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Abstract Book

3rd Edition of Renewable and Sustainable Energy Virtual

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PLENARY FORUM

DAY 1

3rd EDITION OF

RENEWABLE AND SUSTAINABLE ENERGY VIRTUAL

JUNE

03-04, 2022

GMT 07:00 – 12:00

V-REN2022

Yuping Wu
Institute for Catalysis, Hokkaido University, Sapporo 001-0021, Japan.

Electrochemical Energy Storage Systems with High Safety for Large-scale Applications

Energy is an indispensable factor for the sustainable development of human being. To increase the utilization efficiency of traditional coal-power plants and renewable energy such as solar and wind ones, energy storage systems of high safety for large-scale applications are highly desired. In this presentation, our edge-cutting work on novel electrochemical energy storage systems such as aqueous rechargeable lithium batteries, aluminum-, zinc-, magnesium-based batteries and hybrid capacitors will be introduced.

Financial supports from National Key R & D Program of China (2021YFB2400400) and NSFC (52073143, and 52131306) are greatly appreciated.

Biography

Dr. Yuping Wu is a full professor of Southeast University, and Fellow of RSC. He got Ph. D. degree from Institute of Chemistry, CAS in 1997, and then worked at Tsinghua University, Waseda University, and Chemnitz University of Technology (AvH Fellowship), separately. In 2003 he became a full professor of Fudan University. His research is focused on energy storage systems and their key materials. He published over 390 papers with H-index over 89 (WoS) and 9 books. His researches led to some edge-cutting technologies such as pore-free separators for lithium batteries, and aqueous rechargeable lithium batteries. He achieved quite some awards including One of the Most Influential Minds over the World in 2015 from the Most Cited Researchers by Thomson Reuters.

Edgar Harzfeld
Stralsund University of Applied Sciences, Germany

New solutions for storing and using surplus electricity in Methanol

The decline of fossil fuels requires the expansion of renewable energy production. The use of wind and pv energy is associated with strong fluctuations that are insufficiently adapted to the demand. The use of storage systems can help to reduce the mismatch. While short-term storage systems such as batteries rely on charging and discharging cycles, long-term storage systems such as methanol storage can be charged and discharged over any time range. Current studies show a wide variety of possible applications for long-term storage systems based on methanol. Methanol can contribute to the decentralized supply of electricity, heat and fuel as well as to grid stabilization. In an emergency case, it can even supply entire consumer clusters autonomously for several days.

Biography

Edgar Harzfeld, Professor at Stralsund University. Studies and research in Leipzig and Zurich. Since 1996 at the Faculty of Electrical Engineering and Computer Science of Stralsund University responsible for electrical power supply and renewable energy systems. Since 2004 - 2022 numerous research projects on the subject of electrical energy storage technologies.

Efstathios E. (Stathis) Michaelides
Department of Engineering, TCU, Fort Worth, TX, USA

The Road to Renewable Energy and Sustainability Goals

A common misconception for the transition to renewables is that the amount of electric energy supplied from wind and solar sources may be increased without limit. The production of electricity from wind energy is intermittent, the production from solar irradiance is periodically variable and, oftentimes, the supply is not sufficient to satisfy the demand. In addition, the installation of large numbers of solar and wind units and the generation of a higher fraction of the total annual energy from renewables in a region meets a barrier during periods of time when the power produced by the renewable sources is high and exceeds the demand of the electricity grid. At present, this limit is reached when solar and wind units produce 25-30% of the annual quantity of electric energy used in a region. Solutions to this problem for a higher penetration of renewables in the marketplace include large scale energy storage. This presentation examines the causes and effects of the U-shaped demand curve (the duck curve). The analysis is based on hourly data for the supply of electricity from PV cells and wind turbines and the regional demand for energy and power. The hourly energy demand is analyzed and balanced with the supply of energy. Energy storage systems ensure that sufficient energy is available to the consumers at all levels of the demand. Hourly data are presented for the demand, the supply, and the storage system capacity for the entire electricity grid of Texas (ERCOT). Results are presented on the hourly, daily, and seasonal storage requirements; on the energy production and consumption for the wider market penetration of wind and solar units within a region; and the effect of the substitution of fossil fuels with renewables on the price of electricity in a region; and the effect on the goals for a sustainable future.

Biography

Professor Michaelides holds the Tex Moncrief Chair of Engineering at TCU. Among other honors, he was awarded the Lee Johnson award for teaching excellence at Tulane; a Senior Fulbright Fellowship; the ASME Freeman Scholar award; the Outstanding Researcher award at Tulane; the ASME Fluids Engineering award; the ASME 90th Anniversary FED Medal; and the ASME Edwin F. Church Medal. Professor Michaelides has authored more than 170 journal papers; gave more than 280 presentations in national and international conferences; and has authored seven books. His latest books: *Energy, the Environment, and Sustainability,* (CRC Press 2018) and *Exergy and the Conversion of Energy,* (Cambridge Univ. Press, 2021).

