The 7th International Conference on New Energy and Future Energy Systems (NEFES 2022)

CONFERENCE PROGRAM

October 25-28, 2022, China Standard Time (GMT+8)

Online by Microsoft Teams

For NEFES 2022 Academic Exchange Only

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Part II Keynote Speeches

Keynote Speech 1: Hydrogen Energy Systems: Supporting Sustainable Energy and Sustainable Development

Prof. Marc A. Rosen
University of Ontario Institute of Technology, Canada

Biography: Marc A. Rosen is a Professor at the University of Ontario Institute of Technology in Oshawa, Canada, where he served as founding Dean of the Faculty of Engineering and Applied Science. Dr. Rosen was President of the Engineering Institute of Canada. A registered Professional Engineer in Ontario, he serves as Editor-in-Chief of several journals and was a Director of Oshawa Power and Utilities Corporation. With over 60 research grants and contracts and 900 publications, Dr. Rosen is active in sustainable energy, environmental impact, and energy technology (including renewable energy and efficiency). Much of his research has been carried out for industry, and he has written numerous books. Dr. Rosen has worked for such organizations as Imatra Power Company in Finland, Argonne National Laboratory near Chicago, and the Institute for Hydrogen Systems near Toronto. Dr. Rosen has received numerous awards and honors, and is a fellow of several societies and organizations.

Abstract: Through hydrogen energy systems, the energy carrier hydrogen is a key facilitator of sustainable energy and can contribute significantly to attaining sustainability and sustainable development. As easily accessible fossil fuel supplies become increasingly scarce and environmental concerns escalate, hydrogen energy is likely to become an increasingly important. With the world's energy sources becoming less fossil fuel-based, hydrogen and electricity are expected to be the two dominant energy carriers for the provision of end-use services, in a hydrogen economy. A hydrogen economy involves many types of hydrogen energy systems, which together allow greater use of renewable energy resources. Routes to hydrogen production are possible from various energy sources, including renewable and non-renewable energy sources. In fact, numerous commercial and pre-commercial processes exist for producing hydrogen from various fossil fuels as well as non-fossil fuel sources like solar energy, wind energy, bioenergy energy and various other types of renewable in addition to nuclear energy. Renewable energy options are usually considered more sustainable. Furthermore, technologies exist and are undergoing development for the storage, transport, distribution and utilization of hydrogen, especially in the transportation and energy utility sectors. In this presentation, the role of hydrogen as an energy carrier and facilitator of sustainable energy is described and illustrated, and hydrogen energy systems that can contribute to a sustainable world are reviewed and discussed.

Keynote Speech 2: Topology and Formation of Current Source Step Down Resonant Switched Inductor Converters

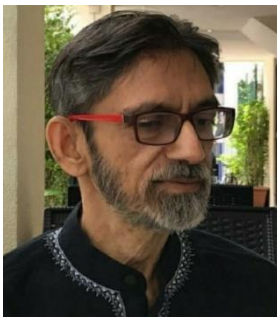
Prof. Eric Cheng

Power Electronics Research Center, Department of Electrical Engineering, The Hong Kong Polytechnic University, Hongkong, China

Biography: Prof. Eric Cheng obtained his BSc and PhD degrees both from the University of Bath in 1987 and 1990 respectively. Before he joined the Hong Kong Polytechnic University in 1997, he was with Lucas Aerospace, United Kingdom as a Principal Engineer and led a number of power electronics projects. He is the electrical designer for the Hong Kong 1st commercial electric vehicle in Hong Kong. He is also the designer for the 1st charging network in Hong Kong. He received the numerous awards related to electrical engineering, energy and automotive. He has published over 500 papers and 7 books. He has over 100 interviews by media on his research and development. He is now the professor and director of Power Electronics Research Centre of the university. His research interests are all aspects of Power electronics, Power Quality, Renewable Energy, Motor Drives, Energy Storage, Energy Saving, Power Distribution, EMI, High Speed Rail, Electric Vessel, Electric Vehicle and Automotive Advanced Components. He is the recipient of the international award in Seoul International Invention Fair 2015 Gold prize for his contribution in super-capacitor to electric vehicles, 2016 iCAN Gold Medal for his contribution in active suspension, and Gold Award of Hong Kong Innovation and Technology in 2017 and Geneva's Invention Expo Silver Award for his contribution in antilock braking system and top 20 Tera Award in 2021. Prof. Cheng is a chartered engineer and a fellow of IEEE and IET.

Abstract: A current converter is discussed here that uses inductor based for the interim energy storage. A family of the circuits for step down conversion is examined for both non-inverting and inverting operations. The paper has disclosed the method of the generation so that any order of 1/n conversion ratio can be made. One of the features is to use two transistors only in common half-bridge style. The main contribution is its special current conversion capability and soft-switching because it eliminates switching loss and the spike in the devices using a resonant capacitor with the switched-inductor. The performance has been proved to work well for current bucking. This is a new concept of the power converter and is an advanced development of the conventional switched-inductor converter, switched-capacitor and resonant converter. It is a duality of the switched-capacitor converter. The talk provides a theoretical approach for current source topology and its formation. It prepares for vast applications in the current source photovoltaic system and current mode system. The converter family has been confirmed by experiment and simulation. Benchmarking comparison with similar converters has been made and advanced features have been described. The proposed converter presents current mode research for increasing application in the coming decade. The talk will discuss the new method of power conversion and the design method. The main feature and the advantage against all other converters will be presented. It represents a good alternative to the classical volate mode power converters and is a new energy system.

Keynote Speech 3: The Daunting Problem of Sewage Treatment in Developing Countries and SHEFROL® Technology as a Possible Solution



Prof. S. A. Abbasi
Centre for Pollution Control & Environmental Engineering, Pondicherry University, India

Biography: Prof. S. A. Abbasi has been a full university professor and centre director during 1987-2015 and is an Emeritus Professor since then. Prior to it he was Head-in-charge of the Water Quality & Environment Division at the Centre for Water Resources, Kozhikode (1979-87), and a Visiting-cum-adjunct Professor at California State University (1984-1987). He has also been a Visiting Professor at the universities of Minnesota, Florida, California–Berkeley, Malaya and Al-Ahsa. With 45 books, over 400 papers in indexed journals, 12 patents, over 17,000 citations and a Hirsch Index currently at 70, Prof. Abbasi is among the world's foremost experts in the fields of process safety and environmental engineering. In the recent Stanford University study, he was ranked among the world's top 0.5% scientists, and among the top 100 Indian scientists, independent of the area of specialization. Among numerous coveted honours and awards received by him are the National Design Award in Environmental Engineering, the IPCL award for Safety and Hazard Management in Petroleum Industries, the National Hydrology Award, the International Desalination Association's prize, and fellowships of the National Academy of Sciences and the Indian Institute of Chemical Engineers. Prof. Abbasi is also well-known for his poetry (ghazal and geet), fiction, and his work on fostering inter-faith harmony. In 1991 Prof. Abbasi had set up, and has led since then, a research group on accident forecasting, risk assessment, and occupational safety at Pondicherry University. The group is among the most productive in Asia and has spearheaded the Indian R & D thrust in this field all through.

Abstract: India is one of the world's largest economies as well as one of the most advanced countries vis a vis science and technology. Yet as much as 80% of the sewage that's generated in India, estimated as 1000 billion litres per year, is discharged in its raw form into water bodies or on land. Similar is the situation in most other developing countries. It is so because the cost and other resources needed to achieve sewage treatment by the conventional activated sludge process and its variants are prohibitive. The alternative technologies requiring lesser inputs of machinery and maintenance, viz the ones based on constructed wetlands, have large land requirements. In recent years floating wetlands have been introduced but they are too slow to be effective in treating raw sewage. But disposal of untreated sewage into water-bodies is playing havoc with the environmental health. Besides polluting rivers, lakes, ponds, and open lands (on which sewage is discharged), it harms the human health in a myriad ways. Apart from the diseases caused by direct contamination, it promotes breeding of disease vectors. As a result, not only millions of productive man-days are lost every year but also billions of rupees have to be spent in curing sewage-related diseases, severely stressing the health care system. In recent years these authors have developed a novel sheet-flow-root-level (SHEFROL) bioreactor to meet this challenge. The innovation has received a patent as well as a trademark and has been licensed for commercialization. Several studies carried out at bench and pilot scales have established that by innovative use of short-statured macrophytes in soil-less and scaffold-free channels, through which sewage is made to flow at root level, very substantial primary and secondary wastewater treatment is achieved along with significant tertiary treatment. The system design ensures such an efficient turbulation as well as diffusive and plant-mediated natural aeration that no mixers or aerators are needed. The system essentially runs on solar and gravitational energy. Further details on the technology are presented.

Keynote Speech 4: Renewable Energy Systems: Current Status in the World and Prospects

Prof. Soteris A. Kalogirou
Department of Mechanical Engineering and Materials Sciences and Engineering, Cyprus University of Technology, Cyprus

Biography: Professor Soteris Kalogirou is at the Department of Mechanical Engineering and Materials Sciences and Engineering of the Cyprus University of Technology, Limassol, Cyprus. He is currently the Dean of the School of Engineering and Technology. In 2011 he received from the University of Glamorgan the title of D.Sc. He is a Fellow of the European Academy of Sciences and Founding Member of the Cyprus Academy of Sciences, Letters and Arts. For more than 35 years, he is actively involved in research in the area of solar energy and particularly in flat plate and concentrating collectors, solar water heating, solar steam generating systems, desalination and absorption cooling. He has a large number of publications as books, book chapters, international scientific journals and refereed conference proceedings. He is Editor-in-Chief of Renewable Energy and Deputy Editor-in-Chief of Energy, and Editorial Board Member of another seventeen journals. He is the editor of the book Artificial Intelligence in Energy and Renewable Energy Systems, published by Nova Science Inc., co-editor of the book Soft Computing in Green and Renewable Energy Systems, published by Springer, editor of the book McEvoy's Handbook of Photovoltaics, published by Academic Press of Elsevier and author of the books Solar Energy Engineering: Processes and Systems, and Thermal Solar Desalination: Methods and Systems, published by Academic Press of Elsevier. He has been a member of World Renewable Energy Network (WREN) since 1992 and is a member of the American Society of Heating Refrigeration and Air-conditioning Engineers (ASHRAE), Institute of Refrigeration (IoR) and International Solar Energy Society (ISES).

Abstract: This presentation examines the current status of renewables in the world. The presentation starts with some facts about the climate change, global warming and the effects of human activities such as the burning of fossil fuels on the climate problem. It then examines the current status of conventional resources of energy such as oil, coal and natural gas and their reserves based on current consumption and known resources, followed by a general outline of the status of renewables in the world, which includes the shares with respect to conventional fuel use for electricity and power and jobs created. Then the basic forms of renewables are examined in some detail, which include solar thermal, both for low and high temperature applications, photovoltaics, hydro power, onshore and offshore wind energy systems and biomass/biofuels. In all these the basic technology is presented followed by the current status as well as the prospects of the technology and new research findings.

Part III Oral Presentations

Online Oral Presentation Guidelines

- Online Oral Presentation will be conducted via **Microsoft Teams Meeting**.
- All presenters are requested to reach the Oral Session Room prior to the schedule time and complete their presentation on time.
- All presentation times are shown in **China Standard Time (GMT+8:00).**
- If a presenter is not able to show up, the session chair/conference secretary will download and play the pre-recorded video presentation during his/her scheduled presentation time, if listeners have questions about the presentation, please contact the conference secretary to forward the questions.
- If a presenter cannot show up on time or have problem with internet connect, the session chair has the right to rearrange his/her presentation, and let the next presentation start.
- Signed and stamped electronic presentation certificate would be issued via e-mail after conference.

