim, A.M., Jamri, M.S., Othman, M.N., Rashid, M.Z.A., Ismail, S.J.S.

The Green Building Index (GBI) is one of rating tool which are provides a prospect for building developers and owners for designing and constructing a green and sustainable buildings. The proposed low cost GBI buildings provide many advantages such as energy savings, water savings, a healthier indoor environment, and better connectivity to public transport. Besides, adoption of recycling and greenery for the projects and can reduce the impact on the environment. However, the implementation to certify as Green Building Index has a lot of concerns such as cost constraint, know how constraints and etc. Therefore, in this paper, the design and development of low cost certified green building by fulfilling the Green Building Index (GBI) is proposed in order to ease the development of green building to have better life for human and environment in this world in term of energy efficiency performances. © (2013) Trans Tech Publications, Switzerland.



18.9 Renewable and Sustainable Energy Reviews, 2013

A review of islanding detection techniques for renewable distributed generation systems

Khamis, A., Shareef, H., Bizkevelci, E., Khatib, T.

Islanding detection of distributed generations (DGs) is one of the most important aspects of interconnecting DGs to the distribution system. Islanding detection techniques can generally be classified as remote methods, which are associated with islanding detection on the utility sides, and local methods, which are associated with islanding detection on the DG side. This paper presents a survey of various islanding detection techniques and their advantages and disadvantages. The paper focused on islanding detection using a conventional and intelligent technique. A summary table that compares and contrasts the existing methods is also presented. © 2013 Elsevier Ltd. All rights reserved.

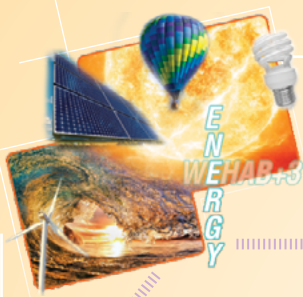


18.10 Przegląd Elektrotechniczny

Renewable energy technologies and hybrid electric vehicle challenges

Azidin, F.A., Hannan, M.A., Mohamed, A.

This paper introduces the utilization of selected renewable energy technologies such as solar cell, battery, proton exchange membrane (PEM) fuel cell (FC) and super-capacitors (SCs) in the electrical vehicle industry. Combination of multiple energy resources is imperative to balance the different characteristic of each resource. Concomitantly, the need of an efficient energy management system arises within the industry. Thus, existing system from past and present undergoing research papers are summarized to give a compact overview on the technology and know-how technique to readers.



18.11 Saudi International Electronics, Communications and Photonics Conference, SIEPC 2013

Energy audit application for building of small and medium enterprise

Maricar, N.M., Othman, M.H.

The excessive use of energy in residential, commercial and industrial buildings and equipment used necessitate the decision maker to always question on how the energy used is being efficient. More emphasize of works will be put into industrial sectors due to the competitive of producing better products with lesser cost. The small percentage of energy use reduction relates to the product cost and profit margins. Therefore, it is important to the energy auditor of an industry or enterprise to have a systematic method to audit the company/factory and energy used by the equipment to produce the practical actions needed in reducing the energy usage and improves the comfort and product quality. This paper describes application of energy audit to help decision maker in using the energy more efficiently. © 2013 IEEE.



18.12 Applied Mechanics and Materials, 2013

An experimental study of different thermal boxes heated by solar thermal radiation for hot water system at night

Yuhazri, M.Y., Kamarul, A.M., Sihombing, H., Yahaya, S.H., Izamshah, R.

This research is related to thermal efficient water heating system, specifically to improve the water heating system that exists nowadays. The goal of this research is to improve the current water heating system by using solar heat as the energy source to heat the water. The focus is to improve the thermal efficiency by adding different thermal boxes as the absorber bed. By implementing the black body and radiation concept, the air trapped in the box is heated. The trapped air then increases the collisions between the molecules and directly increases the temperature inside the box, higher than the outside environment. Based on night experimental results revealed steel thermal box is better to be used for tropical weather like Malaysia.

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19.0

Universiti Teknologi MARA, Malaysia

19.1 Social and Behavioral Sciences, Volume 68, 19 December 2012, Pages 164-172

Mandatory Health Impact Assessment in Malaysian Land Planning and Development Control System

Ainul Jaria Maidin, Nurul Firdaus Salahul Ahamed

The close link between land development activities to human health is undeniable. Indiscriminate land development activities and poorly planned built environment can lead to environmental degradation and subsequently adverse impact on public health. Polluted physical spaces can expose people to toxins or pollutants causing asthma and respiratory problems whilst improperly planned development without open space for recreation can influence lifestyles that contribute to diabetes, hypertension, coronary vascular disease for lack of physical movement. Public health advocates can help shape the design of cities and suburbs in ways that improve public health, but to do so effectively they need to contribute to the development planning and control process. This paper reviews the connection between public health and built environment with the aim of proposing health impact assessment procedure to be made a mandatory requirement for preparation of development plans and application for planning permission. The research relies on literature review, analysis of relevant statutes and governmental policy documents providing for policy directions for formulating the legal regulatory framework.

Keywords

Health impact assessment; Land use planning and development control; Malaysian planning system



19.2 Engineering, Volume 41, 2012, Pages 1812-1817

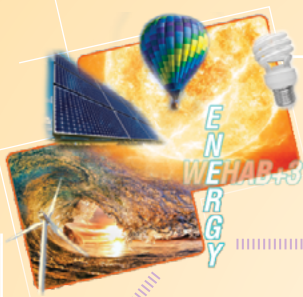
Wedm: Influence of Machine Feed Rate in Machining Titanium Ti-6Al-4 v Using Brass Wire and Constant Current (4a)

Aniza Alias, Bulan Abdullah, Norliana Mohd Abbas

Wire electrical discharge machining (WEDM) technology has been widely used in tool and die-making industry, automotive, medical and practically any conductive materials. It is a non-traditional machining process which used the continuously circulating wire as electrode and cuts the workpiece along a programmed path. The aim of this paper is to investigate the influence of feed rate on the performance of WEDM on Titanium Ti-Al-4 V. Brass wire was employed as the electrode in this study. The results on kerf width, material removal rate and surface roughness are graphically tabulated. The best combination of machining parameter viz. machine feed rate (4 mm/min), wire speed (8 m/min), wire tension (1.4 kg) and voltage (60 V) were identified. The selection of parameters depends on the requirements based on a better surface roughness or a maximum material removal rate. Hence an appropriate combination of variables can be selected accordingly. Furthermore, this combination can contribute to increase production rates perceptibly by reducing machining time.

Keywords

Wire electrical discharge machining (WEDM), Titanium Ti-6Al-4 V; Kerf width, Material removal rate, Surface roughness



19.3 Engineering, Volume 20, 2011, Pages 80-88

Ergonomic Risk Controls in Construction Industry- A Literature Review

A.H. Abdul-Tharim, N. Jaffar, N.S. Lop, I.F. Mohd-Kamar

This paper overview the ergonomics risk control in construction industry. The objective is to give a basic introduction of ergonomic in construction industry and risk controls in relation to minimize the ergonomics risk factors. The study will highlight five (5) significant ergonomics risk controls. Better communication and management control will enhance ergonomics implementation in the workplace. It is followed by the appropriate ergonomics design, organization training and education. Written ergonomics program statement which outlines the goals and plans for the organization ergonomic program are also essential in order to reduce the ergonomics risk factors.

Keywords

Ergonomics, Risk control, Construction industry



19.4 Engineering, Volume 20, 2011, Pages 110-117

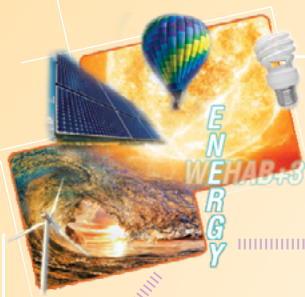
A Conceptual Framework for Describing CSF of Building Maintenance Management

E.M.A Zawawi, S.N. Kamaruzzaman, Z. Ithnin, S.H. Zulkarnain

Critical Success Factors (CSF) is known as a tool for measuring performance in an organisation to achieve their mission. In building maintenance, CSF is becoming very important as it could identify the cause of failure as well as improving the system. The aim of this paper is to derive a generic process and procedure in maintenance management to be used in various organisation in Malaysia. This paper will investigate the current practices of maintenance management in the local authority organisations in Malaysia from strategies, rules and regulations to their future plan for the next generation. More focus given on the management of maintenance including setting up an organisation, policies and quality standard. The target group for sampling of data are the local authorities organisation in Selangor. The respondents are the person incharge of building maintenance in each of the local authority organisation. Based on the findings and literature review, a conceptual framework was then developed. It is believed that implementing CSF would enhanced the management process and work planning which would result in a more economic use of resources an a coresponding reduction in the total cost of maintaining building.