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Yanjun Dai[1, *], Jian Yao[1], Yao Zhao[1], Wenjie Liu[1]

[1]Institute of Refrigeration and Cryogenics, Shanghai Jiao Tong University, Shanghai, China, 200240

Solar energy harvesting with the highest efficiency using advanced photovoltaic/thermal (PVT) heat pump thermodynamic cycle

The photovoltaic/thermal (PVT) heat pump thermodynamic cycle was proposed and adopted to realize co-generation in building sectors which has been proved as the highest-efficiency approach to harvest solar energy till now. The novel structured PVT module utilizes the roll-bond panel as the collector and evaporator, where the refrigerant (direct-expansion type) is the working medium to further increase the heat transfer coefficient. In this regard, the evaporating pressure and temperature of the direct-expansion PVT heat pump system could be enhanced, enabling a higher COP (coefficient of performance) in comparison with the conventional air or water-based PVT heat pump system. The average annual electrical efficiency of the PVT module could reach 18.3%, which is 11.8% higher than the conventional PV module due to the cooling effect of the working medium. The annually-averaged thermal efficiency of the PVT module is 100.1% because it could absorb heat from both solar irradiation and ambient air. Moreover, the dynamic operation strategy of the PVT heat pump system was proposed regarding environmental conditions to adjust the operating parameters in an optimized status. When the solar irradiation is higher than 4200 MJ/m^2, the PVT heat pump can present prominent benefits on economy, energy-saving, and emission reduction. For instance, the system performance could be improved more than 30% throughout the year compared with the air source heat pump system. The PVT heat pump system is suitable for scenarios with heat and electricity demand such as schools, hotels, hospitals, etc.

Biography

Yanjun Dai is a full professor and the Head of the Department of Power and Energy Engineering, Shanghai Jiao Tong University. His research area includes solar energy conversion and utilization, advanced cooling, et al. Prof. Dai is the associate editor of *Renewable and Sustainable Energy Reviewers* and subject editor of *Solar Energy*. Prof. Dai has published more than 200 papers in reputed.

Yaning Zhang, Ce Shi, Tao Liu, Wenming Fu, Sichen Fan, Tariq Maqsood, Bingxi Li

School of Energy Science and Engineering, Harbin Institute of Technology (HIT), Harbin, China.

Microwave-assisted thermochemical conversion technologies for value-added products

Microwave-assisted thermochemical conversion technology is a relatively new approach with limited research as compared with conventional electrical conversion technology. The lack of understanding of some observed results warrants more and in-depth fundamental researches. This presentation mainly fucoses on microwave-assisted thermochemical conversion technologies for value-added products mainly based on our previous related researches, and it covers mainly the follows: (a) microwave heating vs electrical heating (i.e., heating mechanisms, heat transfers, temperature gradients, volatile releases, etc.), (b) the main microwave-assisted thermochemical conversion technologies (i.e., torrefaction, pyrolysis, gasification, etc.), (c) the products obtained from microwave-assisted thermochemical conversion technologies (i.e., biooil, syngas, biochar, etc.), and (d) some insights into process intensification for microwave-assisted thermochemical conversion technologies (i.e., heating process intensification, reaction process intensification, etc.). Hopefully, the contents included in this presentation not only introduce value-added products obtained from microwave-assisted thermochemical conversion technologies but also give insights into renewable and sustainable energy production through using innovative technologies.

Biography

Dr. Yaning Zhang is a full professor at the School of Energy Science and Engineering of Harbin Institute of Technology (HIT) in China. He ever worked as a visiting scholar (2011-2012) and postdoctoral fellow (2013) at Dalhousie University in Canada, and a postdoctor at University of Minnesota Twin Cities in the USA (2016-2018). He has published 5 books, 10 book chapters and more than 130 journal papers. He serves as associate editor for Energy Sources Part A, and editorial broad member for Biomass Conversion and Biorefinery, Biochar, Carbon Research, etc.

Sangeetha Thangavel[1]*, Yan, Wei-Mon[1]*, Chellappan Praveen Rajneesh[2]

1Department of Energy and Refrigerating Air-Conditioning Engineering, National Taipei University of Technology, Taipei, Taiwan.
[2]School of Medicine, Fu Jen Catholic University, New Taipei City, Taiwan.