Best Oral Presentations Selection

The session chair will select one best oral presentation from his/her session based on the following criteria:

- ✓ Research Quality
- ✓ Presentation Language
- ✓ Presentation Performance
- ✓ PowerPoint Design

Best Oral Presentations Award

- **The Best Presenter will receive an official certificate and a free registration to the NEFES 2023.**

Oral Session 1: Energy Materials and Hydrogen Energy

Time: 14:40-18:00, October 26, 2022. (China Standard Time GMT+8)

Session Chair: Dr. Yushi Liu, School of Civil Engineering, Harbin Institute of Technology, China

Session Room Link: http://www.academicconf.com/teamslink?confname=nefes2022

14:40-15:00	**FES2783**	**Sustainable Materials for Energy Storage Industry** *Dr. Jose Rajan, Center for Advanced Intelligent Material, Faculty of Industrial Sciences & Technology, Universiti Malaysia Pahang, Malaysia*
15:00-15:15	**FES2821**	**Ammonia Storage Properties of Mixed Metal Borohydrides System as a Future Energy Carrier** *Dr. Fangqin Guo, Mechanical Engineering Program Graduate School of Advanced Science and Engineering Hiroshima University, Japan*
15:15-15:35	**FES2827**	**High Energy Storage Density in $Batio_3$@Tio_2 Nanosheet/Polymer Composites** *Dr. Gang Jian, School of Materials Science and Engineering, Jiangsu University of Science and Technology, China*
15:35-15:55	**FES2828**	**Piezoelectric Fiber Composites with Polydopamine Interfacial Layer for Self-Powered Wearable Biomonitoring** *Prof. Yuanjie Su, State Key Laboratory of Electronic Thin Films and Integrated Devices, School of Optoelectronic Science and Engineering, University of Electronic Science and Technology of China, China*
15:55-16:10		**Coffee Break**
16:10-16:30	**FES2835**	**Developing a Structure-Function Integrated Thermal Energy Storage Cement Mortar Incorporating Encapsulated Hydrated Salt Phase Change Material** *Dr. Yushi Liu, School of Civil Engineering, Harbin Institute of Technology, China*
16:30-16:45	**FES2846**	**Numerical Study on Thermal Performance and Flow Characteristic of Phase Change Material Heat Storage Unit with Capsule-Shaped Structure** *Dr. Dong Yan, School of Energy Science and Engineering, Harbin Institute of Technology, China*
16:45-17:05	**FES2855**	**ZnO and Tio_2 Thin Films Based Low-Cost Hydrogen Sensors** *Prof. Satyabrata Jit, Department of Electronics Engineering, Indian Institute of Technology (BHU) Varanasi, India*
17:05-17:25	**FES2852**	**Boosting the Thermal Capacitance of Thermally Activated Buildings Using Phase Change Materials** *Dr. Muhammed A. Hassan, Mechanical Power Engineering Department, Faculty of Engineering, Cairo University, Egypt*
17:25-17:40	**FES2836**	**Subsurface Hydrogen Storage for Energy Security – Challenges and Opportunities** *Dr. Niklas Heinemann, School of Geosciences, University of Edinburgh, Edinburgh, UK*
17:40-18:00	**FES2871**	**Magnetic Properties of High Density Iron Dust Core Without Binder** *Dr. Kyyoul Yun, Gifu university, Japan*

Abstracts of Oral Session 1

FES2783: Sustainable Materials for Energy Storage Industry

Rajan Jose
Center for Advanced Intelligent Material, Faculty of Industrial Sciences & Technology, Universiti Malaysia Pahang, 26300 Kuantan, Pahang, Malaysia

Abstract. Emergence of sustainability as the new normal and consequent concerns over material sustainability for various industrial sectors accelerated materials discovery process from renewable sources. Energy storage become one of the dominant industries currently and most of the high performing energy storage devices such as lithium-ion batteries use expensive mined materials as electrodes with enormous processing and value addition. Biomass derived carbon has been suggested as a possible material for energy storage, however, they mainly suffer from lower performance indicators. We have explored augmenting properties of biomass carbon with small amounts (~5 – 10 wt.%) of metals or metal oxides to enhance the charge storage parameters in lithium-ion capacitors, battery–supercapacitor hybrids, and electrochemical capacitor storage modes besides developing eco-friendly and green routes for their processing using physical means than chemical methods. Four strategies were adopted: (i) enhancing the charge storage sites by filling large voids in porous carbon by hierarchical 3D nanoflowers or composite nanostructures, (ii) developing a thin metal oxide film over porous carbon surface through a simultaneous activation and coating process, (iii) developing a thin metal film over porous carbon, and (iv) green reduction of graphene oxide to reduced graphene oxide by means of physical methods than chemical ways. Several advanced carbon structures are thereby synthesized; in supercapacitive charge storage mode they gave charge storability of ~60% of lithium battery and ~10 times more power capability than lithium battery. Only 10% metal compositions could boost up the energy storage capabilities dramatically. Promising green processing routes are also developed which avoid large scale toxic chemicals for developing advanced materials.

Keywords: Biomass carbon, lithium ion capacitors, surface functionalization.

FES2821: Ammonia Storage Properties of Mixed Metal Borohydrides System as a Future Energy Carrier

Fangqin Guo
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Abstract. So far, fossil fuels still are the main energy source consumed in the current industry. The serious environmental issues brought by its harmful emissions cannot be neglected. Air pollution and global warming threaten our healthy life and should be avoided. With the depletion of fossil fuels and rising global temperatures, the urgent demand for renewable, clean, and sustainable fuel alternatives for energy supply must be met with all available resources. Hydrogen has emerged as a new energy vector with many advantages due to its inherent merits: high energy density, high abundance on Earth, ease of production from any primary energy (such as electricity), and most importantly, environmental friendliness due to its oxidation product being only water molecules. This implies the significant role of hydrogen in decarbonized society construction. However, it cannot be effectively stored and transported at high gravimetric and volumetric densities for practical usage due to its extremely low volumetric energy density in the gaseous state under atmospheric conditions and high energy consumption when stored in liquid or compressed states. Therefore, the use of carriers that facilitate its storage, transport, and distribution is indispensable to enabling the practical introduction of hydrogen into existing energy systems. Among the available options for practical utilization of hydrogen, ammonia (NH3) showed its huge potential as an energy carrier. In addition to being used as fertilizer, this molecule can be considered a promising renewable energy source due to its high gravimetric density of 17.8 wt% and a volumetric density of 1.5 times that of liquid hydrogen. Further, the NH3 gas is easily liquefied by compression at room temperature with 1 MPa pressure. Lastly, it is possible to burn NH3 with oxygen to release water (H2O) and nitrogen (N2). To safely and effectively use ammonia at normal pressure and temperature, ammonia storage

materials are a feasible option. Here, the systematic investigation of ammonia storage properties of mixed metal borohydrides system as a future energy carrier was conducted. The thermodynamic changes and basic properties variation will be discussed in detail in this presentation.
Keywords: Ammonia storage, thermodynamics, kinetics, metal borohydrides, density.

FES2827: High Energy Storage Density in Batio$_3$@Tio$_2$ Nanosheet/Polymer Composites

Gang Jian*, Liang Feng, Ning Yang
School of Materials Science and Engineering, Jiangsu University of Science and Technology, Zhenjiang 212100, China

Abstract. Dielectric substances exhibit great potentials for high-power capacitors due to high stability and fast charge-discharge speed. A long-term challenge is to enhance energy density. Here, $BaTiO_3$@TiO_2 nanosheets (nss) 2D hybrid particles with high aspect ratios and their polymer-matrix composites are presented in this work, aiming at combining the advantages of interfacial engineering for core-shell fillers and electron scattering for 2D platelet fillers for an effective improvement of energy density in composites. The optimal PVDF/$BaTiO_3$@TiO_2 nss-4 wt% composite reveals a dielectric constant of 12.6 and a loss of 0.021 at 1 kHz. The composite also possesses high E_b~561.2 MV m^{-1}, which is greatly increased from 407.6 MV m^{-1} for neat PVDF. The resultant $U_{d,max}$~21.3 J cm^{-3} with η~61% is realized in the composite at 550 MV m^{-1}. The existance of an optimal filler loading for maximum energy density is due to the balance between the interface defects introduced by the $BaTiO_3$@TiO_2 nss and improvement of E_b of the matrix by the filler as well. The 2D $BaTiO_3$@TiO_2 nss filled composite exhibit higher energy density than composites filled with core-shell 1D $BaTiO_3$@TiO_2 nws or non-core-shell 0D $BaTiO_3$, 1D TiO_2 or 2D TiO_2 particles. The enhanced E_b may stem from two aspects, i.e., the effect buffer function of the TiO_2 shell between PVDF and $BaTiO_3$ ($\varepsilon_{BT} > \varepsilon_{TO} > \varepsilon_{PVDF}$), which decreases the space charge at interfaces; and the enhanced area of electron scattering caused by the 2D $BaTiO_3$@TiO_2 nss, which blocks and reduces the direct migration of free charges across composites under the effect of an electric field. Finete element simulation reveals that current flow lines are rearranged through 2D fillers and values are decreased. This study presents a significant and facile hybrid strategy to develop excellent performance polymer-matrix composites for applications in high-density electrostatic capacitors.
Keywords: Dielectric, energy storage, nanosheet, mechanism.

FES2828: Piezoelectric Fiber Composites with Polydopamine Interfacial Layer for Self-Powered Wearable Biomonitoring

Yuanjie Su[1, *], Chunxu Chen[1], Weixiong Li[1], Huiling Tai[1], Yadong Jiang[1], Jun Chen[2, *]
[1] *State Key Laboratory of Electronic Thin Films and Integrated Devices, School of Optoelectronic Science and Engineering, University of Electronic Science and Technology of China (UESTC), Chengdu 610054, China*
[2] *Department of Bioengineering, University of California, Los Angeles, Los Angeles, CA 90095, USA*

Abstract. Introduction: As our world is marching into the era of Internet of things, wearable bioelectronics are becoming ubiquitous within our daily lives. Doping polymers with ceramic nanofillers is a widely-adopted routine for developing high-performance nanocomposites. However, the significant modulus mismatch and poor interfacial adhesion between the rigid piezoelectric ceramics and flexible polymers becomes a common challenge in respect to their combined utilization, which dramatically inhibits the stress transfer ability and thus largely undermines the electromechanical coupling efficiency. Herein, a dopamine based interfacial-adherent layer was designed between the inorganic BTO nanofillers and the organic piezoelectric polymer PVDF, aiming at modulating the mechanical strength and electromechanical coupling efficiency of the piezoelectric nanocomposite (Figure 1a-f). A phase-field simulation in combination with a detailed experimental investigation was carried out to study the mechanism and functionalities of dopamine as the connection at the inorganic-organic material interfaces (Figure 1i-p). Device fabrication: Surface Modification Using Dopamine: preparing Tris buffer solution (pH 8.5, 10 mm). Then, 100 mg BTO was added and ultrasonically treated for 30 min. Subsequently, 120 mg of DA·HCl was added to the solution and magnetically stirred at room temperature for

24 h to from suspension. During the stirring processes, the surface of the BTO nanoparticle was coated with a PDA layer because of the self-polymerization of DA. Preparation of Sensing Materials: 68 mg of the prepared PDA@BTO nanoparticles was solved into a mixture of DMF (6 mL) and acetone (4 mL). A follow-up ultrasonic treatment was conducted for 20 min to make the nanoparticles evenly dispersed in DMF solvent. Then, 2.25 g of PVDF powder was added to the mixture, followed by magnetic stirring for 2.5 h under a 50 °C water bath. This process facilitates the formation of hydrogen bond, leading to a stable and homogeneous PDA@BTO/PVDF spinning precursor mixed solution. Fabrication of Textile: After the solution was stirred, 30 min ultrasonication was employed to further disperse the nanoparticles. The composite film was obtained by the electrospinning process (Figure 1g). Subsequently, the flexible nanofiber composite film was cut into small pieces of 2.6 cm × 2.3 cm, and two pieces of aluminum tape (1.8 cm × 2 cm) were attached to both sides of the composite film as electrodes to form a "sandwich" configuration. Finally, the device was seal with medical tape (Figure 1h). **Results and Conclusions:** Both experimental and theoretical results indicated that the introduction of 2.15 vol% polydopamine (PDA) coating on the BTO nanoparticles could remarkably promote the local all-trans conformation and modulus match at the nanofillers-polymer interface, giving rise to the maximum piezoelectric charge coefficient and piezoelectric voltage coefficient as well as mechanical stiffness. Furthermore, the PDA modified electrospun piezoelectric textiles demonstrate high sensitivity and wide pressure sensing range of pressure sensing, revealing an outstanding capability of real-time limb motion detection, facial emotion identification, respiratory monitoring and human-machine interfacing. This work not only sheds light on the fundamental understanding of the interfacial coupling mechanism in piezoelectric nanocomposites, but also endows design strategy for modulating/optimizing piezoelectric wearable electronics.

Keywords: Nanocomposite, piezoelectric textile, wearable bioelectronics, phase-field simulation.

Acknowledgements: Y.S. acknowledges the Funds for Creative Research Groups of China (NO. 61421002), the National Natural Science Foundation of China (Grant Nos. 62074027, 61671115). J.C. acknowledges the Henry Samueli School of Engineering and Applied Science and the Department of Bioengineering at University of California, Los Angeles, for the startup support.

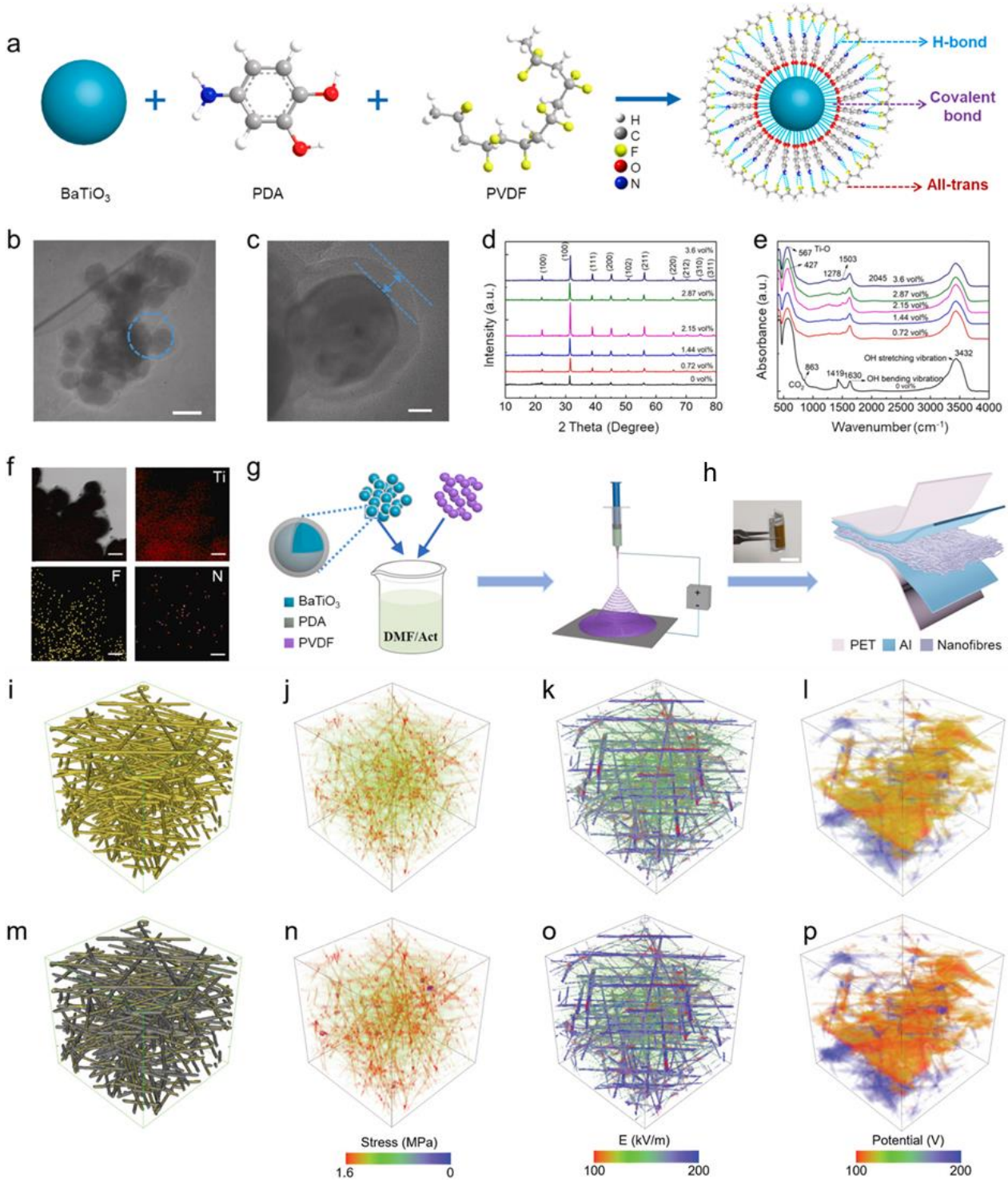

Figure 1a-p: High-performance piezoelectric textiles for wearable physiological monitoring with polydopamine interfacial layer.