Keywords

Critical success factors, Maintenance management, Performance measurement



19.5 Energy Policy, Volume 67, April 2014, Pages 618-625

Progress of feed-in tariff in Malaysia: A year after

*Firdaus Muhammad-Sukki, Siti Hawa Abu-Bakar, Abu Bakar Munir,
Siti Hajar Mohd Yasin, Roberto Ramirez-Iniguez, Scott G McMeekin, Brian G Stewart,
Ruzairi Abdul Rahim*

Malaysia enacted the Renewable Energy Act in April 2011. One of its important components is the feed-in tariff (FiT) scheme—launched in December 2011. The scheme is managed and administered by the Sustainable Energy Development Authority (SEDA) of Malaysia. This paper analyses the impact of the FiT mechanism in Malaysia a year after its implementation; particularly on the installation and economical aspects. First, the history of the scheme is presented before summarising the application process for the scheme. Next, a detailed evaluation on the implication of the scheme is discussed. Some of the key findings from the analysis include: (i) the uptake for renewable energy installations has been extremely high, particularly for solar photovoltaic installation; (ii) the foreign and domestic direct investment related to renewable sectors have increased significantly; (iii) more 'green' jobs have been created, particularly in the manufacturing and installation sectors, and (iv) there are plans to include wind and thermal energy in the FiT scheme. It can be concluded that the FiT scheme in Malaysia has produced significant impact during the first year of its implementation. With a proper monitoring by SEDA and more awareness among the people, renewable energy will most likely flourish in Malaysia.

Keywords

Feed-in tariff, Renewable energy, Solar photovoltaic



19.6 Energy, Volume 34, Issue 5, May 2009, Pages 524-531

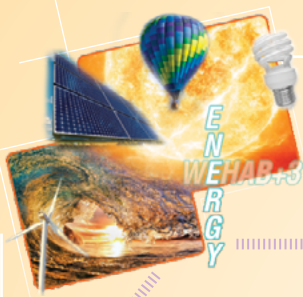
Energy system analysis of 100% renewable energy systems—The case of Denmark in years 2030 and 2050

H. Lund, B.V. Mathiesen

This paper presents the methodology and results of the overall energy system analysis of a 100% renewable energy system. The input for the systems is the result of a project of the Danish Association of Engineers, in which 1 600 participants during more than 40 seminars discussed and designed a model for the future energy system of Denmark. The energy system analysis methodology includes hour by hour computer simulations leading to the design of flexible energy systems with the ability to balance the electricity supply and demand. The results are detailed system designs and energy balances for two energy target years: year 2050 with 100% renewable energy from biomass and combinations of wind, wave and solar power; and year 2030 with 50% renewable energy, emphasising the first important steps on the way. The conclusion is that a 100% renewable energy supply based on domestic resources is physically possible, and that the first step towards 2030 is feasible to Danish society. However, Denmark will have to consider to which degree the country shall rely mostly on biomass resources, which will involve the reorganisation of the present use of farming areas, or mostly on wind power, which will involve a large share of hydrogen or similar energy carriers leading to certain inefficiencies in the system design.

Keywords

Energy system analysis, Renewable energy systems, Denmark



19.7 Engineering, Volume 20, 2011, Pages 188-192

The Means of Escaping for Occupants for Renovation Works of Terrace Houses in Malaysia

H. Ahmad, M.Y. Fadlie, N.A. Yahaya, J. Abu

The Uniform Building By-Law (UBBL 1984) of Malaysia is a reference about the minimum and maximum limits of occupant's comfort and has been implemented since 1984. As a practice norm, all modern houses must follow those limitations suggested. However, pilot survey shows many occupants still renovate their houses and concurrently death causes of fire are increasing. Therefore, the objective of this article is to bring out the actual facts about the enforcement culture and its relevance against UBBL. This research only focuses on means of escaping for occupants; dead-end distance and grilles fixed to windows/doors. Through structured interview and questionnaire survey, analysis using software of Statistical Package for Social Sciences (SPSS) of this research found that certain area of UBBL requirements such as room extending and materials used were overruled by non-compliance persons. This output could be implemented by Local Authority to enforce the culture of house renovation for comfort living.



19.8 Engineering, Volume 20, 2011, Pages 159-165

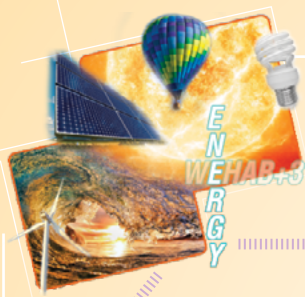
Microbial Participation in the Formation of Calcium Silicate Hydrated (CSH) from *Bacillus subtilis*

H. Afifudin, W. Nadzarah, M.S. Hamidah, H. Noor Hana

Primary hydration of cement induces the formation of calcium silicate hydrated (C-S-H) gel and the latter contributes towards the strength development of concrete. The secondary hydration derived from pozzolanic materials such as silica fume is dependent upon the formation of C-S-H gel of the primary cement hydration reaction. The additional formation of C-S-H gel as a result of second hydration process, densifies the cement microstructures producing low permeability concrete. However, the silica fume is considered expensive material and its availability is limited. Therefore, it is essential to utilise living elements as an alternative agent to form the C-S-H gel. In the present study, the untreated *Bacillus Subtilis* and chemically modified *Bacillus subtilis* (CMBS) were prepared. CMBS was prepared by reacting with ethylenediamine to modify its cell wall to become electropositive facilitating the binding of the silicate during the incubation process. The cell was then incubated in the Si solution ($\text{Na}_2\text{SiO}_3 \cdot 5\text{H}_2\text{O}$) for 10 days which enables the SiO_3^{2-} (silica ion) from the solution to be bonded with the cell wall. The C-S-H gel is expected to be formed from the bonded silica of the cell wall when mixed with saturated calcium hydroxide solution which the latter simulates the concrete environment. The presence of C-S-H gel was then substantiated using X-Ray Diffraction (XRD) analysis. In another series of study, the difference concentration of *Bacillus subtilis* were incorporated into the grade 30 concrete specimens and the compressive strength up to 60 days of age were tested. The results showed that the silicate was adsorbed by *Bacillus subtilis* and there is no difference in the amount of Si adsorbed between untreated *Bacillus subtilis* and CMBS. The incorporation of *Bacillus subtilis* into the concrete enhanced the compressive strength and the concentration of 10^6 cell/ml was found to be the optimum concentration.

Keywords

Bacillus subtilis; C-S-H gel; Microbial; Silica precipitation; Bio concrete



19.9 Energy Conversion and Management 75 (2013) 130–140

Application of computational intelligence techniques for load shedding in power systems: A review

J.A. Laghari, H. Mokhlis, A.H.A. Bakar, Hasmaini Mohamad

Recent blackouts around the world question the reliability of conventional and adaptive load shedding techniques in avoiding such power outages. To address this issue, reliable techniques are required to provide fast and accurate load shedding to prevent collapse in the power system. Computational intelligence techniques, due to their robustness and flexibility in dealing with complex non-linear systems, could be an option in addressing this problem. Computational intelligence includes techniques like artificial neural networks, genetic algorithms, fuzzy logic control, adaptive neuro-fuzzy inference system, and particle swarm optimization. Research in these techniques is being undertaken in order to discover means for more efficient and reliable load shedding. This paper provides an overview of these techniques as applied to load shedding in a power system. This paper also compares the advantages of computational intelligence techniques over conventional load shedding techniques. Finally, this paper discusses the limitation of computational intelligence techniques, which restricts their usage in load shedding in real time.



19.10 Engineering, Volume 20, 2011, Pages 154-158

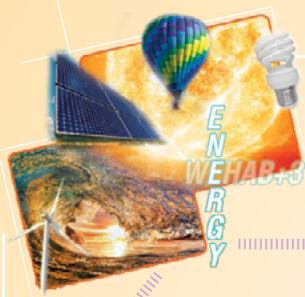
Developing a UiTM (Perlis) Web-Based of Building Space Management System: A Preliminary Study in Locating a Specified Space/Room Area Using Open Source GIS Tool

K. Zainuddin, E.S. Mokhtar, K.Wan Yusof

Space management in building requires the spatial and database of the building. An open source GIS tool is used in this study to develop a web-based space management system of the buildings in the Universiti Teknologi MARA (Perlis) campus. Database management system was used to relate spatial and descriptive data of the buildings and space/room areas of the university. The objectives of the study is i) to develop a web-based system using open source GIS tool, ii) to guide the user identifying the space/area required and iii) to map the building space/room areas available. In this study, the existing template of the Graphical User Interface menu of the open source software is used to help and guide the user to visualize and determine the information of the building space. The preliminary result of the study shows that the spaces and room areas in the building can be mapped out digitally and it can also be made available to be accessed through the web for the resident of the university.