Sustainable and Renewable Energy from Honey Comb Microbial Fuel Cells (HC-MFCs)

Novel inventions on sustainable and Renewable energy sources is booming due to serious environmental issues like global warming and climate change. Microbial fuel cells (MFCs) are bio electrochemical transducers that produce electricity by microbial activity in organic wastewaters. Flow parameter investigation was performed in innovative flow straightener implemented honey comb MFCs (HCMFCs) in the current research study and the impacts of flow channel diameter on the MFC performance in recirculation batch mode was estimated. Nevertheless, the effects of electrode spacing on the reactors performance was also elucidated. Three reactors (HCMFC1, 2 and 3) with different channel diameters (0.4 cm, 0.7 cm and 1 cm) and electrode distances (0, 3 and 6 cm) were designed and operated. Numerical simulation models were presented along with Nyquist plots, polarization and power density curves and equivalent circuits. The HCMFC 2 reactor with 0.7 cm had superior performance with a voltage generation of 0.55 V, current density of 5300 mA/m^2, power density of 430 mW/m^2, organic content removal of 97.6%. Results justification was accomplished by anode biofilm thickness analysis using scanning electron microscope (SEM). The research outcomes proved that shorter electrode spacing with flow straightener devices would improve the performance of MFCs. The best performing reactors had the highest anode biofilm thickness which served as a proof for their heightened power production and treatment ability. These innovative flow straightener MFCs will effectively enhance research and provide great prospects for future applications.

Biography

Dr. Sangeetha Thangavel completed her PhD in the field of Environmental Sciences from Bharathiar University, India. Her Postdoctoral studies were in the field of Environmental Engineering from Harbin Institute of Technology, China. She worked as a Research Assistant Professor in National Taipei University of Technology, Taiwan and currently, she is a Post-Doctoral Researcher in the same institution. She has published 53 SCI papers and 3 book chapters in the field of Sustainable and Renewable Energy.

Corrente Giuseppina Anna

Department of Chemistry and Chemical Technologies, University of Calabria, Via P. Bucci, Cubo 15D, 87036 Arcavacata di Rende (CS), Italy.

Organic Mixed Valence Compounds for Electrochromic and Electrofluorochromic Applications

Organic mixed-valence compounds (MVs) consist of two or more chemically identical but differently charged redox centres connected by a π-conjugated bridging unit.[1] The bridge as well as the nature of the substituents determine their electrooptical properties. Arylamines are the most used redox centers in organic MV systems due to the stability of the radical cation forms and to the high extinction coefficient of the intervalence charge transfer transition (IVCT) in the near infrared region (NIR).[2] These systems are crucial materials in electrochromic (EC) and electrochrofluorochromic (EFC) devices, allowing the modulation of both coloration and emission, respectively, by rapid, reversible and locally focused electrical stimuli. Therefore, they have attracted a great deal of interest due to their potential application as chemical sensors, biochemical labels, optical memories and displays.[3] Herein, we provide an overview on organic MVs with a different number of arylamino redox centres, bridged by properly functionalized fluorene and dibenzofulvene backbones,[5-6] highlighting the importance of the structure-properties relationships that results in a fine-tuning of the EC and EFC response. The developed devices exhibit different colorations as transmissive-to-black EC switching behavior with high transmittance changes (close to 100%) and fast response time, as well as high quantum yield and high contrast ratio (I_{off}/I_{on}) in EFC device application. Additionally, EC device shows an intense absorption in the near-infrared region, which is an important characteristic for tunable shading in dimmable windows.

Biography

Dr Corrente obtained her graduate degree in Chemistry at the University of Calabria in 2012. In 2014, at the same University she took her University II Level Master in “Servizi di Prototipazione e Ricerca per le Nuove Tecnologie e i nuovi materiali (SPRINT)” with the title of “Technical expert in the use of complex instrumentation for the study and analysis of new technologies and new materials.” She earned her Ph.D. in “Ingegneria dei materiali e delle strutture e nanotecnologie” at the University of Salento (Italy) in 2018, working on energy conversion and energy saving by multifunctional dibenzofulvene-based organic materials.

Tomasz Krystofiak

[1]Department of Wood Science and Thermal Techniques, Division of Gluing and Finishing of Surface, Poznan University of Life Sciences, Faculty of Forestry and Wood Technology, Poznań, Poland.