FES2835: Developing a Structure-Function Integrated Thermal Energy Storage Cement Mortar Incorporating Encapsulated Hydrated Salt Phase Change Material

Kunyang Yu, Yushi Liu*, Minjie Jia, Chao Wang, Yingzi Yang

School of Civil Engineering, Harbin Institute of Technology, Harbin 150090, China

Abstract. In recent years, solar passive building containing thermal energy storage cement mortar (TESCM) based on encapsulated phase change material (PCMs) was particularly attractive, since the introduction of PCMs can enhance the thermal comfort and rationalize the thermal energy distribution in buildings. Nevertheless, the existing TESCMs generally exhibited inferior mechanical properties, which was difficult to meet the demands

of building structural materials. For this reason, this work proposed a novel TESCM by the incorporation of polyethylene glycol@SiO_2-coated eutectic hydrated salt/fly ash cenosphere encapsulated PCM (PEG@SiO_2-coated EHS/FAC) into cement mortar, in order to improve the mechanical strength. DSC, SEM and ATR-FTIR results indicated that PEG@SiO_2-coated EHS/FAC had excellent latent heat, encapsulation ability and chemical compatibility. PEG@SiO_2-coated EHS/FAC was added into cement mortar by partially replacing sand. The mechanical experiment results suggested the formed TESCM containing 20% PEG@SiO_2-coated EHS/FAC merely behaved slight decreases in terms of compressive and flexural strengths, which greatly improved the applicability as a building structural material. Furthermore, TG, XRD and BSE were carried out on the prepared TESCM to investigate its hydration degree, hydration products and the interface transition zone between PEG@SiO_2-coated EHS/FAC and matrix, and the effects of these factors on mechanical properties were deeply discussed and analysed. In addition, heating experiment and economic evaluation showed the fabricated TESCM had a prominent temperature controlling ability and energy saving performance. This work provided insights into developing a structure-function integrated cement mortar with superior mechanical strength and thermal energy storage for efficient energy saving and temperature control in solar passive buildings.

Keywords: Thermal energy storage, cement mortar, phase change materials, energy saving, solar passive buildings.

Acknowledgements: The financial support from the National Natural Science Foundation of China (No. 51902068).

FES2855: ZnO and Tio₂ Thin Films Based Low-Cost Hydrogen Sensors

Satyabrata Jit

Department of Electronics Engineering, Indian Institute of Technology (BHU) Varanasi, Varanasi-221005, India

Abstract. Due to limited resources of the natural fossil fuels, hydrogen is projected as an important energy resource for the future generation. However, the problem with the hydrogen gas is that its production, transportation, and use are very risky due to its highly explosive nature. Since hydrogen is a colorless, odorless and tasteless flammable gas, it can't be detected by human senses. Therefore, a highly efficient hydrogen gas sensor is required to detect and monitor hydrogen concentration in case of any accidental leakage. In general, metal oxides such as the ZnO and TiO_2 are widely used as the active materials for fabricating thin film hydrogen sensors. The present lecture will address the fabrication and characterization of some ZnO and TiO_2 thin-film based gas sensors using low-cost techniques such as the sol-gel and vacuum deposition methods. In this regard, the Pd/ZnO based Schottky contact based hydrogen sensors fabricated by thermal evaporation method. Various sensing parameters of the device will be presented. Then TiO_2 based metal-oxide-semiconductor (MOS) and metal-semiconductor-metal (MSM) structures will be discussed for the hydrogen gas sensing-applications. Finally, the suitability of the solution processed ZnO quantum dots for hydrogen detection will be presented. Some hydrogen sensors operating at room-temperature or low-temperatures will also be considered.

FES2852: Boosting the Thermal Capacitance of Thermally Activated Buildings Using Phase Change Materials

Muhammed A. Hassan

Mechanical Power Engineering Department, Faculty of Engineering, Cairo University, Giza 12613, Giza, Egypt

Abstract. One promising technology for reducing the energy consumption of the building sector is radiant heating and cooling, where liquid streams are circulated inside the building mass at relatively lower and higher temperatures (compared to conventional air-based systems) in heating and cooling modes, respectively. A hybrid radiant/air HVAC system comprises the aforementioned hydronic system, alongside a downsized air system for ventilation and management of latent loads. Assuming reliable operation and control, the dual system can drastically improve the energy savings and indoor thermal environment. In modern building envelopes, the lightweight structures have relatively small thermal masses. Hence, phase change materials could be used for

increasing the thermal masses, as well as dampening the indoor temperature variations (through periodic melting and solidification) and shifting the peak loads. Despite the lack of studies on the integration of both technologies in the same building system, the limited available studies in the literature demonstrate energy-saving potentials of up to ~50% in both heating and cooling modes. In this presentation, key studies from the literature will be highlighted. Then, the presentation will discuss the main results from the simulations we carried out to investigate the feasibility of this technology for typical offices in the arid desert climate of Egypt, where we achieved energy savings of up to ~18.5%. Finally, side-by-side experimental comparisons between systems with and without phase change materials will be demonstrated.

Keywords: Thermally activated building system, Radiant cooling, Phase change materials, Thermal storage, Dynamic simulation.

Acknowledgments: The author would like to acknowledge the appreciated input of Mona A. AbdelMawla, MSc, the research assistant of Mechanical power Engineering at Cairo University.

FES2836: Subsurface Hydrogen Storage for Energy Security – Challenges and Opportunities

Niklas Heinemann[1,2], Matthew Booth[2]

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Abstract. The rise in energy prices world-wide, accelerated by the war in Ukraine, has once again exposed the volatility of the global energy market, and the dependence of major economies on external supplies from politically sensitive areas. Measures towards energy independence, while simultaneously complying with climate agreements, will most likely require a substantial expansion of subsurface energy storage. Hydrogen is attracting global attention as a future low-carbon fuel to decarbonise transport, power and heating, as well as fuel-energy intensive industries. Hydrogen made from renewable sources such as solar and wind can be stored in large quantities, which can help to increase the efficiency of renewable energy sources and provide energy security. Firstly, hydrogen produced with renewable electricity that would otherwise be curtailed, can be stored and then reproduced during times of low renewable energy production, and hence can help to alleviate the seasonal intermittency of renewable energy sources. Secondly, green hydrogen stored as emergency backup could be an effective way to increase energy security and reduce the reliance on short and mid-term disruptions of energy imports. Hydrogen can be stored in geological rocks such as halite (salt) or in porous rock reservoirs (porous media). In this presentation, we will outline the scientific and technical challenges of hydrogen storage in porous media, in order to highlight the opportunities and spark a discussion about potential risks. We will introduce cushion gas as an important component of the storage operation. Cushion gas is an expensive investment, and we will introduce ways to optimise the storage operation by reducing the cushion gas to working gas ratio. Furthermore, we will review the fluid flow behaviour of hydrogen in subsurface reservoirs, introduce the probability of geochemical reactions caused by stored hydrogen, and discuss biotic reactions enabled by the presence of excess hydrogen. This summary of opportunities and challenges related to hydrogen storage in porous media will support informed decision making with regards to operational strategies and help to ensure the safe and efficient implementation of low-carbon hydrogen energy storage.

Keywords: Subsurface hydrogen storage, energy transition, energy storage.

FES2846, FES2871 To avoid repeatability issue, the abstracts will be available after the full papers are published in the conference proceedings or other journals.

Oral Session 2: Mathematics Applications in Energy Engineering

Time: 09:00-12:20, October 27, 2022. (China Standard Time GMT+8)

Session Chair: Assoc. Prof. Takuji Matsumoto, Faculty of Transdisciplinary Sciences for Innovation, Kanazawa University, Japan

Session Room Link: http://www.academicconf.com/teamslink?confname=nefes2022

09:00-09:20	**FES2792**	**Rapid Identification of Reactivity for The Efficient Recycling of Coal Fly Ash: Hybrid Machine Learning Modeling and Interpretation** *Prof. Chongchong Qi, School of Resources and Safety Engineering, Central South University, China*
09:20-09:40	**FES2851**	**Construction of Interpretable GAM-Based PV Forecasts That Outperform the Prediction Accuracy of Machine Learning Methods** *Assoc. Prof. Takuji Matsumoto, Faculty of Transdisciplinary Sciences for Innovation, Kanazawa University, Japan*
09:40-09:55	**FES2865**	**Chip Packaging Interaction of SiC Junction Barrier Schottky Diode Packages** *Prof. Sung-Uk Zhang, Dong-Eui University, Korea*
09:55-10:10	**FES2860**	**Novel Deep-Sea Hybrid Wind-Wave Energy System Using Tension Leg Platform and Hydraulic Piston Pumps** *Mr. Yiming Liu, Mulgrave School, Canada*
10:10-10:20		**Coffee Break**
10:20-10:35	**FES2728**	**Solar Powered Ice Maker System in Karimunjawa Island, Indonesia** *Assoc. Prof. Yuli Setyo Indartono, Faculty of Mechanical and Aerospace Engineering, Institut Teknologi Bandung, Indonesia*
10:35-10:50	**FES2893**	**Optimizing Target Temperature and Fan Mode of Intelligent Cooling Management System for Energy Conservation in Smart Home Application** *Mr. Tosapon Intaraumnuay, Department of Electrical and Computer Engineering, Faculty of Engineering, King Mongkut's University of Technology North Bangkok, Thailand*
10:50-11:10	**FES2856**	**Entropy Generation Studies in Laminar Convective Flow Toward Micro-Scale** *Dr. Pallavi Rastogi, Department of Aerospace Engineering, Indian Institute of Technology Bombay, India*
11:10-11:25	**FES2853**	**Computational Fluid Dynamics Studies of a Fluidized Bed with Binary Solid Mixtures** *Dr. Arijit Ganguli, School of Engineering and Applied Sciences, Ahmedabad University, India*
11:25-11:45	**FES2787**	**Passive Cooling Chamber for Fruits/Vegetables Storage** *Dr. Muhammad Hamid Mahmood, Department of Agricultural Engineering, Bahauddin Zakariya University, Pakistan*
11:45-12:05	**FES2824**	**Hydraulic Performance of a Centrifugal Pump and Hydrophobic Surface Effects** *Prof. Hasan Koten, Istanbul Medeniyet University, Mechanical Engineering Department, Turkey*
12:05-12:20	**FES2927**	**Computation of Energy Across the Type-C Piano Key Weir Using Gene Expression Programming and Extreme Gradient Boosting (XGBoost) Algorithm** *Dr. Deepak Singh, Department of Civil Engineering, Delhi Technological University, India*

Abstracts of Oral Session 2

FES2792: Rapid Identification of Reactivity for The Efficient Recycling of Coal Fly Ash: Hybrid Machine Learning Modeling and Interpretation

Chongchong Qi, Mengting Wu
School of Resources and Safety Engineering, Central South University, Changsha, China

Abstract. As the main solid waste produced by coal combustion in thermal plant, the large accumulation of coal fly ash (CFA) causes serious environmental pollution and resource waste. Whether CFA can be recycled depends on its reactivity, which in turns can be represented by its amorphous content. This presentation will introduce a novel methodology for the rapid reactivity identification of CFA. The random forest regression models optimized by artificial bee colony (ABC) were established. The study evaluated the model using correlation coefficient, r-square, root mean square error, and mean absolute error, giving results of testing set of 0.773, 0.477, 6.542, and 5.279. Feature importance and permutation importance were used to measure feature contribution. Partial dependence plots, Shapley additive explanations, and local interpretable model-agnostic explanations were also used to give global and local interpretation of the model performance. The results proved that the established model had good robustness and generalization capability, which can effectively determine the potential of CFA as supplementary cementitious materials to promote the cleaner production of the energy industry.

Keywords: Cleaner production, fly ash reactivity, random forest regression, ABC optimization, thermal plant.
Acknowledgements: This work was supported by National Natural Science Foundation of China (52004330).