Keywords

Open source GIS; Web GIS; Space management



19.11 Engineering, Volume 20, 2011, Pages 118-124

A Study on the Optimization of Control Strategy of a Thermal Energy Storage System for Building Air-Conditioning

M.M. Khushairi, H. Abdullah, H. Hazran

Many new buildings in Malaysia are installed with a centralized air-conditioning system integrated with thermal energy storage system. Building owners are motivated to reduce the operational costs and are being encouraged by the attractive tariff offered by the utility power provider. However, without proper control the operational costs can be even more than the conventional system due to the higher maximum demand charge. This paper describes the results of an investigation on the actual operating data of a centralized air-conditioning plant integrated with thermal energy storage system operated under two different control strategies. Comparisons on the electrical power consumption, overall plant efficiency and chiller coefficient of performance were carried out by using two identical building load profiles. The results show that the supply pressure control is better than delta-temperature control. The electrical power consumption, overall plant efficiency and chiller coefficient of performance for supply pressure control are 30.1%, 33.4% and 33.5% better than the delta-temperature control, respectively. Also from the general observation on the data it was found out that the storage tank is under utilised. The charging capacity is usually less than the nominal storage capacity. In order to further increase the performance characteristic the plant operation schedule need to be revised.

Keywords

Attributions: Thermal energy storage, Control, Chiller



19.12 Renewable Energy, Volume 55, July 2013, Pages 357-365

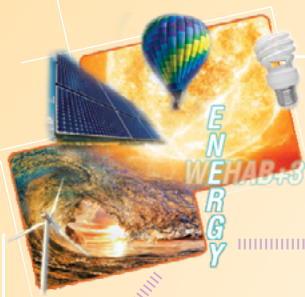
Microwave-assisted pyrolysis of palm kernel shell: Optimization using response surface methodology (RSM)

Muhammad 'Azim Jamaluddin, Khudzir Ismail, Mohd Azlan Mohd Ishak, Zaidi Ab Ghani, Mohd Fauzi Abdullah, Muhammad Taqi-uddeen Safian, Siti Shawalliah Idris, Shawaluddin Tahiruddin, Mohammed Faisal Mohammed Yunus, Noor Irma Nazashida Mohd Hakimi

In this study, response surface methodology (RSM) based on central composite rotatable design (CCRD) was applied to determine the optimum condition for pyrolysis of palm kernel shell (PKS) using microwave-assisted pyrolysis system. Three operating variables, namely reaction time (min), sample mass (g) and nitrogen gas flow rate (mL/min) with a total of 20 individual experiments were conducted to optimize the combination effects of the variables. RSM based upon CCRD can be applied to correlate the experimental microwave-assisted pyrolysis results, with regression coefficients of 96.6, 95.0, 96.4 and 99.2 for the calorific value, fixed carbon content, volatile matters content and yield percentage, respectively. This proved that the RSM based on CCRD is efficiently applicable for the pyrolysis study using microwave-assisted pyrolysis system. The predicted optimum conditions for the pyrolysis process was at 31.5 min for reaction time, 30 g for sample mass and 100 mL/min for nitrogen gas flow rate, resulting in calorific value, fixed carbon content, volatile matters content and yield percentage of 29.9 MJ/kg, 59.8 wt%, 36.4 wt% and 40.0 wt%, respectively. Thus, maximum production of PKS char, with low volatile matters content and high calorific value and fixed carbon content via microwave-assisted pyrolysis system can be optimized using RSM.

Keywords

Microwave-assisted pyrolysis; Palm kernel shell; Char; Response surface methodology



19.13 Engineering, Volume 20, 2011, Pages 222-229

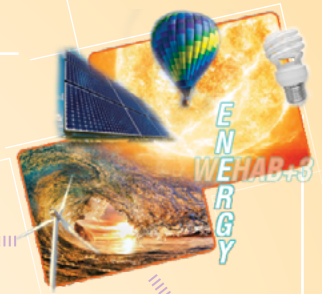
Towards Sustainable Development in Malaysia: In the Perspective of Energy Security for Buildings

N.A. Ahmad, A.A. Abdul-Ghani

Malaysia's economy expansion has been powered by cheap oil making us too dependent and addicted on using fossil fuels. As a country that is primarily reliant on fossil fuels for generating its development, issues such as fossil fuel depletion and peak oil will threaten the development of this country. Oil depletion issue had risen rapidly throughout the globe and the quest for substitute fuels has never been as anxious as it is today. Energy security is in crucial perspective in order to prolong sustainable development in Malaysia. This paper will review the energy sources in Malaysia, the importance of energy security and prospective review of renewable energy towards sustainable development in Malaysia. It will show the impact of power blackouts to Malaysia and the importance of effective measure towards energy security for country's building stock. In order to achieve that, consideration on utilizing renewable energy as a backup energy for the nation is essential. At the moment, the highest potential of adaptable renewable energy for buildings in Malaysia can be gained from solar. Thus, it is important to value this natural energy which is environmental-friendly and abundant in Malaysia. The main objective is to acquire energy security for buildings in Malaysia.

Keywords

Energy security; Renewable energy; Sustainable development; Solar energy



19.14 Renewable Energy, Volume 34, Issue 8, August 2009, Pages 1939-1946

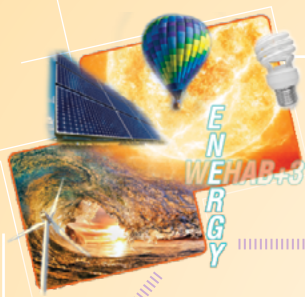
A practical field study of various solar cells on their performance in Malaysia

Nowshad Amin, Chin Wen Lung, Kamaruzzaman Sopian

A practical field study has been carried out with the intention to analyze and compare the performance of various types of commercially available solar panels under Malaysia's weather. Four different types of solar panels, such as mono-crystalline silicon, multi-crystalline silicon, amorphous silicon and copper-indium-diselenide (CIS) solar panels are used for the practical field study. A number of performance related parameters have been collected using data logger over a period of three consecutive days in the hope that this would give some initial information on the real performance of different solar panels. Results show that mono-crystalline silicon and multi-crystalline silicon solar module perform better when they are under hot sun, whereas the CIS and triple junction amorphous silicon solar panel perform better when it is cloudy and has diffused sunshine. Furthermore, the efficiency of crystalline silicon solar panel has been found to drop when the temperature rises higher. This phenomenon does not appear in the CIS and amorphous silicon solar panels, which shows that the performance of CIS and amorphous silicon solar cells are better in terms of power conversion efficiency and overall performance ratio. Better performance of thin film solar cells like amorphous silicon and CIS are observed from the initial results, which draws attention over the selection of solar panels and also may encourage the usage of these in tropical weather like Malaysia.

Keywords

PV performance, Silicon solar cell, CIS solar cell, Field test



19.15 Engineering, Volume 20, 2011, Pages 147-153

The Importance of Building Condition Survey Report for New House Buyers

N.A.M. Radzuan, W.S.ZW Hamdan, M.Y Hamid, A.H. Abdullah-Halim

This paper is to identify the importance of Building Condition Survey Report (BCSR) for New House Buyers by way of listing the detailed of building defects and to report any building's specification incompliance literally stated in Sales & Purchase Agreement (SPA) and to highlight requirements of Uniform Building By-Law (UBBL). BCSR will be used as a comprehensive report to be submitted to the respective property developer for repairing and replacement works. In the event, If property developer failed to carry out the required complaints, the same report could be extended for filing to Tribunal of Housing Claims. Thus the report will protect the interest of new house buyers. Methodology: This paper attempts to establish understanding and importance of BCSR in reporting all defects occurred within Defect Liability Period (DLP). This research presents preliminary study on BCSR contributions in securing interest of New House Buyers in Malaysia. The research adopts comprehensive literature reviews from numerous published sources such as journals, magazines, government reports, unpublished thesis and website document focusing on Malaysia's housing problems published by Malaysia Ministry of Local Housing and Authority (MLHA). Comprehensive literature reviews focusing on the Scenario housing of problems in Malaysia, Understanding the rights within Defect Liability Period, Understanding the importance of building condition survey report and its benefit to New House Buyers. Anticipated Outcomes: The paper expects that new house buyers will understand the function of BCSR to list their defects complaints before submitting them to Property Developer. BCSR should be recognized as a double edged sword, whereby it can be used as a tool for Property Developer in monitoring defects complaint and to ensure every complaint received to be rectified by the appointed contractor. lastly, the paper intends to generate awareness among new house buyers on their rights to receive newly completed houses in acceptable standard.