Sustainable thermoplastic adhesives and bonding technologies for woodworking industry

For many years, thermoplastic adhesives based on EVA copolymers have been used in the woodworking industry. Today, adhesive manufacturers are introducing solutions based on EPDM, EVA (without fillers), PA, PO, POR and PUR polymers. They can be used to join not only wood and lignocellulosic materials, but also non-porous composites and plastics. Differentiation of the selection of bonding agents for individual materials requires the observance of appropriate logistic procedures in the production technology. This requires not only the use of a suitable adhesive, but also application equipment. The final cost of the gluing operation is significantly affected by the amount of applied adhesives. For the discussed groups of adhesives, the smallest quantities are applied in the case of hot-melt adhesives based, respectively, on PO and EVA in the without filler version.

The presentation will focus on thermoplastic adhesives in the aspect of sustainable technology. Pro-ecological application technologies will be presented in the economic and technological aspects. Innovative solutions including hot air or laser energy will be presented.

The advantages of both thermoplastic adhesives and their application technologies predispose them to the production of ecological furniture and interior design elements.

Biography

Tomasz Krystofiak in 1994 was finished study of Faculty of Wood Technology at Agriculture Academy in Poznan. In 2002 he prepared a PhD dissertation and in 2019 habilitation. Author or co-author of more than 300 scientific publications in the scope of gluing and finishing of wood and wood based composites. To his research activities belongs surface phenomena, wettability, adhesion and adherence, modification, gluability and paintability of lignocellulosic materials. He was a Management Committee Member of COST Actions FP1006 and CA15216 and Working Group Member (FP1303 and FP1407). Since 2021 Guest Editor in 6 Special Issues in Coatings, Forests, Materials journals.

Jan DeWaters

Institute for STEM Education and Coulter School of Engineering, Clarkson University, Potsdam, NY 13699, USA.

Engineering Education for a Sustainable Energy Future

Engineering graduates must be prepared to address complex, global challenges to ensure sustainability of the planet and its inhabitants. A sustainable future will require development of clean, renewable energy resources that are distributed equitably among the world's populations. Complex problems related to energy and sustainability require engineers to consider the broad spectrum of interrelated consequences including human and environmental health, sociopolitical, and economic factors. Educational programs must evaluate not just 'what' we teach but 'how' we teach. Broad professional skills must accompany deep technical knowledge and skills. Moreover, teaching engineering students about energy within a societal context, emphasizing connections between technical issues and the human and natural environment, will better prepare them to solve real-world problems.

Few energy courses that approach energy topics from a human-centered perspective exist within engineering programs. Engineering students often take such courses as supplemental to their course of study. This presentation will share an engineering course that approaches energy education from a socio-technical perspective, emphasizing the complex interactions of energy technologies with sustainability dimensions. Course content and learning activities are structured around learning outcomes that require students to gain technical knowledge as well as an understanding of broader energy-related impacts. The course attracts students from a variety of majors and grade levels. A mixed quantitative/qualitative assessment conducted from 2019–2021 indicates successful achievement of course learning outcomes. Students demonstrated significant gains in technical content knowledge as well as the ability to critically address complex sociotechnical issues related to current and future energy systems.

Biography

Jan DeWaters is an Associate Professor at Clarkson University in Potsdam, NY, USA. Her research focuses on effective, inclusive teaching and learning in engineering education. She is also interested in energy education, and has developed and applied quantitative and qualitative measures of energy literacy to help us understand how energy education can improve energy literacy in various settings. She has published her work in national and international conferences and journals, and is a recent recipient of the Women in Engineering Division of the American Society for Engineering Education's EEEG award, an early career award that celebrates strong leadership and support for female/minority engineering students.

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Chengbin Yu[1*], Young Seok Song[2*]

1*Chengbin Yu, Researcher, Seoul National University, Seoul, Korea.

[2*]Young Seok Song, Professor, Dankook University, Yongin-si, Gyeonggi-do, Korea.

Cross-linked graphene/cysteamine aerogel (GCA) supported form-stable phase change materials (PCMs) for pyroelectric energy harvesting

Phase change materials (PCMs) can absorb and release a large amount of heat during the phase transition process. However, the leakage problem is a serious problem that restricts the thermal energy application. To prevent the leakage problem and sustain high thermal energy storage (TES), the supporting material is selected to hold plenty of pure PCM to fabricate form- stable PCM composite. For supporting material, 3D porous graphene aerogel is an appropriate substance because of its excellent thermal and chemical stabilities. Therefore, the graphene aerogel supported PCM composite exhibits an initial solid state upon melting process without any leakage. Although the high porosity of graphene aerogel can sustain the form stability, volume shrinkage causes some loss of internal space which can decrease the TES of PCM composite. To reduce the volume shrinkage, increase the mechanical property and flexibility of graphene aerogel is mentioned that cross-linked internal structure of graphene aerogel is fabricated in this work. This graphene aerogel is synthesized by the cysteamine vapor method and obtain the graphene/cysteamine aerogel (GCA). The GCA can reduce the volume shrinkage and infiltrate the pure PCM effectively. Thus, the GCA supported PCM composite has high form stability and provides sufficient thermal energy during the phase transition process. The PCM composites are connected to the pyro-electrode that the pyroelectric power generator can produce stable and continuous output electrical voltage and current without any leakage during the light- on/-off process.