FES2851: Construction of Interpretable GAM-Based PV Forecasts That Outperform the Prediction Accuracy of Machine Learning Methods

Takuji Matsumoto[1,*], Yuji Yamada[2]
[1] *Faculty of Transdisciplinary Sciences for Innovation, Kanazawa University, Japan*
[2] *Faculty of Business Sciences, University of Tsukuba, Japan*

Abstract. In recent years, the rapid increase in photovoltaic (PV) power generation worldwide has increased the need for a highly accurate PV power generation forecasting model that is easy to implement for a wide range of electric utilities. Against this background, this study proposes PV generation forecasting models based on the generalized additive model (GAM) and examines their properties from several perspectives, including ease of interpretation and comparison of forecast accuracy with multiple machine learning methods. Specifically, we construct different GAM-based forecast models with respect to regional and individual PV power generations in Japan and confirm the effectiveness of the models by visualizing the estimated trends for their intuitive and rational interpretations. In particular, for the individual PV generation model, a new forecasting model using a 3D tensor product spline is constructed, and it is shown that the robustness and prediction accuracy of the proposed model can be improved by incorporating smoothing conditions in three different directions of season, time, and solar radiation. The prediction performance of each GAM-based model is also compared with popular machine learning (ML) methods such as the k-nearest neighbor, artificial neural networks, support vector regression, and random forests. As a result, the GAM-based models are found to outperform these ML methods in terms of both computational efficiency and prediction accuracy, where the superiority of GAM-based models in prediction accuracy is especially evident when complementing periodic trends. Our empirical results suggest that the GAM-based models, a statistical approach that more easily reflects the modeler's prior knowledge, facilitate more rational and robust model building than the ML methods, which rely more on pattern recognition of data, and can therefore contribute to improving prediction accuracy.

Keywords: Forecasting method, machine learning, non-parametric regression, photovoltaic power generation, tensor product splines.
Acknowledgements: This work was funded by a Grant-in-Aid for Scientific Research (A) 20H00285, Grant-in-Aid for Challenging Research (Exploratory) 19K22024, and Grant-in-Aid for Young Scientists 21K14374 from the Japan Society for the Promotion of Science (JSPS).

FES2728: Solar Powered Ice Maker System in Karimunjawa Island, Indonesia

Yuli Setyo Indartono[1,2] And Andhita Mustikaningtyas[1]
[1] *Faculty of Mechanical and Aerospace Engineering, Institut Teknologi Bandung, Bandung, Indonesia*
[2] *Research Center on New and Renewable Energy, Institut Teknologi Bandung, Bandung, Indonesia*

Abstract. The solar-powered ice maker was developed in Kemujan, Karimunjawa island, Indonesia. It was powered by 6.66 kWp of solar PV, 19.2 kVAh battery storage, as well as 2 kW of solar ice maker machine, and connected into the utility grid (PLN). Solar energy is applied in this system to minimize utility grid consumption, which is produced by a diesel generator. The hierarchy of the energy supply was PV, batteries, and PLN, respectively. The system is capable to produce 180 kg of ice per production cycle, with a production cycle duration of roughly 20-27 hours. On cloudy days, the renewable energy penetration is around 15-19%. The COP of the ice maker machine is 1.02 and 1.45 for production cycle with ambient brine water temperature and low brine water temperature, respectively.

Keywords. Solar, ice maker, PV, battery, renewable energy penetration, COP.

FES2856: Entropy Generation Studies in Laminar Convective Flow Toward Micro-Scale

Pallavi Rastogi* and Shripad P. Mahulikar
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Abstract. Entropy generation and energy degradation studies in laminar micro-convective flow are of interest for reducing irreversible losses. Variation of entropy generation rate ($\dot{S}_{\mathrm{gen}}$) and energy degraded (q_{deg}) are theoretically studied en-route the micro-scale. A fully developed forced convective laminar water (coolant) flow through N number of circular micro-tubes for constant wall heat flux boundary condition (q''_{w} = const. BC) is considered. The N en-route the micro-scale is increased by correspondingly decreasing each tube diameter (D_{N}) and keeping the sum total cross-sectional flow area of N tubes fixed. A given total heat flow rate ($q_{\mathrm{w,tot}}$) is to be removed by using a fixed total mass flow rate ($\dot{m}_{\mathrm{tot}}$) of water, through N tubes. Hence, the uniform wall heat flux for one of the N tubes decreases towards the micro-scale, which is "thermal under-loading" relative to a reference tube. For given micro-tube length (l), cooling capacity of the heat sink increases towards the micro-scale. For given l, there exist – (i) an optimum $D_{\mathrm{N,opt}}$, (ii) corresponding optimum natural number N_{opt} at which, the sum-total $\dot{S}_{\mathrm{gen}}$ ($\dot{S}_{\mathrm{gen,tot}}$, due to fluid friction and conduction heat transfer in fluid) is minimum. Similarly, for given l, there exist optimum $D_{\mathrm{N,deg,opt}}$ and corresponding optimum natural number $N_{\mathrm{deg,opt}}$ at which, the sum-total q_{deg} ($q_{\mathrm{deg,tot}}$, due to fluid friction and conduction heat transfer in fluid), is minimum. As l decreases, $D_{\mathrm{N,opt}}$ and $D_{\mathrm{N,deg,opt}}$ shift towards the micro-scale. General criteria for $D_{\mathrm{N,opt}}$ and $D_{\mathrm{N,deg,opt}}$ to minimize $\dot{S}_{\mathrm{gen,tot}}$ and $q_{\mathrm{deg,tot}}$ are obtained in terms of Reynolds number, Brinkman number and dimensionless l. Unlike other reported studies, the fluid temperature term in the denominator of entropy generation expression is considered as local and thus variable. Therefore, in the present research investigations, $\dot{S}_{\mathrm{gen}}$ estimates are different from energy degradation estimates. The difference in $\dot{S}_{\mathrm{gen}}$ based on reported studies and this investigation increases significantly especially towards the micro-scale. The present research findings are of significance for several practical applications for the optimum design of micro-channel heat sinks. A fully-developed laminar convective flow in a single circular micro-tube (with q''_{w} = const. BC) is "convectively overloaded" towards the micro-scale, by decreasing the micro-tube diameter (D). The $\dot{S}_{\mathrm{gen}}$ is theoretically obtained (with and without the viscous dissipation term) for a given q_{w} to be removed, using a fixed $\dot{m}$ of water flow. The uniform wall heat flux and mass flux in a tube increase towards the micro-scale, which is "thermal and flow overloading", respectively. The variations of – $\dot{S}_{\mathrm{gen}}$ due to fluid friction, fluid conduction heat transfer, and their sum-total are analyzed toward the micro-scale. Since, $\dot{S}_{\mathrm{gen,tot}}$ remains almost the same towards the micro-scale, it is worth overloading a tube for miniaturization up to the laminar-flow limit.

Keywords: Convective overloading, Brinkman number, energy degraded, entropy generation minimization, flow overloading, laminar micro-convection, micro-channel heat-sink, thermal overloading.
Acknowledgement: The authors thank the Ministry of Human Resource Development, Govt. of India, for the financial support to Dr. Pallavi Rastogi (roll no. 154010008 at IIT-Bombay) for pursuing this study.

FES2853: Computational Fluid Dynamics Studies of a Fluidized Bed with Binary Solid Mixtures

Viraj Bhatt, Arijit Ganguli*, Jaydevsinh Chavda, Harsh Gadoya
School of Engineering and Applied Sciences, Ahmedabad University, Navrangpura, Ahmedabad, 380009, India

Abstract. In the present work, hydrodynamics of a fluidized bed with binary solid mixture have been studied using CFD simulations. Two different cases one with binary mixtures of 20% large and 80% small particles and other with 40% large particles 60% small particles respectively (both of Geldart B type) are chosen. Transient and steady state flow patterns have been reported for understanding the stability and increase in bed height for the chosen mixtures. Further, the velocity, turbulence parameters and solid volume fraction profiles have been analyzed to understand the characteristics like mixing and segregation in the beds

Keywords. CFD, fluidized bed, binary mixtures, flow patterns, bed segregation.

FES2787: Passive Cooling Chamber for Fruits/Vegetables Storage

Muhammad Hamid Mahmood
Department of Agricultural Engineering, Bahauddin Zakariya University, Multan, Pakistan

Abstract. World energy consumption is increasing day by day which may lead to alarming conditions for the availability of fossil fuels in the future. The extensive use of fossil fuels also causes severe environmental degradation. The conventional fruits and vegetables storage systems consume high energy which further leads to environmental deterioration. It necessitates the development of a low-cost, energy, and environment friendly system for the storage of agricultural products. In this regard, structuring the passive cooling chamber for short-term farm-level storage of products becomes inevitable. In the passive cooling chamber, heat moves from higher temperature brick walls to wet evaporative media (sand/coconut fiber/sugarcane bagasse, etc.) that resulting in evaporative cooling. The study includes thermodynamic performance evaluation of passive cooling chamber and Physico-chemical analyses of stored products.

Keywords: Passive cooling chamber, cooling media, performance evaluation, agricultural products.

FES2824: Hydraulic Performance of a Centrifugal Pump and Hydrophobic Surface Effects

Hasan Koten
Istanbul Medeniyet University, Mechanical Engineering Department, Istanbul, 34700, Turkey

Abstract. Ncreasing amounts of consumption led people make technological improvements about energy efficiency. One of these improvements which is called biomimicry, which imitates structures and systems at nature, can be applied in various areas where decrease of energy losses are desired. It is mostly believed that decreasing sand grain roughness on surfaces decreases friction losses that can be obtained from low surface energy. This case can be seen at leaves of Lotus (N. nucifera) which shows hydrophobic properties on its surfaces. In this study, efficiency of pump and its characteristics are examined with CFD methods and performance tests. Inner surfaces of volute and impeller itself are coated to gain features of hydrophobic surfaces. Characterization of hydrophobic surfaces in flow simulations are validated with comparison of test results. To investigate the influence of low energy surfaces on hydrophobic coating, closed-loop tests are conducted using relevant measurement techniques as per international standards. made with necessary equipment. Results show that performance curves of the pump have been improved and efficiency of the pump is increased by 8.3% at its best efficiency point.

Keywords: Hydrophobic coating, hydrophobic properties, hydrophobic.

FES2865, FES2860, FES2893, FES2927 To avoid repeatability issue, the abstracts will be available after the full papers are published in the conference proceedings or other journals.

Oral Session 3: Fuel Cell, Biomass Energy, and Waste-to-Energy Technologies

Time: 14:00-18:15, October 27, 2022. (China Standard Time GMT+8)

Session Chair: Dr. Nicolo Morselli, BEELAB (Bio Energy Efficiency Laboratory), Department of Engineering "Enzo Ferrari", University of Modena and Reggio Emilia, Italy

Session Room Link: http://www.academicconf.com/teamslink?confname=nefes2022

14:00-14:20	**FES2786**	**Hybrid Systems of Metal Complexes and Oxygen Reducing Laccase** *Dr. Takashiro Akitsu, Department of Chemistry, Faculty of Science, Tokyo University of Science, Japan*
14:20-14:35	**FES2799**	**Methanol Synthesis by Gasification of Medical Plastic Waste Caused by COVID-19** *Ms. Zimiao Wang, School of Energy and Power Engineering, University of Shanghai for Science and Technology, China*
14:35-14:50	**FES2808**	**Energy Regenerative Approaches at the Urban Scale: Investigating Strategies in Compact Textures** *Ms. Federica Fiacco, Department of Architecture and Civil Engineering, City University of Hong Kong, China*
14:50-15:05	**FES2841**	**Stable Li Metal Anodes Realized by an Organic-Inorganic Composite Artificial SEI** *Dr. Xiangru Sun, College of Chemistry, Tianjin Normal University, China*
15:05-15:25	**FES2872**	**Printing Fuel Cells and Batteries on Paper for The Future Market of Portable Electronics** *Dr. Yifei Wang, School of Mechanical Engineering and automation, Harbin Institute of Technology, China*
15:25-15:40	**FES2895**	**A Brief Overview on the in Silico Studies on the Effect of Donors and π-Spacers on Dye Sensitized Solar Cells** *Dr. Anik Sen, CMDD Lab, Department of Chemistry, GSS, GITAM Deemed to be University, India*
15:40-15:55		**Coffee Break**
15:55-16:15	**FES2767**	**Energy, Environmental and Feasibility Evaluation of Tractor-Mounted Biomass Gasifier for Flame Weeding** *Dr. Nicolo Morselli, BEELAB (Bio Energy Efficiency Laboratory), Department of Engineering "Enzo Ferrari", University of Modena and Reggio Emilia, Italy*
16:15-16:30	**FES2770**	**Specific and Cumulative Exhaust Gas Emissions in Micro-Scale Generators Fueled by Syngas from Biomass Gasification** *Dr. Marco Puglia, Dipartimento di Ingegneria "Enzo Ferrari", Università degli Studi di Modena e Reggio Emilia, Italy*
16:30-16:45	**FES2822**	**Quaternary Ammonium Functionalized Polymers as Scalable Solid Sorbent for Selective and Reversible CO_2 Capture** *Dr. Cataldo Simari, Department of Chemistry and Chemical Technologies, University of Calabria, Italy*
16:45-17:00	**FES2826**	**Asia–Africa Energy Development Cooperation: Double Coincidence of Interests** *Dr. Ahmad Khaleel, Department of Economics & Dev. Studies, Federal University, Nigeria*
17:00-17:15	**FES2873**	**Comparison of Olive Cake, Argane Nut, and Argane Cake Combustion to Determine the Biomass Most Suitable for CHP System** *Dr. Ayoub Najah Elidrissi, Inational school of applied science, Morocco*