Keywords

Building Condition Survey Report, New House Buyers, Defect Liability Period, Tribunal of Housing, Building surveyor



19.16 Engineering, Volume 20, 2011, Pages 193-202

Factors of Conflict in Construction Industry: A Literature Review

N. Jaffar, A.H. Abdul Tharim, M.N. Shuib

Conflict seems to be very synonym with construction projects and giving the impressions of problems includes in increasing project cost, project delays, reduce productivity, lost of profit or damage in business relationships. The main goal of this paper is to overview the factors of conflict in construction industry. The study highlighted three (3) types of conflict factors which are conflict factors due to behavioral problems, contractual problems and technical problems. Factors of conflict due to behavioral factors includes reluctant to check for constructability, clarity and completeness and poor communication among project team. Meanwhile the factors of conflict which is due to contractual problems are such as late giving of possession, delay interim payment from client and unclear of contractual terms. Whereas, contractor fails to proceed in a competent manner and late instructions from architect or engineer are the factors of conflict which arise due to technical problems. This paper was hoped to be guidance for conflict management in future construction projects.

Keywords

Conflict, Construction industry, Factors



19.17 Intermetallics, Volume 18, Issue 4, April 2010, Pages 730-735

Effect of Bi addition on the activation energy for the growth of Cu_5Zn_8 intermetallic in the Sn-Zn lead-free solder

Ramani Mayappan, Zainal Arifin Ahmad

The growth kinetics of Cu_5Zn_8 phase has been investigated under long-term thermal exposure conditions using single shear lap joints. The Cu_5Zn_8 phase was formed by reacting Sn-Zn and Sn-Zn-Bi lead-free solders with Cu substrate. A scanning electron microscope (SEM) was used to observe the morphology of the phases and energy dispersive X-ray (EDX) was used to estimate the elemental compositions of the phases. The morphology of the Cu_5Zn_8 phase is rather flat for all the aging temperatures. The Cu_6Sn_5 isolated phase was observed after long-term aging. Intermetallic thickness measurements show that the thickness of the Cu_5Zn_8 phase in the Sn-8Zn-3Bi/Cu system is lower than in the Sn-9Zn/Cu system. Subsequently the activation energy for the growth of Cu_5Zn_8 intermetallic is higher in the presence of Bi. Therefore, the presence of Bi in the Sn-matrix lowers the Zn diffusion and hampers the higher-growth of intermetallics in the Sn-8Zn-3Bi/Cu system compare to the Sn-9Zn/Cu solder interface.

Keywords

A. Intermetallic, Miscellaneous, B. Phase transformations, C. Crystal growth, C. Heat treatment, F. Electron microscopy, Scanning



19.18 Engineering, Volume 20, 2011, Pages 54-60

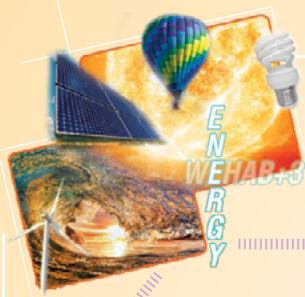
Vulnerability of Public Buildings in Sabah Subjected to Earthquake by Finite Element Modelling

R. Ismail, A. Adnan, A. Ibrahim

This paper presents the vulnerability of public buildings in Sabah which are subjected to earthquakes from Sumatra and the Philippines. Tremors in Peninsular Malaysia and East Malaysia due to Sumatra and Philippine earthquakes have been reported several times. Engineers are concerned of the seismic vulnerability of public buildings due to lack of earthquake consideration in Malaysia's building design procedure. 8 (eight) reinforced concrete buildings which are mostly categorized as moment resisting frames has been selected for vulnerability study. A case study has been conducted on low rise, medium rise, and high rise buildings. The buildings are analyzed using Finite Element Modeling (FEM) under different types of analyses including Time History Analysis (THA) considering low to medium earthquake intensities. Different intensities of earthquake load, 0.05g, 0.10g, 0.15g and 0.20g are applied to the structures to know the maximum allowable earthquake load intensities for the buildings. In the non-linear analysis of modal frames, it indicates that most of the buildings are categorised in the moderate damage level where there is no structural damage but some non-structural damage are expected. The performances of the structure are shown by the yield point at beam-column connections where the internal forces at beam elements exceed the design capacity of the beams. The Labuan Airport building was performed the early yielding point at 3.85 sec for column element at intensity 0.05g. The study indicates that the plastic hinge initially formed on the column at the lower storey level for both low and high rise building frames.

Keywords

Building vulnerability; Seismic demand; Dynamic analysis; Non-linear analysis



19.19 Renewable and Sustainable Energy Reviews, Volume 14, Issue 9, December 2010, Pages 2916-2925

Review on Malaysia's national energy developments: Key policies, agencies, programmes and international involvements

Shing Chyi Chua, Tick Hui Oh

This paper aims to present a review on Malaysia's national energy developments by looking at various angles in terms of renewable energy and energy efficiency. Energy demand and consumption by sectors are presented as well as the fuel mix in electricity generation. Key energy policies implemented from the incorporation of Malaysia's national oil company, Petronas in 1974 until the National Green Technology Policy 2009 and a future policy will be addressed. The roles of key players as well as important agencies in energy development are briefly presented. Key programmes in energy development such as Malaysian Industrial Energy Efficiency Improvement Project, Small Renewable Energy Power Programme and Building Energy Efficiency Programme are discussed as well as successful initiatives from the programmes. Malaysia's international involvements towards reduction of greenhouse gas emissions and carbon emissions especially Montreal Protocol and Kyoto Protocol are highlighted. As a conclusion, Malaysia is aware of its role in formulating its national energy development policies, sensitive towards the country's development towards the environment and utilization of energy resources as well as conscientious and responsive towards the call for sustainable development in promoting renewable energy and energy efficiency.

Keywords

Energy development; Energy efficiency; Renewable energy; Energy policy



19.20 Engineering, Volume 20, 2011, Pages 174-179

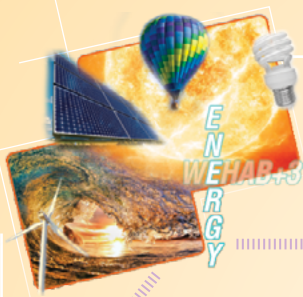
A Review Factors Affecting Building Defects of Structural Steel Construction. Case Study: Student Accommodation in UiTM Perak

S.N.A. Wahab, M.Y. Hamid

In Malaysia, building condition survey is currently vastly underrated and ignored by owners, managers and professionals. The building owners or facilities managers has identified that the complaints about building defects have gone up in recent years with common problem such as leaky roofs and walls, dampness and water penetration from the upper toilet, crack at floor slab and others. This paper presents a brief description of building defect in use of student hostels in UiTM Perak. The main objective is to highlight the important problems and suggest a possible remedial work and increased the awareness of building owners regarding building condition survey and its relation to building maintenance management. The building condition survey will take quite a range of Building Surveyor specialist equipment to seven hostel buildings in UiTM Perak. This paper has gained an insight into a better understanding of factors affecting building defects of structural steel construction. It also explores opportunities for improving the understanding of building surveying profession in our country.

Keywords

Building defect; Building surveyor; Condition survey; Common problem



19.21 Engineering, Volume 20, 2011, Pages 279-283

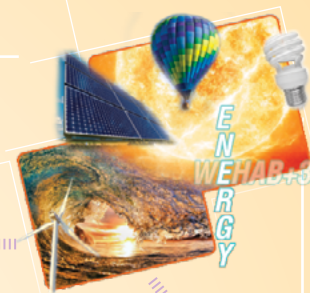
Green Building Concept at Children Activity Centre

S.Z. Hashim, H. Hashim, A.A. Saleh, N. Kamarulzaman

Green building practices are perceived by many construction industry professionals to be part of the solution to these problems. The green building criteria included an integrated design process, environmental impacts, water conservation, energy efficiency and etc. Based on the criteria, how it can be apply in the Children Activity Centre. This concept can give more comfortable to children during the learning process. This concept also can give advantages to environment and community because it can save on the cost of maintenance and also it can provide a private space to the children. The tool used to achieve best practice in this research is benchmarking for efficiency.