Biography

Have published 17 papers (13 first author, 4 co-author) and 7 papers (3 first author, 4 co-author) are under revision process. The published journals are Energy Conversion and Management, Macromolecular Research, Fibers and Polymers, Polymers for advanced technologies, Journal of Sound and Vibration, Materials & Design, Journal of Polymer Research, ACS Applied Energy Materials, Nanomaterials, Chemical Engineering Journals, and Applied energy.

[1]Noriko Irie and [2]Naoko Kawahara

[1]Department of Environmental Design, Faculty of Collaborative Regional Innovation, Ehime University, Ehime, Japan.
[2]Faculty of Business Administration, Kindai University, Osaka, Japan.

Harvesting costs of forest biomass in Japan: A Bayesian multilevel meta-analysis

Forest biomass can become a promising alternative energy source, and its usage could lead to the conservation of forest ecosystems and increase the carbon sequestration potential of forests. These are termed in economics as positive externalities, and they have prompted considerable interest in the supply potential of forest biomass and the socio-environmental impacts of forest biomass usage. However, studies on the costs of forest biomass usage are lacking, which is crucial to realistically calculate the biomass usage potential of forests in Japan and the world.

To fill this knowledge gap, the present study aims to estimate the harvesting cost of forest wood biomass in Japan using a Bayesian meta-analysis. We analyzed 31 studies from Japan, which included 51 data points. The estimated harvesting cost was lower than the typical harvesting costs reported in Japan.

Biography

Dr. Noriko Irie earned a Diploma and a MSc in Applied Environmental Economics at the Imperial College, a MPhil in Environmental Policy at the Land Economy Department of the University of Cambridge, and a PhD from the University of Tokyo. She is an Associate Professor at the Department of Environmental Design, Faculty of Collaborative Regional Innovation in the National University Corporation Ehime University, Japan. She also has a working experience in environmental management and have knowledge of environmental and energy facilities.

[1]Noriko Irie and [2]Naoko Kawahara

[1]Department of Environmental Design, Faculty of Collaborative Regional Innovation, Ehime University, Ehime, Japan.
[2]Faculty of Business Administration, Kindai University, Osaka, Japan.

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To fill this knowledge gap, the present study aims to estimate the harvesting cost of forest wood biomass in Japan using a Bayesian meta-analysis. We analyzed 31 studies from Japan, which included 51 data points. The estimated harvesting cost was lower than the typical harvesting costs reported in Japan.

Biography

Naoko Kawahara earned a Diploma in Academic English at International Foundation Courses and English Language Studies of the SOAS University of London, and a MSc in Finance and Financial Law at the Centre for Financial and Management Studies of the SOAS University of London. She is a professor at the Department of Accounting, Faculty of Business Administration in Kindai University, Japan. She also possesses work experience as a certified public accountant in Japan.

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Anders E Carlsson

[1]Department of Physics, Washington University, St Louis, MO, USA,

Enhancing the Efficiency of Underground Thermal Energy Storage by Mathematical

A major obstacle to extensive deployment of renewable energy sources is their seasonal intermittency. Borehole thermal energy storage (BTES) is an inexpensive technology that can mitigate this intermitency. Hot water is pumped from the center to the edge of an array of boreholes to heat it in the summer, and heat is discharged in winter by reversing the process. Mathematical modeling is key to efficiency improvement. I develop an approach to modeling BTES that is simpler than most existing approaches. It focuses on the average radial flow of water, and develops coupled 1d reaction-diffusion equations for the water and soil temperatures. These are supplemented by a time-dependent heat-transfer coefficient. With two adjustable parameters, the model fits four-year temperature data at 10-minute intervals from the Drake Landing Solar Community closely. I use the model to explore possible modifications to the charging and discharging strategies. A strategy in which heated water is discharged at variable distances can increase the efficiency by over 20% in some cases.

Biography

Anders Carlsson received his PhD from Harvard University, USA and did postdoctoral studies at Cornell University, USA. He is a Professor of Physics at Washington University in St Louis. He has published more than 150 papers in reputed journals.

Kevin P. Hallinan, Hao Lu, Austin Mitchell, Alan Schroeder

[1]Department of Mechanical Engineering, University of Dayton, Dayton, OH, USA.
[2]Enterprise Strategy and Risk, NiSource, Columbus, OH, USA.
[3]Commercial and Sustainability, Evolution Midstream, LLC, Denver, Co, OH, USA.