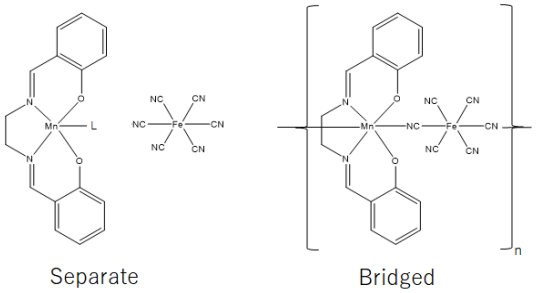
17:15-17:30	**FES2843**	**Electricity Generation and Wastewater Treatment Using Microbial Fuel Cells with Graphite and Aluminum Electrodes** *Dr. Segundo Jonathan Rojas Flores, Escuela de Ingeniería Ambiental, Facultad de Ingeniería, Universidad César Vallejo, Perú*
17:30-17:45	**FES2909**	**Modeling and Mockup Testing of a Ventilated Façade Integrating a Luminescent Solar Concentrator Photovoltaic Panel** *Dr. Giulio Mangherini, Physics and Earth Science Department, University of Ferrara, Italy*
17:45-18:00	**FES2915**	**Experimental Optimization of Castor Oil Transesterification by Central Composite Design for Biodiesel Production** *Somboon Sukpancharoen, Division of Mechatronic and Robotics Engineering, Rajamangala University of Technology Thanyaburi, Thailand*
18:00-18:15	**FES2920**	**Optimization Study of the Steam Injection to Control Nonequilibrium Condensation in Steam Turbine** *Dr. Esmail Lakzian, Department of Mechanical Engineering, Andong National University, Korea*

Abstracts of Oral Session 3

FES2786: Hybrid Systems of Metal Complexes and Oxygen Reducing Laccase

Asaki Ishizuka, Daizuke Nakane and Takashiro Akitsu*
Department of Chemistry, Faculty of Science, Tokyo University of Science, Tokyo, Japan

Abstract. Biofuel cells are batteries of enzymes converting chemical energy into electrical energy. Fuels used are glucose for anode and oxygen for cathode. Biofuel cells have advantages in cost and safety, while disadvantage in stability of enzymes and a small amount of electricity. Therefore, we have attempted to search various types of metal complexes as suitable mediators between cathode and enzyme to increase flow of electron to reduce oxygen. Previously, we have reported two-mediator systems for cathode composed of carbon nanotube / Nafion polymer / mediators ("separate" $[Fe(CN)_6]^{3-/4-}$ and salen-type Mn complexes) / laccase in phosphate buffer. In these systems, not only electrochemical potential but also electron transfer distance (docking to laccase) depends on the function of laccase. According to many studies on certain metal-organic frameworks with enzyme, adsorption of enzymes on nano-scale metal complexes or their crystals may enhance stability and reactivity of enzyme. In this study, we synthesized "cyanide-bridged" bimetallic assemblies (coordination polymers) of $[Fe(CN)_6]^{3-/4-}$ and salen-type Mn complexes to compare the related "separate" systems. Due to many redox ions in a molecule, electrochemical factors were improved (increasing current from cathode), unfortunately, steric factors of "bridged" system may sometimes not suitable as mediator for docking appropriate on the surface of laccase.



Keywords: Coordination chemistry, bioinoganic chemistry, metal complex, laccase, oxygen, biofuel cells.
Acknowledgements: The author thank to the former students of Akitsu group.

FES2808: Energy Regenerative Approaches at the Urban Scale: Investigating Strategies in Compact Textures

F. Fiacco[1], G. Talamini[2]
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[2] *Department of Architecture and Civil Engineering, City University of Hong Kong, Hong Kong, China*

Abstract. Cities are striving for faster decarbonization. Over 65 per cent of the existing buildings are expected to exist till 2050, often behaving with high energy consumption and low-energy performances. The decarbonization of urban areas built when energy conservation and carbon sequestration were not priorities will be the challenge of the following decades.

This study investigates strategies for an energy-driven urban regeneration to convert architectural products of cities with extreme urban conditions, potentially impacting energy demand reduction of whole portions of urban textures. Namely, a prototypical approach has been tested, showing that a network of energy positive new high-rise buildings would be able to regenerate the overall energy performance of a high-populated, mainly mid-rise, compact neighbourhood in Kowloon City, Hong Kong. Indeed, sharing the surplus of on-site produced clean energy, in this case coming from wind turbines and photovoltaic systems integrated onto the high-rise buildings, has been demonstrated to be effectively able to invert the trend for which a high-density texture is only an energy consumer. Various scenarios have been investigated, hypothesizing different configurations of new buildings incorporated into the existing built environment to maximize energy production. Results demonstrate that the

strategic network of high-rise energy-positive buildings can reduce the demand for external energy supply by about 25 per cent and, according to the CO_2 emission factor in Hong Kong, avoid the emissions of 5,978 tons of CO_2-e per year in the considered neighbourhood (inhabitants: ~15,000; area: 0.3039 km²). This study proposes innovative approaches, shifting the focus from building-related solutions to comprehensive strategies at the neighbourhood scale advocating for the introduction of novel climate-related policies. The regenerative approaches proposed and tested by this study are easy-replicable and can speed up cities' decarbonization.
Keywords: Urban regeneration, decarbonization, renewable energy integration, zero-carbon neighbourhood.

FES2841: Stable Li Metal Anodes Realized by an Organic-Inorganic Composite Artificial SEI

Xiangru Sun[1], Dejun Li[1,2*]
[1] *College of Chemistry, Tianjin Normal University, Tianjin 300387, China*
[2] *College of Physics and Materials Science, Tianjin Normal University, Tianjin 300387, China*
Abstract. Lithium metal has been considered as the most promising candidate for next-generation anode materials in LIBs because of its ultra-high theoretical capacity (3860mAh g^{-1}) and low reduction potential (-3.04V). However, lithium dendrite is still the most serious problem of lithium metal anodes (LMAs). The interface regulation of LMAs is considered one of the most critical solutions. Herein, a high-dielectric artificial solid electrolyte interface (SEI) is designed to stabilize the surface of LMAs by adjusting the electric field distribution and Li^+ flux. Through the analysis of dielectric property measurement and CV test in this organic-inorganic polydopamine (PDA)-SiO_2 artificial SEI, the enhanced dielectric permittivity by SiO_2 has important effects in preventing current variation, guiding uniform current/potential distribution and homogenizing the Li^+ flux within the SEI interface, thus achieving uniform Li plating. After DFT calculation and other experiments, we proved that the high elasticity, strong Li affinity and lithiophilic/hydrophilic property of PDA can suppress Li dendrite growth and stabilize the SEI structure over long cycles. More than that, a series of characterization methods (such as FT-IR, XPS, etc.) were used to analyze the structure, composition and mechanical properties of the film and the guided SEI. The results show that PDA@SiO_2-SEI can reduce the decomposition of electrolyte and the consumption of lithium. These multi-functional properties of the artificial SEI for LMAs can achieve remarkable cycling in both symmetric cell configuration (2800h at 5mA cm^{-2} with 1mAh cm^{-2},800h at 10mA cm^{-2} with 1mAh cm^{-2}) and Li||Cu half cells (780h at 0.4mA cm^{-2} with 0.4mAh cm^{-2}). This strategy was further demonstrated to be successful in $LiCoO_2$||Li full cells with dramatically enhanced cyclic and rate performances. Our study provides a physical point-of-view of the novel configuration of the artificial SEI for stable LMAs and can be extended to the protection of other alkali metal anodes.
Keywords: Artificial SEI, interface, lithium dendrite, lithium metal anode.

FES2872: Printing Fuel Cells and Batteries on Paper for The Future Market of Portable Electronics

Yifei Wang
School of Mechanical Engineering and automation, Harbin Institute of Technology, Shenzhen, China
Abstract. The market of portable electronics is experiencing a revolution in both quantity and function. Compared with conventional 3C products with relatively high power requirement, new electronic gadgets with μW to mW level power input are continuously developed in different sectors, such as the lateral-flow testing for healthcare, the smart packaging for logistics, and the wireless sensor network for environmental monitoring. These new electronics will be produced in great quantity in the coming era of Internet-of-Things, which require low-cost, flexible and environmentally-friendly energy technologies instead of conventional batteries. Our research is mainly focused on developing micro fuel cells, metal-air batteries and aqueous ion batteries for these new electronics, by utilizing printing techniques for cell fabrication, microfluidics for mass transport, and the cellulose paper as cell substrate. The paper-based fuel cell retains the long-term operation ability of fuel cells by delivering the fuel & oxidant efficiently through the cellulose network, which is suitable for uninterrupted electronics such as wearable healthcare sensors. The paper-based metal-air battery is well known for its green raw materials together with high energy density, which is mainly targeted for single-use and disposable electronics such as lateral flow testers and smart packages. As for the paper-based metal ion batteries, the

employment of non-Li metal anode, carbonaceous cathode and water-in-salt aqueous electrolyte can significantly improve both the cost-efficiency and safety level, which are more competitive for powering the large quantity of wireless sensors. To manufacture these paper-based energy devices, printing is a mature and efficient method with great degree of freedom, which can deposit the functional inks of electrode, electrolyte, current collector and cell boundaries in an integrated manner. Considering their great application prospect, our future research goal is to continuously optimize both the cell performance and the fabrication efficiency for these paper-based fuel cells and batteries, and to achieve their successful commercialization.

Keywords: Fuel cell, metal-air battery, aqeuous ion battery, battery printing, portable electronics.

FES2895: A Brief Overview on the in Silico Studies on the Effect of Donors and π-Spacers on Dye Sensitized Solar Cells

Dr. Anik Sen

CMDD Lab, Department of Chemistry, GSS, GITAM Deemed to be University, Visakhapatnam-530045, AP, India

Abstract: A world without energy is not a world indeed. Energy is required by every living daily life and its need is also increasing daily. Though we are still dependent on the sources like fossil fuels, natural gas, oils but these sources are limited, and also non-environment friendly, so renewable sources of energy came in light. Solar energy being one of the renewable sources has been one of the primary sources of energy and is highly abundant to capture and use. The solar cells or photovoltaic cells are the electrical device which can capture the solar energy which and convert the light to electrical energy which can be used for daily life. There are different solar based cells like the crystalline silicon based 1st generation solar cells; thin film based solar cells including the amorphous silicon based solar cells as well as the inorganic semiconductor based dye sensitizer solar cells and the very new perovskite cells are well known photovoltaic cells. Dye sensitized solar cells are flexible lightweight, low cost and highly efficient solar cells and are a prime research area. Recently, organic dye sensitized solar cells with a general structure of Donor-pi Spacer-Acceptor (D-π-A) have a very important area of research. A slight change in any part of the donor, spacer or the acceptor may lead to a change in the efficiency of the DSSCs. Computational modelling has always been at par with the research on the DSSCs. Several studies on how the slight change in the parameters can have an effect on the efficiencies have been studied with Density Functional Theory calculations and the best one has been forwarded for the synthesis for experimental verification. I have been working on this field through in silico modelling in the last few years mainly contributing on both the metal organic and organic dye sensitized solar cells for n-type as well as p-type semiconductors. Here I would like to briefly talk about the effect on the DSSCs for the changes associated with the donors and the pi-spacers for both for n-type and p-type semiconductor based dyes.

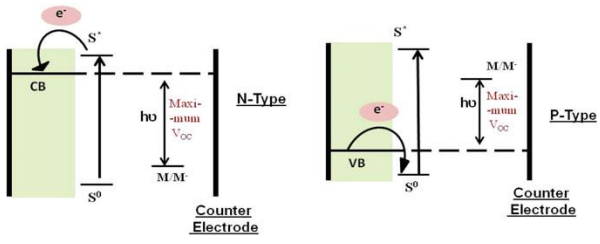

Figure 1. Schematic diagram of n- and p-type DSSCs.

FES2767: Energy, Environmental and Feasibility Evaluation of Tractor-Mounted Biomass Gasifier for Flame Weeding

Nicoló Morselli

BEELAB (Bio Energy Efficiency Laboratory), Department of Engineering "Enzo Ferrari", University of Modena and Reggio Emilia, Via Vivarelli 10/1, 41125 Modena, Italy

Abstract. Weed control is an agronomic technique that must be carried out on almost any cultivation, to prevent undesired weeds from competing with crops for nutrients, water, and light and reducing the annual yield. Nowadays, agriculture is experiencing a transition to both sustainable and organic approaches that is driving the

increase in non-chemical treatments. Within this framework, thermal methods are gaining attention due to their higher working speed and effectiveness when compared to mechanical ones but thermal devices are still fueled with fossils leading to considerable greenhouse gas emissions. This work investigates the advantages of substituting liquefied petroleum gas (LPG) powered weeder with a portable gasification-based flame weeder fueled with woody biomass. Energy balance, carbon footprint and feasibility aspects are taken into account and the proposed solution is compared with the reference literature of LPG flame weeder. A flame weeder prototype is built starting from the gasification reactor of a commercial micro scale cogeneration unit. The gasifier is then fueled with A2-grade fir pellets and the syngas is burnt in a swirled flare designed for cross-flame weeding in woody crop rows. The biomass-fueled prototype is capable of a thermal flux directed towards the weeds of 208–247 kJ m-2 at a temperature that ranges from 850 to 980 °C. When compared to LPG systems applied to vineyards or orchards, the proposed solution reduces the fuel cost of the 72% and CO2 emissions up to 118% considering the carbon-negative effect added by a 0.653 kg ha-1 of biochar production for each treatment. Results showed a specific fuel consumption of 52.2 kg ha-1 y-1 that can be self-sustained if vineyards prunings are used as fuel.