Keywords

Sustainable, Environmental issues and waste material



19.22 Carbon, Volume 54, April 2013, Pages 492-494

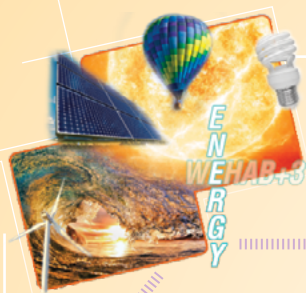
Synthesis of carbon nanohorn–carbon nanotube hybrids using palm olein as a precursor

S.A.M. Zobira, Z. Zainal, C.S. Keng, S.H. Sarijob, M. Yusopa

The formation of carbon nanohorn (CNH)–multi walled carbon nanotube (MWCNT) hybrids was accomplished using chemical vapour deposition at 950 °C. A bio-renewable resource, palm olein, and a mixture of zinc nitrate and ferrocene were used as the carbon precursor and catalyst, respectively. The hybrid shows good graphitic quality and a high aspect ratio of the aligned MWCNT. The estimated lengths and diameters of CNH are about 100–400 and 50–100 nm, respectively. It is believed that the surface of the ZnO particles was impregnated by the metal irons from ferrocene and grouped them together, which then served as a base for the formation of bundles of aligned MWCNTs. Lately, intense research has been conducted to utilise green, renewable bioresource as an alternative way to produce nanomaterials, especially carbon nanostructures. Previous studies showed that palm olein, the main products from palm trees (*Elaeis guineensis*) can be used for the synthesis of carbon micro- and nanospheres [1] and carbon nanotubes [2]. It was found that carbon nanostructures are useful for various applications from electronics to medical applications and from simple to complex applications. This is due to their superior properties compared with their counterpart in the bulk form [3] and [4].

CNH is carbon nanostructure with a horn-shaped sheath aggregate of graphene sheets with approximately 40–50 nm in tubule length and approximately 2 and 3 nm in diameter. The structure is derived from a single walled carbon nanotube (SWCNT) and ended by a five-pentagon conical cap with a cone opening angle of approximately 20°. CNH can be aggregated together to form 'dahlia-like' and 'bud-like' structures with diameters of approximately 80–100 nm [5]. Moreover, CNH has the potential to be used for gas storage, biosensing, drug delivery and catalyst support due to their unique structures involving microporosity and a high surface area.

This work explored the potential use of palm olein as the carbon precursor for the formation of carbon nanostructures, in particular, CNH.



Zinc nitrate hexahydrate (System) and hexamethyltetraamine (Riedel-de-Haen) were used as received. A (1 0 0) p-type silicon wafer (0–10 Ω /cm resistivity) purchased from the Polishing Corp of America was used as a substrate. The silicon wafers were cut into small, 1 cm² pieces and cleaned with acetone, ethanol, and hydrofluoric acid. Deionised water was used to remove residual chemicals, and the sample was dried. The catalyst was prepared by mixing 0.15 M zinc nitrate with PO at a ratio of 30 PO:20 Zn(NO₃)₂ (v/v) and in the presence of ferrocene, 2% (w/v). The zinc nitrate–PO–ferrocene mixture was stirred for 30 min.

A dual furnace system, Furnaces 1 and 2, arranged in parallel, was used in this work. A quartz tube with a diameter of 3.5 cm was placed at the centre of the furnaces. Silicon substrates were placed at the centre of Furnace 2, while the mixture solution was placed in Furnace 1 in the quartz tube, and both ends of the tube were sealed by stoppers. Nitrogen gas, as a gas carrier was introduced with a constant flow rate of 150 sccm/min. The pyrolysis was started by switching on Furnace 2 at 950 °C, followed by Furnace 1 at 500 °C. Then, the deposition time was set for one hour, followed by post-annealing for another 30 min and allowed to cool down to room temperature under a continuous supply of nitrogen gas.

The Raman spectrum (Fig. 1) reveals four prominent bands: D, G, 2D and D + G bands. The D and G bands can be observed at 1343 and 1582 cm⁻¹, respectively, due to defects and graphite, respectively with an IG/ID value obtained was 1.0 [3], [4] and [5]. The former is usually associated with the impurities that destroy the graphitic symmetry, while the latter represents the splitting of the E_{2g} stretching mode for the graphite [6] and [7]. The overtone of the D band, which is usually denoted as 2D or G', is observed at 2711 cm⁻¹. The band is usually associated with the degree of the graphitic crystalline phase [8].



19.23 Engineering, Volume 20, 2011, Pages 180-187

Contribution of Facilities Management Processes in Supporting Malaysia National Higher Education Strategic Plan

W.S.Z. Wan-Hamdan, M.Y. Hamid, N.A. Mohd-Radzuan

This paper is to understanding and identifies the contribution of Facilities Management Processes in supporting Malaysia National Higher Education Strategic Plan (MNHESP) for fulfil the National Higher Education Action Plan by Ministry of Higher Education Malaysia (MOHE). This paper attempts to establish understanding and contribution of FM Processes in relation with Malaysia National Higher Education Strategic Plan for Malaysia higher education institutions. This research also presents preliminary study on influencing FM processes implementation in higher education institution toward strengthen higher education management in term of strategic plan in Malaysia. The application of FM to be extended to higher level, whereby the result of good education practice to be achieved by way of improving and facilitating FM process in National Higher Education Strategic Plan. Ministry of Higher Education(MOHE) recently determine seven (7) outline the National Higher Education Strategic Plan. The research adopts comprehensive literature reviews from numerous published sources such as journals, magazines, government reports, unpublished thesis and website document focusing on higher education in Malaysia published by Malaysia Ministry of Higher Education. Comprehensive literature review focusing on the understanding development of Facilities Management Processes (FMP), Malaysia National Higher Education Strategic Plan, and Contribution of Facilities Management Processes in supporting Malaysia National Higher Education Strategic Plan. The paper expecting that major improvement will be achieved once adopting FM processes in the system of Higher Education and it will also contribute to major changes and improvement in Malaysia Education systems. The ideas to be implemented at every level and perhaps to achieve the strategic plan outlined by MOHE.

Keywords

Facilities Management Processes; Malaysia National Higher Education Strategic Plan; Higher education institution



19.24 Energy Conversion and Management, Volume 51, Issue 3, March 2010, Pages 538-545

Economic assessment of Operational Energy reduction options in a house using Marginal Benefit and Marginal Cost: A case in Bangi, Malaysia

Wan Rahmah Mohd Zaki, Abdul Hadi Nawawi, Sabarinah Sh Ahmad

Energy Efficient (EE) appliances such as Compact Fluorescent Light (CFL) bulbs and Renewable Energy (RE), namely solar Photovoltaic (PV) can help to reduce Operational Energy (OE) in a house. In addition, a house should also incorporate Passive Architecture (PA) design strategies which in the hot and humid tropical climate, mean avoiding direct heat gain, encouraging natural cross ventilation and optimising the abundant daylight. Nevertheless, reducing OE must also mean economic gain to households to encourage their participation. Common economic gauges such as Return on Investment, Payback Period, Cost Benefit Analysis, Life Cycle Assessment and Life Cycle Cost are not suitable to validate OE options in households. These economic gauges approach economic assessment as an end-result on the cost side of the product and may result for good intention to be shelved, primarily because EE equipment and RE have high capital cost compared with the alternatives. On the other hand, reducing OE in houses is actually a continual progression from the status quo and there is always a marginal gain in doing so. The challenge is to know how much is the marginal benefit against the marginal cost of investing in EE and RE. In Economics, the ratio of Marginal Cost (MC) and Marginal Benefits (MB) measure additional benefits of every additional costs of investment at a specific level of production and consumption; and Economists suggests that effective gain and loss should be compared to the status quo, i.e., Relative Position (RP). The Economics theories of MC, MB and RP are being adapted to measure the progression of reducing OE. The living/dining area in two types of houses: with and without PA design strategies are simulated to use conventional incandescent light bulbs and CFL as well as solar PV in lieu of the mains electricity supply. The power requirement for artificial lighting in every case is translated into monetary value and the ratio of MB against MC for each case shows the gain or loss in investment to reduce OE in a 30-year period. The result suggests that the value of MB/MC is high when both houses use CFL, i.e., approximately (Ringgit Malaysia) RM2.5 gain for every RM1 cost. It is also found that investment in solar PV benefits the most in the PA case that uses superior CFL bulbs, i.e., approximately RM2 gain for every RM1 cost. Despite the high capital cost of EE equipment and RE, MB/MC approach seems to make economic sense for household to invest in reducing OE at certain stages.