Blockchain-Based Finance of Resilience Enabling and Economically Beneficial Microgrid Clean Energy Projects Anywhere and at Any Scale

The 2022 IPCC report on climate change presents a dismal future for humanity and the planet. It calls for massive governmental action. But the prospect of such action is dim. Here, we offer a solution that is not dependent upon governmental action. The system we've devised includes: (1) a contracting mechanism, which will eventually be automated, to enable communities to develop a microgrid system to meet their power demand needs and aspirations, as well as other needs such as healthy resilient food production, community WiFi, and/or clean water production; (2) a community income generation stream through the inclusion of blockchain based data and bitcoin miners as part of the microgrid to enhance the ROI of each project; (3) a smart contracting mechanism to enable impact investment from investors worldwide at any scale via a digital currency stream; and (4) a blockchain-enabled automatic distribution of income from the mining functions to the impact investors. The development of this system for each of these components is ongoing. But the prospect is exciting. Across all cryptocurrencies, total transaction volume grew to $15.8 trillion in 2021, up 567% from 2020's totals. The need for more cryptocurrency mining is assured. Additionally, distributed data mining is the latest trend in order to mitigate the cybersecurity issues associated with large data mining farms. Thus, there is real potential to enable projects which bring income, clean energy, and other community benefits to the world at a scale sufficient to make a dent in worldwide carbon emissions.

Biography

Kevin P. Hallinan is currently a Professor in the Department of Mechanical and Aerospace Engineering and Director of the Renewable and Clean Energy Program. His Ph.D. was from Johns Hopkins University in 1988. His research research focuses on community level sustainability with equitable impact. Hallinan is author of nearly 150 archival papers mainly focused on sustainable energy, has successfully graduated 28 Ph.D. students and has garnered funding in support of his research of nearly $5M. He is also a contributor to Synota, a start-up social enterprise seeking to bring clean energy to the world at any scale.

Soshu Kiriahra

JWRI, Osaka University, Japan.

Stereolithographic Additive Manufacturing of Electromagnetic Devices

In stereolithographic additive manufacturing (STL-AM), 2-D cross sections were created through photo polymerization by UV laser drawing on spread resin paste including nanoparticles, and 3-D models were sterically printed by layer lamination. The lithography system has been developed to obtain bulky ceramic components with functional geometries. An automatic collimeter was newly equipped with the laser scanner to adjust beam diameter. Fine or coarse beams could realize high resolution or wide area drawings, respectively. As the row material of the 3-D printing, nanometer sized metal and ceramic particles were dispersed into acrylic liquid resins at about 60 % in volume fraction. These materials were mixed and deformed to obtained thixotropic slurry. The resin paste was spread on a glass substrate at 50 μm in layer thickness by a mechanically moved knife edge. An ultraviolet laser beam of 355 nm in wavelength was adjusted at 50 μm in variable diameter and scanned on the spread resin surface. Irradiation power was changed automatically for enough solidification depth for layer bonding. The composite precursors including nanoparticles were dewaxed and sintered in the air atmosphere. In recent investigations, ultraviolet laser lithographic additive manufacturing (UVL-AM) was newly developed as a direct forming process of fine metal or ceramic components. As an additive manufacturing technique, 2-D cross sections were created through dewaxing and sintering by UV laser drawing, and 3-D components were sterically printed by layer laminations with interlayer joining. Though the computer aided smart manufacturing, design and evaluation (Smart MADE), practical materials components were fabricated to modulate energy and material transfers in potential fields between human societies and natural environments as active contributions to Sustainable Development to Goals (SDGs).

Biography

Soshu Kirihara is a doctor of engineering and a professor of Joining and Welding Research Institute (JWRI), Osaka University, Japan. In his main investigation “Materials Tectonics as Sustainable Geoengineering” for environmental modifications and resource circulations, multi-dimensional structures were successfully fabricated to modulate energy and materials flows effectively. Ceramic and metal components were fabricated directly by smart additive manufacturing, design and evaluation (Smart MADE) using high power ultraviolet laser lithography. Original stereolithography systems were developed, and new start-up company “SK-Fine” was established through academic-industrial collaboration

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Seongwoo Woo[1]

[1]Seongwoo Woo, Ph.D., Manufacturing Technology, Mechanical Technology Faculty, Ethiopian Technical University, Addis Ababa PO box 190310, Ethiopia.