FES2770: Specific and Cumulative Exhaust Gas Emissions in Micro-Scale Generators Fueled by Syngas from Biomass Gasification

Marco Puglia
Dipartimento di Ingegneria "Enzo Ferrari", Università degli Studi di Modena e Reggio Emilia, Modena, Italy
Abstract. Climate change, environmental degradation, and biodiversity loss are prompting production systems to shift from a fossil-based economy to a circular bio-based one. In this context, biomass gasification is a promising alternative to fossil fuels that can contribute to power generation in rural communities and remote areas as well as provide a sustainable source of energy for developed countries. In this work, exhaust gas emissions (CO, NOx, and SO2) of two syngas-fueled micro-scale generators were measured. The first system is a commercial biomass gasifier genset, whereas the second is composed of a laboratory-scale gasifier prototype and a portable petrol generator. For this second facility, emissions were measured both running on gasoline and on syngas. The comparison was performed both on the pollutant concentration and on their cumulative amount. This comparison was made possible by calculating the exhaust gas flow by knowing the combustion stoichiometry and fuel consumption. The results showed a much lower pollutant concentration running on syngas compared to gasoline. In particular, considering the best configurations, every cubic meter of exhaust gas released running on syngas contains about 20 times less CO and almost one-third less NOx compared to gasoline. Moreover, the cumulative amount of emissions released was also considerably lower due to the lower exhaust gas flow (about 25%) released running on syngas.
Keywords: Emissions analysis, biomass gasification, portable generator, syngas, gasoline, engine.

FES2822: Quaternary Ammonium Functionalized Polymers as Scalable Solid Sorbent for Selective and Reversible CO_2 Capture

Cataldo Simari
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Abstract. Meeting the increasing global demand for energy while simultaneously facing the climate change due to anthropogenic carbon dioxide (CO_2) has become the great paradox of the 21st century. If we really want to meet both these criteria, the development of CO_2 capture, use, and storage technology has become imperative for sustainable energy infrastructure development. Regardless of the maturity if the various type of carbon dioxide capture technologies, the amine-based ones seem, so far, the most promising strategy to develop efficient decarbonation's processes. Indeed, primary, secondary and tertiary amines as well as quaternary ammonium groups can rapidly and reversibly react with CO_2, making them ideal for the separation of CO_2 from a mixture of gasses. Unfortunately, the current technology is still based on the use of amine solutions which typically implies several issues during operation, including high energy consumption during the desorption stage, low absorption capacity, oxidative and thermal degradation, loss of the amine due to poisoning, and piping corrosion.

This makes the overall process quite expensive. Against this background, the development of membrane technology can effectively represent a competitive way of the decarbonation, since can potentially conjugate remarkable thermal, chemical and mechanical resistance with high CO_2 affinity. In the presentation, some preliminary data will be discussed concerning the design, synthesis and characterization of quaternary-ammonium-functionalized polymers to be employed in the CO_2 capture processes. The physico-chemical and CO_2 capture features of the prepared sorbents were deeply characterized by different and complementary techniques. TGA and DSC were used to investigate the gas capture properties of the sorbents. Simultaneously, pulse field gradient (PFG) Nuclear Magnetic Resonance (NMR) spectroscopy was used to effectively clarify the confinement effects and molecular interactions with the polymer that greatly influence the mobility of the CO_2, thus enabling a profound comprehension of the structure-performance relationship in such a complex system.

Keywords: CO_2 capture, quaternary ammonium functionalities, polymer sorbents, reversible adsorption.
Acknowledgements: The author would like to thank the Italian Ministry of Universities and Research -MUR for the for the financial support through AIM - "Attraction and International Mobility" Project (PON R&I 2014–2020. AIM1899391-2).

FES2826: Asia–Africa Energy Development Cooperation: Double Coincidence of Interests

Ahmad Khaleel
Department of Economics & Dev. Studies, Federal University, Nigeria

Abstract. Double coincidence of interests between Africa and India particularly and Asia generally is becoming more apparent with the emergence of needed tools, frameworks, and conditions for simultaneously satisfying all parties' interests. This cannot be timelier than now that, development challenges amid resource abundance in Africa can be a near-perfect match to the emerging excess capacities/energy need in India to create one of the best opportunities that will systematically result in a win-win situation. Africa's resource potential of meeting India's hydrocarbon energy needs while hosting investments to improve financial and technological absorptive capacities indicates the more obvious benefits of such cooperation. However, any energy collaboration strategy should consider the implicit climate change/action impacts (carbon lock-in/carbon bubble) vis-à-vis the cooperation conditions, as the world is witnessing the changing attitude of some emerging powers in debt-ridden arrangements towards weaker countries. This will go a long way in uplifting the reputation and acceptance South-South Cooperation.

Keywords: Hydrocarbons, Africa, carbon bubble, carbon lock-in, energy security.

FES2873: Comparison of Olive Cake, Argane Nut, and Argane Cake Combustion to Determine the Biomass Most Suitable for CHP System

Ayoub Najah elidrissi, Mohammed Benbrahim, Rassai Nadia
National school of applied science, Morocco

Abstract. The physicochemical properties of argane cake were determined and the results were compared with other studies of argane nut and olive cake. The energy and emissions of the 3 biomasses during the combustion process were investigated. the result showed that the combustion was affected by the particle size supply air flow, temperature of the air and biomass moisture. The pre-treatments increase the HHV of the combustible and reduce emissions. the three biomasses are a suitable combustible for a CHP system to produce electricity and thermal energy thus valorizing the agricultural waste. The analysis on the ash indicates his richness on alkali metal and may use as a materiel for silicate ceramics.

Keywords: Biomass combustion, energy conversion, CHP system.

FES2909: Modeling and Mockup Testing of a Ventilated Façade Integrating a Luminescent Solar Concentrator Photovoltaic Panel

Giulio Mangherini[1, *], Paolo Bernardoni[2], Alfredo Andreoli[1], Mohamed Amine Ouelhazi[1], Valentina Diolaiti[1], Eleonora Baccega[3], Donato Vincenzi[1]

[1] *University of Ferrara, Department of Physics and Earth Sciences, via Saragat 1, Ferrara, Italy*
[2] *University of Ferrara, Department of Chemical, Pharmaceutical and Agricultural Sciences, Ferrara, Italy*
[3] *University of Ferrara, Department of Architecture, Ferrara, Italy*
Abstract. The impact of building energy requirements on the global energy balance is becoming more and more significant, and they can weight up to 30% of the total primary energy requirements of industrialized countries. This energy consumption is primarily related to electricity needs and air conditioning, thus the implementation of Building Integrated PhotoVoltaic (BIPV) devices seems to be one of the most promising options to lead this transition. In fact, this solution limits both distribution and environmental drawbacks of utility scale PV plants, moreover when properly installed BIPV devices can highly impact on building overall energy efficiency, as they reduce both thermal and electrical loads. The increment of building envelope insulation efficiency is one of the key parameters to increase their energy performance. For this reason, the recent interest of the scientific community is focused on the design and development of new technological answers able to combine energetical purposes with architectural and aesthetical functions. An alternative that could satisfy all these requirements is the implementation of a Ventilated Façades (VFs) on the building envelope. A VF is composed by two panes, commonly called skins, separated by a cavity, having a different width according to its functional and/or design concepts. Despite recent literature presents studies about the integration of standard flat PV modules on different VF configurations, their implementation in metropolitan environment presents some criticality, like their architectonic impact and their tolerance to shading. Luminescent Solar Concentrators (LSC) panels represent an interesting alternative for the integration in this type of structures, as they can be manufactured starting from intrinsic low-cost materials, and they drastically reduce the amount of solar cell per square meter of collecting surface. Moreover, thanks to their optical properties they are better candidate to be inserted in urban context, in which due to the heterogeneity of the environment, diffuse radiation and partial shading effects dominate with respect to direct solar radiation. The aim of this contribution is to present the performance of a narrow VF integrating a large area LSC panel as external skin, and a high reflective pane as internal one. The results were obtained by modeling the behavior of the VF in Mediterranean climate, by using a dedicated software called COMSOL Multiphysics. The models were validated thanks to a mockup build at the University of Ferrara, which was assembled by using 50x100x0.5 cm3 LSC panel, a 0.3 cm thick aluminum plate, a 5.5 cm thick insulating layer, and a 12 cm thick brick layer embedded in a structural and insulation frame having a front surface area of 50x100 cm2. Between the VF external and internal skin (the LSC panel and the aluminum plate, respectively) a narrow air channel having a width of 9 cm was left. The models were then extent performing the retrofit of a typical building envelope and proving that this structure can be employed to decrease the building thermal budget in both summer and winter seasons.
Keywords: BIPV, Ventilated Façade, LSC, energy saving, COMSOL Multiphysics.
Acknowledgements: Thanks to Michele Bottarelli, Professor at the Department of Architecture of the Ferrara University, for his precious advises in the development of numerical simulations by using COMSOL Multiphysics, without which this contribution would not have been possible.

FES2920: Optimization Study of the Steam Injection to Control Nonequilibrium Condensation in Steam Turbine

Mohammad Ghodrati[1], Esmail Lakzian[2*], Heuy Dong Kim[2*]
[1]*Center of Computational Energy, Department of Mechanical Engineering, Hakim Sabzevari University, Sabzevar, Iran*
[2]*Department of Mechanical Engineering, Andong National University, Andong, Korea*
Abstract. One of the high-speed flow characteristics in the end stage of steam turbine is nonequilibrium condensation due to the rapid expansion of the steam, which has been well known to give rise to appreciable energy loss as well as blade erosion. In some cases, the condensate droplets can affect the dynamic vibration and stability of the steam turbine. Thus, the flow control strategy of the condensing flow in steam turbine is of practical importance in the steam turbine operation and maintenance. In the present study, hot steam injection into the flow passage of turbine blades has been adopted for the generic flow control technique, as schematically

shown in Fig. 1. The 3-dimensional compressible Navier-Stokes equations, incorporated with SST k-ε turbulence model were solved based on the Eulerian-Eulerian approach to reasonably capture the flow physics of supersonic nonequilibrium condensation. The present computational results were carefully validated with experimental ones available. The effectiveness of the flow control of the present hot steam injection was investigated in terms of condensation loss, kinetic energy, liquid mass fraction ratio, erosion ratio and economic cost, which were also utilized to get the optimization of hot steam injection.

Keywords: Nonequilibrium condensation, steam turbine, hot steam injection. shock wave, supersonic flow, flow control.

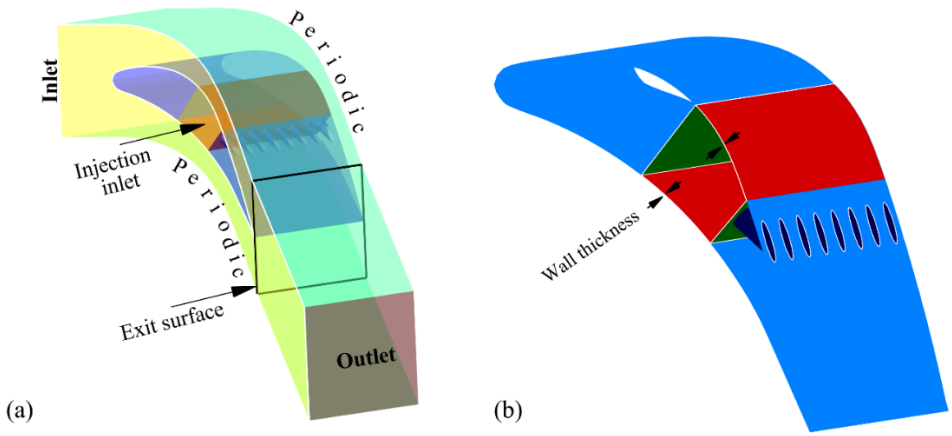


Fig. 1. Steam turbine blades and boundary conditions.

FES2799, FES2843, FES2915 To avoid repeatability issue, the abstracts will be available after the full papers are published in the conference proceedings or other journals.