Keywords

Passive Architecture; Compact Fluorescent Light; Photovoltaic



20.0

Universiti Tenaga Nasional, Malaysia

20.1 Energy Conversion and Management, Volume 75, November 2013, Pages 152–161

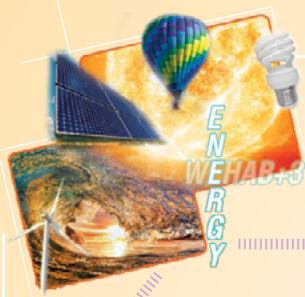
Modeling and simulation to determine the potential energy savings by implementing cold thermal energy storage system in office buildings

B. Rismanchia, R. Saidura, b, E-mail the corresponding author, H.H. Masjukia, T.M.I. Mahlia

In Malaysia, air conditioning (AC) systems are considered as the major energy consumers in office buildings with almost 57% share. During the past decade, cold thermal energy storage (CTES) systems have been widely used for their significant economic benefits. However, there were always doubts about their energy saving possibilities. The main objective of the present work is to develop a computer model to determine the potential energy savings of implementing CTES systems in Malaysia. A case study building has been selected to determine the energy consumption pattern of an office building. In the first step the building baseline model was developed and validated with the recorded data from the fieldwork. Once the simulation results reach an acceptable accuracy, different CTES system configuration was added to the model to predict their energy consumption pattern. It was found that the overall energy used by the full load storage strategy is considerably more than the conventional system. However, by applying the load leveling storage strategy, and considering its benefits to reduce the air handling unit size and reducing the pumping power, the overall energy usage was almost 4% lower than the non-storage system. Although utilizing CTES systems cannot reduce the total energy consumption considerably, but it has several outstanding benefits such as cost saving, bringing balance in the grid system, reducing the overall fuel consumption in the power plants and consequently reducing to total carbon footprint.

Keywords

Ice thermal storage (ITS); Building modeling; Energy consumption pattern; TRNSYS



20.2 IOP Conference Series: Earth and Environmental Science, Volume 16 , Conference 1, 012126 doi:10.1088/1755-1315/16/1/012126, 2013

Electricity energy outlook in Malaysia

C S Tan, K Maragatham and Y P Leong

Population and income growth are the key drivers behind the growing demand for energy. Demand for electricity in Malaysia is always growing in tandem with its Gross Domestic Product (GDP) growth. The growth for electricity in Malaysia forecasted by Economic Planning Unit (EPU) has shown an increase of 3.52% in 2012 compared to 3.48% in 2011. This growth has been driven by strong demand growth from commercial and domestic sectors. The share of electricity consumption to total energy consumption has increased from 17.4% in 2007 to 21.7% in 2012. The total electricity production was reported at 122.12TWh in 2012, where gas is still the major fuel source contributing to 52.7% of the total generation fuel mix of electricity followed by Coal, 38.9%, hydro, 7.3%, oil, 1% and others, 0.2%. This paper aims to discuss the energy outlook particularly the electricity production and ways toward greener environment in electricity production in Malaysia.



20.3

International Journal of Electrical Power & Energy Systems, Volume 54, January 2014, Pages 288–292

Detection of faulted phase type in distribution systems based on one end voltage measurement

Eyada A. Alanzi, Mahmoud A. Younis, Azrul Mohd Ariffin

Distribution power systems exposed to various unexpected failures due to many random causes. These failures are mostly happened as a result of phase faults in power system and will affect negatively the availability and reliability of the power system. Accurate detection of these faults will help in restoration of power in a timely manner and not to cause any severe damage to the power system equipment. This paper investigates the problem of accurate detection of faulted phase types occurred in the distribution system. The features of the voltage waveforms recorded from one end measurement of the distribution system during the fault occurrence are used in the proposed technique. Clarke's transformation criterion used to identify if the fault is line-to-ground (grounded fault) or phase-to-phase (ungrounded fault). Then the fault types are classified by the high performance comparison method of the voltage signals using phase angle shift prior and during the fault occurrence. Different types of faults namely, single-phase to ground, double-phase to ground, phase-phase and balanced three-phase faults that are occurred at different locations with different fault resistances and inception angles are tested and analyzed. Results from simulation of faults on a model of 33 kV distribution system typical networks presented.

Keywords

Distribution system; Fault type detection; Modal transformation; Phase angle shift

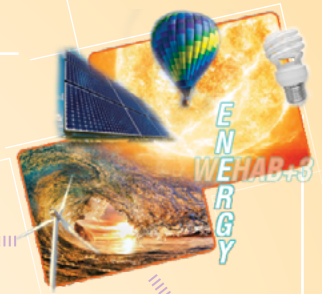


20.4 IOP Conference Series: Earth and Environmental Science, Volume 16 , Conference 1, 012053 doi:10.1088/1755-1315/16/1/012053, 2013

Preliminary evaluation of the effectiveness of moisture removal and energy usage in pretreatment module of waste cooking oil for biodiesel production

K Palanisamy, M K Idlan and N Saifudin

Waste Cooking Oil (WCO) is a plausible low cost biodiesel feedstock but it exhibits few unfavorable parameters for conversion into biodiesel. One of the parameter is the presence of high moisture content which will inhibit or retard catalyst during the acid esterification or base transesterification causing lower purity and yield of biodiesel. This will effect the post processing and escalate production cost making WCO a not favorable biodiesel feedstock. Therefore, it is important to have an effective moisture removal method to reduce the moisture content below 0.05%wt or 500 ppm in WCO for an efficient biodiesel production. In this work, the effectiveness of moisture removal and the energy usage of a newly develop innovative pretreatment module has been evaluated and reported. Results show that the pretreatment module is able to reduce up to 85% to effectively reduce the moisture content to below 500ppm of the initial moisture content of WCO and only consume 157 Wh/l energy compared to conventional heating that consume 386 Wh/l and only remove 67.6% moisture in 2 hours.



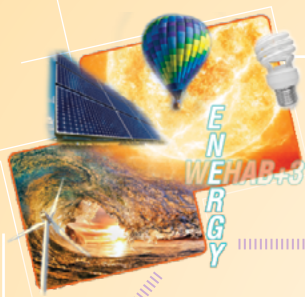
20.5

IOP Conference Series: Earth and Environmental Science, Volume 16 , Conference 1, 012035 doi:10.1088/1755-1315/16/1/012035, 2013

Energy flow models for the estimation of technical losses in distribution network

Mau Teng Au and Chin Hooi Tan

This paper presents energy flow models developed to estimate technical losses in distribution network. Energy flow models applied in this paper is based on input energy and peak demand of distribution network, feeder length and peak demand, transformer loading capacity, and load factor. Two case studies, an urban distribution network and a rural distribution network are used to illustrate application of the energy flow models. Results on technical losses obtained for the two distribution networks are consistent and comparable to network of similar types and characteristics. Hence, the energy flow models are suitable for practical application.



20.6 IOP Conference Series: Earth and Environmental Science, Volume 16 , Conference 1, 012136 doi:10.1088/1755-1315/16/1/012136, 2013

Nuclear energy in Malaysia? closing the gaps

Malaysian Nuclear Society (Mns)

This article is prepared by the Malaysian Nuclear Society (MNS) to present the views of the Malaysian scientific community on the need for Malaysia to urgently upgrade its technical know-how and expertise to support the nuclear energy industry for future sustainable economic development of the country. It also present scientific views that nuclear energy will bring economic growth as well as technically sound industry, capable of supporting nuclear energy industry needs in the country, and recommend action items for timely technical upgrading of Malaysian expertise related to nuclear energy industry.