Improving the Reliability Design of Mechanical Systems

To enhance the lifetime of mechanical system such as automobile, new reliability methodology – parametric Accelerated Life Testing (ALT) – suggests to produce the reliability quantitative (RQ) specifications—mission cycle—for identifying the design defects and modifying them. It incorporates: (1) a parametric ALT plan formed on system BX lifetime that will be X percent of the cumulated failure, (2) a load examination for ALT, (3) a customized parametric ALTs with the design alternatives, and (4) an assessment if the system design(s) fulfill the objective BX lifetime. So we suggest a BX life concept, life-stress (LS) model with a new effort idea, accelerated factor, and sample size equation. This new parametric ALT should help an engineer to discover the missing design parameters of the mechanical system influencing reliability in the design process. As the improper designs are experimentally identified, the mechanical system can recognize the reliability as computed by the growth in lifetime, LB, and the decrease in failure rate, □. Consequently, companies can escape recalls due to the product failures from the marketplace. As an experiment instance, two cases were investigated: 1) problematic reciprocating compressors in the French-door refrigerators returned from the marketplace and 2) the redesign of hinge kit system (HKS) in a domestic refrigerator. After a customized parametric ALT, the mechanical systems such as compressor and HKS with design alternatives were anticipated to fulfill the lifetime – B1 life 10 years.

Biography

Dr Woo has a BS and MS in Mechanical Engineering, and he has obtained PhD in Mechanical Engineering from Texas A&M. He majors in energy system such as HVAC and its heat transfer, optimal design and control of refrigerator, reliability design of thermal components, and failure Analysis of thermal components in marketplace using the Non-destructive such as SEM & XRAY. In 1992.03–1997 he worked in Agency for Defense Development, Chinhae, South Korea, where he has researcher in charge of Development of Naval weapon System. He was working as a Senior Reliability Engineer in Refrigerator Division, Digital Appliance, SAMSUNG Electronics. Now he is working as associate professor in mechanical department, Ethiopian Technical University.

Suresh Aluvihara[1]*, C.S. Kalpage[1], P.W.S.K. Bandaranayake[2], W.M.A.T. Bandara[3]

[1]Department of Chemical and Process Engineering, University of Peradeniya, Peradeniya, Sri Lanka.
[2]Department of Physics, University of Peradeniya, Peradeniya, Sri Lanka.
[3]Department of Chemistry, University of Peradeniya, Peradeniya, Sri Lanka.

Investigations and Analysis of Earth Materials towards the Developments in Some Advanced Chemical and Catalytic Uses

Earth materials are some sort of valuable resources with some multiples uses in some of industrial purposes and they are obtaining some economical values based upon the demand and the abundance. According to the most of research and experiments that relevant with the characteristics of solid earth materials. m ainly there were obtained and disclosed some various outstanding physic-chemical characteristics of a large number of earth materials including the applications of material processing, nano-materials, composite materials and hard materials. In the existing research there were expected to characterize some selected clay varieties, a dolomite variety and a feldspar variety which are available in Sri Lanka towards the developments especially in some advanced chemical and catalytic applications. The X-ray fluorescence (XRF) spectroscopic analysis and Scanning electron microscopic (SEM) analysis were done for all of selected materials. The X-ray diffraction (XRD) analysis was done for three different selected clays and the Fourier transforms infrared (FT-IR) spectroscopic analysis was done for three different clay types and for a dolomite variety. According to the obtained results for the research, there were found the presence of at least 75% of Fe as the major element in each of clay with some other trace metallic elements such as K, Ti, Ca, Ba and Zr in such clays, kaolinite, montmorillonite and some of Fe minerals namely as muscovite and glauconite in such clays with quartz as a non-clayey mineral. There were found some higher amount of calcite in the selected dolomite with a trace amount of K and also there were found some higher K and Ca amounts presence in the selected feldspar rocks. When comparing the obtained results with past research out comes and modifications of materials, it seems that these materials will be much useful in the industrial applications such as the catalytic activities, waste water treatment applications in the removal of heavy metals due to the adsorption capacity, ion exchanging materials to remove unnecessary ions from waste water and in the removal of hardness from waste water due to the adsorption capacity of dolomite.

Biography

Mr. Suresh Aluvihara is a postgraduate research scholar at the Department of Chemical and Process Engineering, University of Peradeniya, Sri Lanka since the year 2018 under the disciplines of Environmental Engineering, Chemical and Water Engineering. He received his B.Sc. (Hon's) degree in Mineral Science in the year 2017 from a recognized state government university in Sri Lanka. When considering his academic background, he is having a large number of research publications under the modes of abstracts, full papers and conference papers while incorporating with some reputed research symposiums, international research conferences and journals. In addition that he has taken a part of the roles of keynote speaker, invited speaker, featured speaker and organizing committee member of some world recognized conference and webinars.