Oral Session 4: Electric Energy, and Thermal Energy

Time: 08:30-12:10, October 28, 2022. (China Standard Time GMT+8)

Session Chair: Dr. Somporn Sirisumrannukul, King Mongkut's University of Technology North Bangkok, Thailand

Session Room Link: http://www.academicconf.com/teamslink?confname=nefes2022

08:30-08:50	**FES2823**	**Analysis of Two Specific Electrodes Geometries for Alkaline Water Electrolysis** *Ms. Maria Jose Lavorante, National Defense University, Engineer Faculty of the Army Div. Grl. Manuel Nicolás Savio, Argentina*
08:50-09:10	**FES2781**	**Electric Truck Hydropower, a Flexible Solution to Hydropower in Mountainous Regions** *Dr. Julian David Hunt, International Institute for Applied Systems Analysis (IIASA), Austria*
09:10-09:30	**FES2864**	**Power Enhancement of a Cavity-Free Si-Nanowire Thermoelectric Generator for Energy Harvesting** *Dr. Tianzhuo Zhan, Graduate School of Interdisciplinary New Science, Toyo University, Japan*
09:30-09:50	**FES2849**	**Computational Analysis of Fluid Flow and Convection Heat Transfer Characteristics of Multiple Heat Sink for Electrical Power Stack Cooling** *Assoc.Prof. Alhassan Salami Tijani, School of Mechanical Engineering, College of Engineering, Universiti Teknologi MARA, Malaysia*
09:50-10:10	**FES2883**	**Enhancing Thermoelectric Properties of SnSe Film by Vacancy Effect** *Dr. Guihua Tang, MOE Key Laboratory of Thermo-Fluid Science and Engineering, School of Energy and Power Engineering, Xi'an Jiaotong University, China*
10:10-10:20		**Coffee Break**
10:20-10:35	**FES2896**	**Study on Heat Transfer Performance of Thermal Flow-Reversal Reactor for Recovering Ventilation Air Methane** *Dr. Yuqi Zhou, Energy Conservation Technology Research Institute, Shandong University of Technology, China*
10:35-10:50	**FES2897**	**Study on Heat Transfer Performance of Thermal Flow-Reversal Reactor for Recovering Ventilation Air Methane** *Dr. Yuqiu Zhang, Energy Conservation Technology Research Institute, Shandong University of Technology, China*
10:50-11:05	**FES2891**	**Direct Control Methodology for EV Charging Demand Management Based on Genetic Algorithm** *Mr. Nattavit Piamvilai, Department of Electrical and Computer Engineering, Faculty of Engineering, King Mongkut's University of Technology North Bangkok, Thailand*
11:05-11:20	**FES2892**	**Grid-Based Estimation of Increasing Power Demand and Recommended Electric Vehicles Public Chargers for a Large-Scale Charging Infrastructure Planning** *Mr. Pokpong Prakobkaew, Department of Electrical and Computer Engineering, Faculty of Engineering, King Mongkut's University of Technology North Bangkok, Thailand*
11:20-11:35	**FES2894**	**Development of Strategies and Policy Guideline for Charging Infrastructure to Support Electric Vehicle Target in Thailand**

		Ms. Ongorn Rattananatthawon, Department of Electrical and Computer Engineering, Faculty of Engineering, King Mongkut's University of Technology North Bangkok, Thailand
11:35-11:55	**FES2875**	**Servo Motor Selection and Energy Saving for Heavy Duty Machine Tools** *Dr. Recep Halicioglu, Turkish Machine Theory Association, Turkey*
11:55-12:10	**FES2903**	**Equation Correlations of Air PVT Collector Efficiency as a Function of Mass Flow Rate and Duct Depth** *Dr. Ismail Baklouti, National School of Engineers of Monastir, University of Monastir, 5019 Monastir, Tunisia*

Abstracts of Oral Session 4

FES2823: Analysis of Two Specific Electrodes Geometries for Alkaline Water Electrolysis

Maria Jose Lavorante[1,2]
[1] *Institution of Scientific and Technological Research for Defense, Argentina*
[2] *National Defense University, Engineer Faculty of the Army Div. Grl. Manuel Nicolás Savio, Argentina*

Abstract. The implementation of renewable sources of energy is the main path for the creation of a carbon neutral society. Hydrogen, as an energy vector, plays a promising and important role, when it is obtained from renewable resources. Currently, about 4% of the world's hydrogen production is carried out through the electrolysis process and a large part of that percentage is as a by-product of the electrochemical production of chlorine. Water electrolysis is the electrochemical process where water is split into hydrogen and oxygen by the flow of an electric current. Since they require direct current for their operation, they could be used in DC microgrids which have energy losses up to 20% lower than AC ones, such as, grid balancing services and energy storage systems. Although actually, three methods have been developed: alkaline, proton exchange membrane and solid oxide electrolysers; alkaline is the oldest, mature, simple and cheapest technology. It has the advantage to scale-up from kilo to megawatt range production capacities and it is used in many industrial applications. Today's research and development activities are focused on reducing capital and operational expenditures by increasing current density and equipment efficiency, respectively. In this work, two specific geometries on the electrode surface were studied, with the aim of analysing their performance in the alkaline electrolysis of water. One of them consists of horizontal and vertical straight channels, with internal angles of 90 degrees, which intersect (pin-type) and the other, vertical straight channels with a w-shape. Each pair of electrodes was evaluated at 4 different distances between them. It was found that at comparable distances, the performance of w-shape electrodes is superior to that of pin-type.

Keywords: Electrodes geometry, alkaline electrolyser, hydrogen.
Acknowledgements: Authors wish to thank the Argentinean Ministry of Defence for their support through the subsidy PIDDEF 04/2020 granted to carry out this research. Our thanks extend to the staff of the CITEDEF's Prototype Department for the construction of the evaluated electrodes and to the staff of CITEDEF's Solid Research Division for the micrographs.

FES2781: Electric Truck Hydropower, a Flexible Solution to Hydropower in Mountainous Regions

Julian David Hunt*
International Institute for Applied Systems Analysis (IIASA), Austria

Abstract. The world is undergoing a transition to a more sustainable energy sector dominated by renewable energy sources. This paper proposes an innovative solution that consists of catching water from streams at high altitudes to fill storage containers and transport them down a mountain, converting the potential energy of water into electricity with the regenerative braking systems of electric trucks and storing it in the truck's battery. The energy stored in the electric truck can be sold to the grid or used by the truck to transport other goods. Results show that the levelized cost of the electricity truck hydropower (ETH) is 30–100 USD/MWh, which is cheap when compared with conventional hydropower 50–200 USD/MWh. The electricity generation world potential for the technology is estimated to be 1.2 PWh per year, which is equivalent to around 4% of the global energy consumption in 2019. Apart from being a low cost and impact electricity generation technology, electric truck hydropower can operate in combination with solar and wind resources and provide energy storage services to the grid.

Keywords: Energy storage, hydropower, electric trucks, battery, renewable energy.

FES2864: Power Enhancement of a Cavity-Free Si-Nanowire Thermoelectric Generator for Energy Harvesting

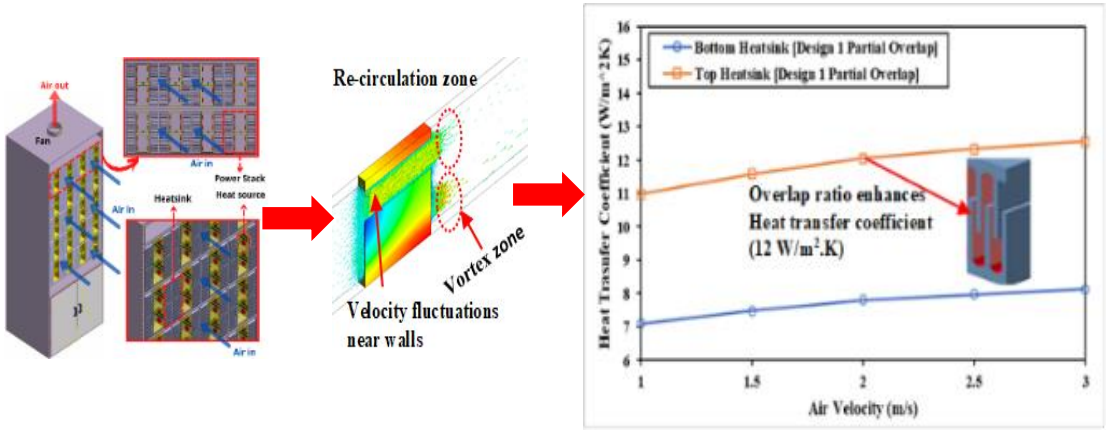
Tianzhuo Zhan

Graduate School of Interdisciplinary New Science, Toyo University, Japan
Abstract. Thermoelectric generators (TEG) have attracted great attention as wireless power supply for the sensor nodes in the IoT society. We proposed a planar cavity-free Si-nanowire thermoelectric generator (SiNW-TEG) that could be fabricated on commercially available silicon-on-insulator (SOI) substrates by the complementary metal-oxide-semiconductor (CMOS)-compatible technology. This SiNW-TEG features the use of a steep temperature gradient generated near the heat source by shortening the TEG legs. Thus, there is no need to etch away the substrate to form suspended SiNWs that is necessary in the conventional planar nanowire TEGs, which leads to a low fabrication cost and well-protected nanowires. This SiNW-TEG is composed of several hundreds of SiNW thermoelectric elements connected electrically in series and thermally in parallel. Therefore, a thermally conductive but electrically insulative heat guide layer is necessary for the heat spreading from the heat source to the hot side of each thermoelectric element. The design of the heat guide layer helps to form a large temperature difference across the thermoelectric elements by reducing the parasitic thermal resistance.
Keywords: Thermoelectric generators, heat guide layer, parasitic thermal resistance.

FES2849: Computational Analysis of Fluid Flow and Convection Heat Transfer Characteristics of Multiple Heat Sink for Electrical Power Stack Cooling

Alhassan salami Tijani

School of Mechanical Engineering, College of Engineering, Universiti Teknologi MARA, Malaysia
Abstract. Microelectronic devices are increasingly becoming miniaturized, especially in the semiconductor industry. The miniaturization of these Microelectronic technologies has significantly increased their power density. To meet the goals of achieving iindustrial revolution (IR 4.0), most manufacturing companies such as power transformers, battery banks of electric vehicles, CPU, industrial inverters and electronic circuit boards are continuously shifting towards downsizing. Thermal energy dissipation is the main challenge limiting these microelectronics' reliability and efficiency. In this research work, cooling performance of new design overlap heat sinks was investigated, two different designs were simulated using ANSYS FLUENT. Design 1 is a heat sink with trapezoidal fillet and symmetrical half-round pins in horizontal arrangement. Design 2 is a heat sink with half parabolic fillet and symmetrical half-round pins in a horizontal arrangement. Each design consists of 0% overlap ratio (non-overlap), 50% overlap ratio (partial-overlap) and 100% overlap ratio (fully-overlap). The accuracy of the results of this study was validated with experimental data. The findings from this study make several contributions to the current literature through heat transfer enhancement and electrical power stack space minimization. The results show that the partial overlap design has the highest Nusseslt number, followed by non-overlap and fully-overlap heatsink. At a velocity of 2m/s, the performance for non-overlap, partial overlap and fully overlap are 0.45, 0.25 and 0.15, respectively. The deterioration of the performance was due to increase in pressure drop penalty. Design 1 with fully overlap has about 30 % increase in pressure drop compared with design 2. Interestingly the heat transfer coefficient of partial overlap design (Design 1) is about 12W/m2.K which is about 36.6 % increase in heat transfer coefficient. In terms of space minimization, the fully overlap heat sink can be applied in minimizing electrical stack cabinet space, however for heat transfer characteristics, the partial overlap heat sink has a better performance.



FES2883: Enhancing Thermoelectric Properties of SnSe Film by Vacancy Effect

Guihua Tang*, Yifei Li, Yinan Nie, Xin Zhao, Min Zhang

MOE Key Laboratory of Thermo-Fluid Science and Engineering, School of Energy and Power Engineering, Xi'an Jiaotong University, Xi'an 710049, China

Abstract: Nanostructured thermoelectric materials have attracted extensive attention due to the broad application prospects in the fields of micro sensors, electronic thermal management, and wearable devices. In this work, SnSe nanofilms with different thicknesses were prepared by single-target magnetron sputtering technology, annealed in argon atmosphere at 673 K for 30 minutes. The geometric structure, composition and thermoelectric properties were systematically measured. The electrical properties of thin films were measured by the four-point probe method, and the thermal properties of the thin films were measured by the time-domain thermal reflectometry method. The calculation based on the first principle theory was also conducted to understand the carrier transport mechanism in SnSe films. Se vacancies were formed in the 130 nm-thick ultrathin film since Sn atoms were preferentially deposited on the substrate. The theoretical results confirmed that the unbonded Sn2+ can form an intermediate band near the valance band, which reduces the indirect band gap while maintains a relatively large direct band gap over 0.48 eV, achieving band engineering strategy. Additionally, Se vacancies can improve the electrical conductivity significantly by reducing electron-phonon scattering effect. Meanwhile, the thermal conductivity of the vacancy structure has an average reduction of 33.8% compared to the pristine SnSe films due to the vacancy scattering effect. As a result, a high ZT value of 0.61 were achieved at 700 K in the 130 nm-thick film sample, mainly originating from the vacancies formed during the synthesis process, rather than the reduced film thickness. The present work reveals the mechanism of vacancies on energy transfer in thin films, which may promote further optimization and application of nanoscale thermoelectrics.

Keywords: Thermoelectric material, SnSe film, magnetron sputtering, density functional theory.

Acknowledgements: This work was supported by the National Natural Science Foundation of China under Grants 51825604 and 52130604.

FES2875: Servo Motor Selection and Energy Saving for Heavy Duty Machine Tools

Recep Halicioglu

Turkish Machine Theory Association, Turkey

Abstract. Due to the development of technology in the world, energy consumption is increasing day by day. The decrease in fuel reserves and the damage caused by fuel oil to the environment have also led to the search for new energy sources. In particular, energy consumption in the industry has a large proportion of total energy consumption. In this respect, the design of the machine tools and the selection of the actuators used in them are of great importance. Recycling of braking energy has gained importance in recent years. In this way, great energy savings are achieved through using energy more beneficially. In this study, using two cases, a method for servo motor selection is presented through machine tool examples. With this method, it is aimed to reduce

the production cost by providing optimum motor selection. Significant energy saving was achieved by using the capacitor module.

Keywords: Regenerative energy, machine tool design, motor selection.