21.0

University Sumatera Utara, Indonesia

21.1 International Journal of Hydrogen Energy, Volume 38, Issue 22, 26 July 2013, Pages 9395-9400

Electrochemical properties of a PEMFC operating with saturated hydrogen and dry

Erni Misran, Nik Suhaimi Mat Hassan, Wan Ramli Wan Daud, Edy Herianto Majlan, Masli Irwan Rosli

The electrochemical properties of a single-cell proton exchange membrane fuel cell (PEMFC) were characterized. A single serpentine flow field design with an active area of 200 cm² was employed in this investigation. The flow field consisted of grooves on a plate with a width of 5 mm, a depth of 2.5 mm and a 2.5-mm rib. Several operating temperatures were tested (25, 40, 50 and 60 °C), and the pressure was fixed at 1 bar on both the anode and the cathode sides. The gas inlet velocities of hydrogen and air were fixed at 3 L min⁻¹ and 6 L min⁻¹, respectively. The inlet gases were saturated hydrogen and dry air. A polarization curve for the experimental data was fitted to an empirical model equation, and a good-fitting correlation was obtained. The kinetic parameters of the cell, namely, the Tafel slope, the area resistance and the mass transport parameters, were obtained from the model fitting. The proton conductivity of the membrane was found to be inversely proportional to the area resistance. Electric yield rates in the range of 45.9%–56% were obtained.

Keywords

PEMFC; Tafel slope; Mass transport parameters; Electric yield rate



21.2 International Journal of Hydrogen Energy, Volume 38, Issue 22, 26 July 2013, Pages 9401-9408

Water transport characteristics of a PEM fuel cell at various operating pressures and temperatures

Erni Misran, Nik Suhaimi Mat Hassan, Wan Ramli Wan Daud, Edy Herianto Majlan, Masli Irwan Rosli

In this investigation, water in a single-cell proton exchange membrane (PEM) fuel cell was managed using saturated hydrogen and dry air. The experiment was conducted at temperatures of 40, 50 and 60 °C and pressures of 1 and 1.5 bar at both the anode and cathode gas inlets. The feed velocities of hydrogen and air were fixed at 3 and 6 L min⁻¹, respectively. After reaching steady-state conditions, the relative humidity along the single serpentine gas channel was measured. From the experimental data, water transport properties were characterized based on a membrane hydration model. The electro-osmotic drag coefficient, water diffusion coefficient, membrane ionic conductivity and water back-diffusion flux were significantly influenced by the water content in the membrane of the PEM fuel cell. The water content depended on the relative humidity profile along the gas channel. In this investigation, a negative value for the water back-diffusion flux was measured; thus, the transport of water from the cathode to the anode did not occur. This phenomenon was due to the large water concentration gradient between the anode and cathode. Therefore, this strategy successfully prevented flooding in the PEM fuel cell.

Keywords

PEM fuel cell; Single serpentine flow-field channel; Relative humidity; Water transport properties; Flooding



21.3

International Journal of Hydrogen Energy, Volume 38, Issue 22, 26 July 2013, Pages 9553-9561

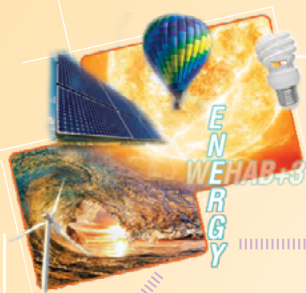
PTFE-nafion membrane reactor for hydrogen production

Teuku Husaini, Majlan Edy Herianto, Yaakob Zahira, Wan Daud Wan Ramli

This paper presents an experimental and modelling study of the kinetics of hydrogen production through the methanol steam reforming (MSR) process using a membrane reactor with a self-made, porous PTFE-nafion membrane. The operating conditions were optimised through an analysis of the hydrogen recovery and the CO selectivity. The membrane reactor was modelled based on the hydrogen production rate, which was linked (chain) to the changes in the reactant concentrations. The analysis of the reaction kinetics provided an overview of the reaction process and the factors that affect the process. Moreover, the size of the membrane was estimated using the distribution of hydrogen concentrations along the reactor. The separation factors, particularly the separation of hydrogen from CO and CO₂, are some of the factors that can influence the performance of a membrane reactor

Keywords

Methanol steam reforming; Water–gas shift reaction; Modelling; Fuel cell



21.4 Energy and Buildings, Volume 43, Issue 7, July 2011, Pages 1676-1684

Exergy analysis for day lighting, electric lighting and space cooling systems for a room space in a tropical climate

T.M.I. Mahlia, B.N. Taufiq, K.P. Ong, R. Saidur

Turning off the electric lamp during available daylight will save electricity, while at the same time thermal energy from solar radiation transmitted through the window will increase the space-cooling load. Therefore, it is necessary to evaluate the whole system that includes not only the room space with the windows and the electric lighting systems, but also the air conditioning system. For analysis of the whole system using different types of energy (i.e. electricity, solar radiation, light emitted by lamps and thermal energy), it is important to take into account the quality of these different types of energy. The concept of entropy and exergy were applied in this analysis. The purpose of this study is to show the energy use for daylighting, electric lighting, and space cooling systems as a series of exergy input, output, and consumption and reveal how a daylighting system consumes solar exergy and how electric lighting and space cooling systems consume exergy from fossil fuel. The methodology to calculate the exergy consumption of the system during a given time was developed first. This method was then applied to the lighting and cooling for a typical room. The study found that electric lighting consumes the lowest amount of exergy while the space cooling consumes the highest amount of exergy for the system.

Keywords

Exergy analysis; Day lighting; Electric lighting; Air conditioner



21.5 Sensors and Transducers 129 (6) , pp. 86-96. 2011

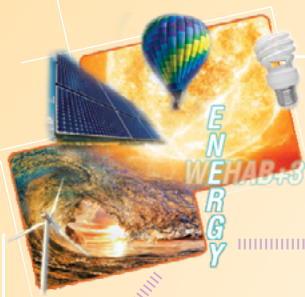
The DC motor speed controller using AT89S52 microcontroller to rotate stepper motor attached into potentiometer in variable regulated power supply

Situmorang, M.

The DC motor speed controller using AT89S52 microcontroller with stepper motor attached into potentiometer in variable regulated power supply had been evaluated. The voltage across DC motor is varied using program subroutine in microcontroller. The reference speed was determined using keypad and actual speed measured using rotating disc with holes in optocoupler sensor. The actual speed in rpm was determined after running time base 1 second and subtracted with reference speed. The error was used to turn right stepper motor if actual speed less than reference speed and vice versa. The number of step of stepper motor rotation in one cycle execution was varied using subroutine starting from 1 step, 3 step, 5 step and using approximation of difference value between actual speed and reference speed. It was observed that the best performance of controller was achieved if number of step of turning stepper motor was not constant but depending on the difference between actual speed and reference speed. © 2011 IFSA.

Keywords

DC motor speed controller, Microcontroller AT89S52, Stepper motor and regulated power supply



21.6

GLOBAL ECOLOGY AND BIOGEOGRAPHY Volume: 22 Issue: 12 Pages: 1261-1271
Published: DEC 2013

Large trees drive forest aboveground biomass variation in moist lowland forests across the tropics

Slik, J. W. Ferry; Paoli, Gary; McGuire, Krista; et al.

Aim: Large trees (d.b.h.70cm) store large amounts of biomass. Several studies suggest that large trees may be vulnerable to changing climate, potentially leading to declining forest biomass storage. Here we determine the importance of large trees for tropical forest biomass storage and explore which intrinsic (species trait) and extrinsic (environment) variables are associated with the density of large trees and forest biomass at continental and pan-tropical scales.

Location: Pan-tropical.

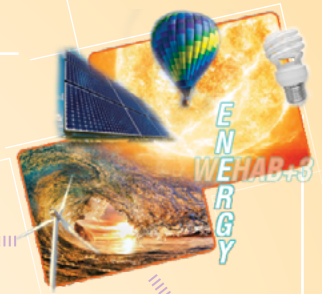
Methods: Aboveground biomass (AGB) was calculated for 120 intact lowland moist forest locations. Linear regression was used to calculate variation in AGB explained by the density of large trees. Akaike information criterion weights (AICc-wi) were used to calculate averaged correlation coefficients for all possible multiple regression models between AGB/density of large trees and environmental and species trait variables correcting for spatial autocorrelation.

Results: Density of large trees explained c. 70% of the variation in pan-tropical AGB and was also responsible for significantly lower AGB in Neotropical [287.8 (mean) 105.0 (SD) Mg ha⁻¹] versus Palaeotropical forests (Africa 418.3 +/- 91.8 Mg ha⁻¹; Asia 393.3 +/- 109.3 Mg ha⁻¹). Pan-tropical variation in density of large trees and AGB was associated with soil coarseness (negative), soil fertility (positive), community wood density (positive) and dominance of wind dispersed species (positive), temperature in the coldest month (negative), temperature in the warmest month (negative) and rainfall in the wettest month (positive), but results were not always consistent among continents.