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A Case Study of HVAC System Optimization with Smart Valves Installed in a Library

This research is based on the construction of the air-conditioning system in the National Yang Ming Chiao Tung University Library. Since the system has been installed with smart valves and running for several years, the annual power consumption has been observed with significant energy-saving effects. The research had tried to figure out more advanced energy-saving effects by adding other control methods.

However, due to the lack of control mode and equipment data before the smart valves were installed in the experiment, in this research, the model of the smart valves installed in accordance with the current control methods was first designed and verified with the actual measurement data. To simulate the energy saving of the part of the building, flow meters and thermometers were installed to catch the operation status data of the air conditioning system. After collecting and analyzing parameters such as building structure and space, Simulink and COMSOL are used to construct a numerical parameter similar to the real case field in the control methods and flow with heat transfer respectively.

This model is the structure of the installed smart valves. Based on this, the control parameters are modified to simulate the energy consumption of the earlier air conditioner before the smart valves are installed, so as to compare with the energy consumption after the smart valves are installed to analyze the improvement benefits. And we used different control methods to compare the energy saving and try to obtain more energy saving with different air conditioning control modes.

Biography

Yen-Tang Chen is currently doing doctoral research at the National Taipei University of Technology and is also a lecturer in the Department of Aircraft Engineering at the Army Academy. This research is the content of doctoral thematic research.

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Modified technological scheme for the remove of inorganic nitrogen species in WWTP of the Causeni city

Ammonium ion exported from water basins is a product largely derived from the degradation of organic matter of protein origin, manifested a selective toxic effect. Similar to carbon dioxide and methane, it is a final product of living organisms and substrates of the combustion/fermentation processes. The influe- influence of the decomposition of excrements, an activity product of animals and man, must be taken into account in the wastewater analysis as a source of NH_4^+. About 20 - 60 mg/L of NH_4^+ of urban and rural domestic wastewaters in the Republic of Moldova, at the entrance to the WWTPs, contain over 100 mg/L of NH_4^+. Wastewaters from animal complexes usually exceed 1600 mg/L NH_4^+ and sometimes even up to 5600 mg/L of NH_4^+, much higher than in more developed countries. The presence of ammonium ions in natural waters stimulates an increase in algae and heterotrophic (e.g *Pseudomonas putida*) and autotrophic (*AOB*, *Nitrosomonas and Nitrosospira*; *AOA*, *Nitrososphaerea, Nitrosopumilus*) bacterial activities. As a result of the degradation and decarboxylation of protein amino acids, the aquatic environment contains a large variety of organic ammonium derivatives, in which hydrogens partially or totally are replaced by different radicals. Analysis of natural waters was accomplished according to the current ISO methods. In order to estimate the processes taken place in each bioreactor of the Causeni city WWTP and the effects of nitrogen migration in different forms ($NH_4^+ \leftrightarrow NO_2^- \leftrightarrow NO_3^- \leftrightarrow ... \leftrightarrow N_2$), research laboratory investigations of CCO_{Cr}, NO_2^-, NO_3^-, NH_4^+ as well as the preliminary analysis of change dynamics were performed. The first variant tested with prolonged aeration treatment with sludge 24-30 days age, dose by volume 130-100 mL, dose by weight 2.71-3.21 g/dm^3 showed an insufficient efficacy, which did not fall within the norms discharge into the aquatic environment. The elimination of organic substances and nitrification took place completely, while the denitrification occurred only in the secondary decanter, being an unacceptable fact and leading to unstable treatment processes due to the sludge floating. The second variant tested, with the inclusion in the purification of the consecutive aeration-anoxic-aeration zones with sludge age of 30 days, dose by volume 130-190 mL, dose by weight 2.9-3.4 g / dm^3, showed enough efficiency. In this case, however, the quality of the treated water did not fall within the norms of discharge into the aquatic environment compared only to NO_2^-. This is explained by the lack of oxygen in the biofilter, for technical reasons of the potential of air aggregates and can be overcome by their adjusting. At oxygen deficiency below 2 mg/dm^3, the rate of multiplication of the bacterial mass at the first stage of nitrification $NH_4^+ \rightarrow NO_2^-$ was higher than the rate of multiplication of the bacterial mass at the second stage $NO_2^- \rightarrow NO_3^-$, as a result of the accumulation of nitrites in treated waters. The succession of anaerobic and anaerobic treatment was shown to increase the elimination effect of biogenic substances, while the inclusion in consecutive schemes of biological treatment of adjoining areas substantially amplified this effect in the same technological volumes with a reduced air consumption for aeration using oxygen from nitrates.