FES2903: Equation Correlations of Air PVT Collector Efficiency as a Function of Mass Flow Rate and Duct Depth

Ismail Baklouti

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Abstract. This work presents a parametric study of mass flow rate and channel depth using a combined procedure of experimental and numerical data on electrical and thermal efficiency effects. The implemented technique is carried out to simplify the determination of hourly collector performance as a function of key parameters without the need for many experimental parameter tests. Besides, the study method consists of developing and testing an experimental device for a PVT air collector with an acquisition data system based on the ARDUINO Mega 2560 card. The experimental measurements were carried out on a sunny day in Sfax Tunisian city with a mass flow coefficient of 7.4 $g \cdot s^{-1}$ and an air channel depth of 0.04 m. The numerical procedure is performed using ANSYS-Fluent 17.0 software to execute different simulations of mass flow rates and airway depths and using MATLAB file software to determine the corresponding electrical performance for each simulated condition. The linear fits of electro-thermal efficiency are respectively implemented as a function of the input parameters for the term $\left[(T_c - T_{amb})/G\right]$ and $\left[(T_i - T_{amb})/G\right]$ during the measurement day. New mathematical expressions based on the linear regressions are developed as a function of the input parameters, mass flow rate and channel depth to calculate the hourly efficiency for different parameter configurations. The validity of the method with experimental results proved that the error of RRMSE is 1.5 % for electrical efficiency and 0.6 % for thermal efficiency. The new correlation formulation for the electrical efficiency deducted is written as $\eta_{e,\dot{m},\eta_{STC}} = -U_{el}\left[(T_c - T_{amb})/G\right] + \eta_{e0}$ with $\eta_{e0} = C_{e1}\,\dot{m}^{C_{e2}}$ also $U_{el} = C_{e3}\,\eta_{STC}\,\dot{m}^{C_{e4}}$. Moreover, the new correlation formulation for the thermal efficiency deducted is written as $\eta_{t,\dot{m},d} = C_{t1}\,d^{C_{t2}}\dot{m}^{(C_{t3}\,d\,+\,C_{t4})}\left[(T_i - T_{amb})/G\right] + C_{t5}\,d^{C_{t6}}\dot{m}^{(C_{t7}\,d\,+\,C_{t8})}$

Keywords: Solar energy, air PVT, aero-voltaic, experimental, numerical, equation correlations.

Acknowledgements: The financial support for this work was provided by Sustainable Energy Company, Sfax, Tunisia under the project: Smart Aero-voltaic System (SAV). The numerical work was carried out at the Laboratory of Electromechanical Systems (LASEM), National School of Engineers of Sfax, University of Sfax, 3038, Sfax, Tunisia.

FES2896, FES2897, **FES2891, FES2892, FES2894** To avoid repeatability issue, the abstracts will be available after the full papers are published in the conference proceedings or other journals.

Part IV Poster Presentations

Online Poster Guidelines

Online Poster Presentations will consist of two parts:

- **Poster Presentations:** A collection of posters in PDF format (with/without audio) will be available at conference website for attendees to view.
- **Poster Q&As:** Attendees could type the questions in the chat box on MS Teams or leave questions in the note box below the posters on the conference page. Presenters will answer the questions as soon as they can.
- Signed and stamped electronic presentation certificate would be issued via e-mail after conference.

List of Posters

Time: 11:20-12:00, October 26, 2022. China Standard Time (GMT+8)

Online Posters will be updated on the official website:

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FES2773	**Residual Stress Analysis of Solid Oxide Fuel Cells with Functional Gradient Material Electrodes** *Shuai Ma, MOE Key Laboratory of Thermo-Fluid Science and Engineering, School of Energy & Power Engineering, Xi'an Jiaotong University, China*
FES2775	**Study on Residual Stress and Failure Probability of Waveform Interface of Solid Oxide Fuel Cell** *Dingxi Xue, MOE Key Laboratory of Thermo-Fluid Science and Engineering, School of Energy & Power Engineering, Xi'an Jiaotong University, China*
FES2777	**Zero-Sequence Circulating Current Suppression for Parallel Three-Level Back-to-Back Converters Based on DPWM Hybrid Switching Modulation Strategy** *Lei Xie, Nanjing SAC New Energy Technology Co. Ltd., China*
FES2778	**Experimental Investigation of the Performance of an Air Type Photovoltaic Thermal Collector System with Fixed Cooling Fins** *Dr. Zhonghua Zhao, Tianjin Renai College, China*
FES2794	**Study on Bubble Dynamic Characteristics of Lead-Bismuth Alloy Under Natural Circulation** *Zhanzhong Liu, MOE Key Laboratory of Thermo-Fluid Science and Engineering, School of Energy & Power Engineering, Xi'an Jiaotong University, China*
FES2800	**Study on the Properties of Lauric Acid Paraffin Wax Volcanic Rock Shape-Stabilized Phase Change Materials** *Yongtai He, School of Physics and Electronic Science, Chuxiong Normal University, China*
FES2805	**Experimental Investigation of Indoor Cooling by Stored Ice Through Ceiling Panels** *Mr. Zhiqiang Wu, School of Energy and Power Engineering, Dalian University of Technology, China*
FES2810	**Parametric Finite Element Analysis of Belt Type Assembly of PEMFC** *Mr. Guoqing Liu, School of Automotive & Rail Transit, Nanjing Institute of Technology, China*
FES2814	**Geometry Optimization of Hot Water Storage Tank Based on Numerical Simulation** *Tingsen Liu, School of Physics and Electronic Science, Chuxiong Normal University, China*
FES2815	**Analysis on Transformer Protection Potential Fault Trip Resulting from CT's Wrong Connection** *Nina Liu, Shandong Electric Power Industry Boiler and Pressure Vessel Inspection Center Co., Ltd, China*
FES2816	**The Analysis on Controlbox Mal-operation Resulting from Secondary Circuit's Mistaken Wiring** *Kai Qiao, State Grid Shandong Electric Extrahigh Voltage Company, China*
FES2818	**Improvement of Solar Photovoltaics Efficiency by Means of Cooling Using the Underground** *Dr. Lopez Pascual, Mechanical Engineering Area, Escuela Politécnica de la Univesidad de Alcalá, Spain*
FES2819	**Electricity Production Enhancement of a Thermoelectric Generator Using Concentrating Optics**

	Dr. Ignacio Valiente-Blanco, Mechanical Engineering Area, Escuela Politécnica de la Univesidad de Alcalá, Spain
FES2831	**The Improvement of Triple Trip Realization Method of Circuit Breaker Trip Circuit Communication** *Jie Hui, State Grid Shandong Electric Extrahigh Voltage Company, China*
FES2848	**Decolorization and Detoxification of Azo Dyes in Textile Industrial Effluent by Exploring the Bioremediation Potential of Bacteria** *Dr. Ambika Saxena, Department of Bioscience and Biotechnology, Banasthali Vidyapith, India*
FES2869	**A Computationally Efficient Heuristic Approach for Solving a New Sophisticated Arrangement of Cogeneration Combined Heat and Power Cycle** *Dr. Soheil Mohtaram, School of Energy and Power Engineering, University of Shanghai for Science and Technology, China*
FES2870	**Design and Realization of a 200 A Low-Cost High-Side Switch for Automotive Applications** *Assoc. Prof. Annunziata Sanseverino, DIEI, University of Cassino and Southern Lazio, Italy*
FES2874	**Cause Analysis and Improvement Measures of 35kV Dry Hollow Reactor Burning Failure** *Nina Liu, Shandong Electric Power Industry Boiler and Pressure Vessel Inspection Center Co., Ltd, China*
FES2905	**Li-ion Battery Charge Transfer Stability Studies with Direct Current Impedance Spectroscopy** *Assoc. Prof. Yun Bao, Department of Applied Physics, Donghua University, China*
FES2887	**Research and Application of Characteristic Test Device for Electrochemical Energy Storage Grid Connected** *Yongming Zhang, Shandong Zhongshi Yitong Group Co., Ltd, China*
FES2902	**Novel Cell Balancing Applied Near-Field Coupling and Serial-Parallel Circuit Configuration** *Dongho Lee, Department of Electrical & Control Engineering, Mokpo National University, Korea*

Abstracts of Posters

FES2805: Experimental Investigation of Indoor Cooling by Stored Ice Through Ceiling Panels

Zhiqiang Wu, Jiaming Chen, Fei Guo*
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Abstract. Cooling ceilings provide a pleasant indoor climate all year round. In summer, the ceiling cooling supplies a uniform temperature reduction without the disruptive effects of air conditioning such as cold air circulation and noise. With a comparably low energy consumption. The absence of radiators opens up additional horizons for architecture. The cooling process also needs energy gradient to extract the sensible heat through the chilled ceiling. In this work, ice bricks stored near local reservoir in winter were used as the cooling source and conveyed through piping system to the active ceiling panels. The performance of indoor cooling by stored ice through ceiling panels was investigated via various operating conditions. The vertical temperature drop below the cooling ceilings is lower than 2 ℃, which meets the requirements of human comfort. Through thermodynamic analysis, the radiant heat transfer coefficient of the cooling ceilings is about 5.1 W/m^2/K. The values of heat transfer coefficients for cooled radiant ceilings are overestimated, which are commonly used in practice. Changing the way of adding ice bricks, the cooling effect of adding ice bricks continuously shows better performance than that of adding ice bricks of equal quality in one time. Finally, through thermos-economic analysis, the cooling ceiling has lower operation cost than the air conditioning system.

Keywords: ceilings panels, cooling source, thermodynamic analysis, thermos-economic analysis.

FES2818: Improvement of Solar Photovoltaics Efficiency by Means of Cooling Using the Underground

D. Lopez-Pascual, I. Valiente-Blanco, M. Muñoz-Fernandez, E. Diez-Jimenez
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Abstract. Solar photovoltaic modules drastically loss efficiency in electricity production when they are heated by sun radiation, specially in warm areas with larger photovoltaic potential. A novel method for improvement of the efficiency Silicon photovoltaic module by means of low-enthalpy geothermal cooling is presented. The underground is used as a natural heat sink for dissipation of the residual heat absorbed by the solar module during normal outdoor operation. A prototype of the technology was designed, manufactured and experimentally characterized in summer 2021 in Spain. Heat transfer is done using a heat exchanger attached to the back of the solar module and a second heat exchanger introduced in a borehole in the ground of 15 m depth, naturally filled by water present in the underground. Experimental results demonstrate that peak efficiency improvements up to 12% are possible using this novel technique.

Keywords: Efficiency, solar photovoltaics, geothermal.
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FES2819: Electricity Production Enhancement of a Thermoelectric Generator Using Concentrating Optics

I. Valiente-Blanco, D. Lopez-Pascual, F. Salas-Gomez, M. Muñoz-Fernandez and E. Diez-Jimenez
Mechanical Engineering Area, Escuela Politécnica de la Univesidad de Alcalá, Ctra. Madrid-Barcelona, 28805, Alcalá de Henares, Spain

Abstract. Thermoelectric generators (TEG) based in the Seebeck effect directly produce electricity from a temperature gradient across them. However, their efficiency is still low, and it is highly dependent in the temperature gradient. In this research, we present a mean to improve their efficiency by concentration of the incident light in a smaller thermoelectric generator. A prototype has been designed, manufactured and tested in outdoor conditions in Spain in 2021. A Fresnel Lens of 2 inches in diameter was used to concentrated light over

a small size TEG of about ½ inch in size. Thanks to the light concentration, the hot side temperature increases, increasing the temperature gradient across the thermoelectric generator and therefore improving its efficiency in energy harvesting more than one order of magnitude when compared to a non-concentrating prototype with same total area of 2 inches (TEG+optics). Experimental results are presented in this work including the analysis of the sensitivity of the electricity productivity with the orientation of the system and an electronic development for stabilization and pull-up of the output voltage from the TEG.

Keywords: Efficiency, thermoelectric generation, concentration optics.

Acknowledgements: This work has been founded by the Ramon y Cajal Program of the Spanish Ministry of Science and Innovation under gran agreement RYC-2017-23684 and by Community of Madrid under grant agreement number CM/JIN/2021-035.

FES2848: Decolorization and Detoxification of Azo Dyes in Textile Industrial Effluent by Exploring the Bioremediation Potential of Bacteria

Ambika Saxena, and Sarika Gupta*

Department of Bioscience and Biotechnology, Banasthali Vidyapith, Banasthali, Tonk-304022, Rajasthan, India

Abstract. Textile industries majorly contributes towards the economy of India. However, the effluent discharged from these industries contain various contaminants like azo dyes, heavy metals, inorganic/organic pollutants, etc. which pollutes the adjoining waterbodies and landmasses. Azo dyes are xenobiotic in nature, possessing -N=N- bond in complexation with differently large number of substitutions making them recalcitrant. Dye load accumulation in the environment results from the residual fraction of the dye discharged during the dyeing and printing processes in the textile effluent. Over the years, increase of the dye contaminants has been one of the biggest concerns, thus needs a potent strategy for their remediation. The conventional method used are associated with limitations as use of hazardous chemicals, voluminous sludge and incompetent with compliances for the discharge limits. Present study aims to elucidate the remediation potential of the bacteria to be deployed under *ex situ* condition. It cleaves the azo bond along with their conjugates into nontoxic byproduct through multiple-step conversion (aerobic/anaerobic). UV-VIS spectroscopy confirmed the degradation of dye contaminants on the contrary detoxication was assessed through FTIR and GCMS spectral analysis. Fifty two bacterial strains isolated from dye contaminated samples near the textile industries, 6 bacterial isolates were screened possessing more than 90% Acid Red 249 dye at 100 ppm, under static condition at 37±2˚C within 16-18 hours. These screened isolates also exhibit biodegradation and detoxification of the wide spectrum of dyes under *in vitro* condition upto 100 ppm (Disperse Yellow 3, Direct Blue 6, combination) and effluent (*ex situ*) from various Combined Effluent Plants (CETPs). Under both the conditions FTIR and GCMS profiling indicated the dye detoxification in the range 60-97% and 25-76% respectively. The present investigation creates a path for the screened bacterial isolates for effective decolorization and detoxification of dye contaminants that can be further explored for textile effluent treatment at the industrial scale capacity as per the regulatory compliances standards.

To avoid repeatability issue, the abstracts of other posters will be available after the full papers are published in the conference proceedings or other journals.

Part V Acknowledgements

On behalf of the NEFES 2022 Organizing Committee, we would like to take this opportunity to express our sincere gratitude to our participants. We would also like to express our acknowledgements to the Technical Program Committee members who have given their professional guidance and valuable advice as reviewers. For those who contribute to the success of the conference organization without listing the name below, we would love to say thanks as well.

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