Main conclusions: Density of large trees and AGB were significantly associated with climatic variables, indicating that climate change will affect tropical forest biomass storage. Species trait composition will interact with these future biomass changes as they are also affected by a warmer climate. Given the importance of large trees for variation in AGB across the tropics, and their sensitivity to climate change, we emphasize the need for in-depth analyses of the community dynamics of large trees.

Keywords

Climate; Ectomycorrhizal associations; Large tree density; Pan-tropical analysis; Soils; Species traits; Tree size; Topical forest biomass; Wood density; Wind dispersal



22.0

WWF Malaysia

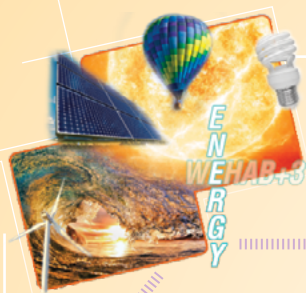
22.1

Energy for Sustainable Development, Volume 16, Issue 3, September 2012, Pages 320-327

Can Tanzania realise rural development through biofuel plantations? Insights from the study in Rufiji District

Agnes Godfrey Mwakaje

Biofuel is a fast growing sector in Tanzania. Foreign and domestic companies are acquiring big portions of land, some up to 440,000 hectares. It is believed that the country has a reserve of 88 million hectares for agriculture. The government is committed to promoting the sector. But what are the implications of biofuel plantations for rural development in Tanzania? This is an area of inquiry which has not received adequate attention. The main objective of the study was to investigate whether biofuel plantations will have any significant impact on rural development in Tanzania, using the case of Rufiji District. The choice of the district was fourfold. One, it has a considerable number of potential biofuel investors. Two, a high proportion of the investors intend to use the vertical integration model of production, processing and marketing. Three, the district is dominated by smallholder farmers, who are poor with chronic food insecurity. Four, Rufiji district is rich in biodiversity and natural resources. The findings from this study will reflect the likely impact of biofuel plantations on rural development as the selected district represents the characteristics of many rural areas of Tanzania. A total of 161 respondents were selected randomly for interview. There were also consultations with village governments, non-government organisations, policy makers and researchers. The findings show both high expectations and concerns. The respondents anticipate benefiting from employment, income-generating opportunities, access to markets for crops, and improved social services. More men than female respondents are hoping to become out-growers. However, male respondents in particular were concerned about land grabbing while for women it was about food security, water use conflicts and whether they will be able to access clean energy. The lack of a biofuel policy and legal framework as well as poor rural infrastructure may undermine the realisation of biofuel benefits.



22.2 Energy Policy, Volume 62, November 2013, Pages 1128-1137

Capturing stakeholders' views on oil palm-based biofuel and biomass utilisation in Malaysia

Dina Darshini, Puneet Dwivedi, Klaus Glenk

Malaysia is the world's second largest producer of palm oil and generates surplus palm biomass waste that can be used for bioenergy development. Malaysia aims to diversify its energy portfolio by investing into renewable energy mostly to reduce its reliance on fossil fuels. This paper captures synergetic and conflicting interests of key stakeholders, who play an important role in shaping the regulatory and business environment in Malaysia's renewable energy sector. Particularly, this research analyses the perceptions of three stakeholder groups (government agencies, industry players, and non-governmental organisations) regarding palm-based biofuel and biomass utilisation in Malaysia by combining Strengths, Weaknesses, Opportunities, and Threats (SWOT) analysis with an Analytical Hierarchy Process (AHP) framework. Overall, results show a greater sense of optimism among the three stakeholder groups for the development of palm-based biomass utilisation in Malaysia, compared to the development of first generation palm-oil based biodiesel. We discuss the findings in light of on-going debates and policy processes, highlighting some key issues that need to be addressed in order to meet oil-palm related targets set in Malaysia's ambitious renewable energy plan.

Keywords

Palm-oil bioenergy; SWOT-AHP; Malaysia



22.3 Progress in Energy and Combustion Science, Volume 39, Issue 6, December 2013, Pages 577-605

Dimethyl ether synthesis from Victorian brown coal through gasification – Current status, and research and development needs

Sankar Bhattacharya, Kazi Bayzid Kabir, Klaus Hein

Victorian brown coal, one of the largest and cheapest energy sources in the world, is currently used in mine-mouth coal-fired power plants. These power plants have low efficiency and high CO₂ emission. Alternative process paths leading to electricity generation and chemical production can provide more energy efficient and environment friendly applications of brown coal. Synthesis of dimethyl ether (DME) from brown coal is an attractive option because of its environmentally benign properties and wide range of applications. This article first reviews the current and likely future applications of brown coal. In the latter part of the article emphasis has been given on DME, since it stands out as a suitable option from both environmental and economic point of view. Finally research needs for the development and commercialisation of DME production process from brown coal has been identified.



22.4 Journal of Cleaner Production, Volume 28, June 2012, Pages 225-232

Life cycle costing and externalities of palm oil biodiesel in Thailand

Thapat Silalertruksa, Sébastien Bonnet, Shabbir H. Gheewala

One of the issues related to the increased use of biofuel (ethanol and biodiesel) in the transport sector concerns their higher production costs, either in pure or blended form, as compared to conventional fuels (gasoline and diesel). Based on the average cost of biodiesel, the former is not able to compete with diesel if no subsidies are provided by the government to boost its cost competitiveness. However, such a cost comparison is not a true reflection of the various potential benefits of biofuels. This study aims to evaluate the influence of externalities on the cost performance of various palm oil biodiesel blends (B5, B10 and B100) when internalized into their respective production cost for the case of Thailand. A case study of palm oil biodiesel has been assessed and compared to conventional diesel. An income elasticity of willingness to pay (WTP) was used as multiplier factor to transfer the values of selected environmental damage costs obtained from the Environmental Priority Strategies (EPS) methodology into Thai context. The three key environmental burdens considered in this work include land use, fossil energy resources depletion and air pollutants emissions i.e. CO_2 , CH_4 , N_2O , CO , NO_x , SO_2 , VOC and PM_{10} . The results obtained indicate that environmental costs contribute to 34% of the total costs of conventional diesel. In comparison to diesel and for the same performance, the total environmental cost of biodiesel based palm methyl ester (PME) is about 3–76% lower depending on the blending levels. This is mainly due to two major advantages that biofuels present which are a reduction in the depletion of fossil energy resources and mitigation of carbon dioxide emissions. In terms of net social benefits, the promotion of biodiesel to replace diesel is economically feasible contributing a gain in welfare of about 0.01 and 0.76 THB L^{-1} diesel equivalent for B5 and B10 respectively.



22.5 International Journal of Hydrogen Energy, Volume 36, Issue 17, August 2011, Pages 11399-11407

Comparative exergetic performance analysis of hydrogen production from oil palm wastes and some other biomasses

Yildiz Kalinci, Arif Hepbasli, Ibrahim Dincer

In this study, we investigate the exergetic performance assessment of hydrogen production from gasification of various biomasses, including oil palm. We employ the operational and energy data as taken from the literature for two different gasifier samples of oil palm biomasses. The first one is a steam gasification of oil palm wastes over supported tri-metallic catalyst. We calculate the specific exergies for shell, fiber and empty fruit bunches (EFB) as 22.7, 21.1 and 20.03 MJ/kg, respectively. Based on these, with no catalyst, calcined dolomite and tri-metallic catalyst cases, hydrogen contents of syngas change from 36.5 to 53.6 (%v/v). We then calculate the specific exergy values of these syngases to be 14.59, 16.65 and 15.15 MJ/kg with no catalyst, calcined dolomite and tri-metallic catalyst, cases, respectively. The second one is done by air gasification in a fluidized bed reactor of EFB. For the two samples considered, we investigate the effects of some operational parameters such as gasification temperatures, catalytic bed temperatures, steam biomass ratio (SBR), equivalence ratio (ER) and particle size, to hydrogen and combustible gas contents, specific exergy values and exergy efficiencies. Finally, the performance results of EFB are compared with six different biomass fuels, namely almond shell (ASF), walnut pruning (WPF), rice straw (RSF), whole tree wood chips (WWF), sludge (SLF) and non-recyclable waste paper (NPF). The specific exergy values of the syngases and exergy efficiencies for the six biomasses change from 4.07 to 6.95 MJ/kg and from 25.73% to 55.4% as compared to 12.35 MJ/kg and 61.66% for EFB.



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