1946th Conference

Renewable Energy & Energy Materials 2018

2nd International Conference on

Renewable Energy and Resources
&
Energy Materials and Fuel Cell Research

August 27-28, 2018 | Boston, USA

Keynote Forum

Day 1

Christopher Niezrecki, Innov Ener Res 2018, Volume 7
DOI: 10.4172/2576-1463-C2-004

Christopher Niezrecki

University of Massachusetts Lowell and University Cooperative Research Center, USA

Recent advances in wind turbine technologies and sensing for structural health monitoring

A significant amount of interest exists in performing wind turbine structural health monitoring, characterization, and evaluation. The presentation highlights some recent advances in optical sensing, acoustic methods, infrared, UAV sensing, and radar technologies that can be applied to characterize wind turbine structural health, structural dynamics, damage, and embedded defects. Non-contacting, full-field surface dynamic measurements are presented that leverage three-dimensional (3D) digital image correlation (DIC), point tracking (PT), and motion magnification methods. The approaches are able to obtain full-field geometry data, in three dimensions. Information about the change in geometry of an object over time can be found by comparing a sequence of images and virtual strain gages (or position sensors) can be applied over the entire visible surface of an object of interest. Non-contact structural dynamic information can be extracted. Results from the structural interrogation of acoustic monitoring, infrared sensing, and radar sensing are also presented on a variety of test objects. Several examples of various sensing technologies are presented on wind turbine rotors and blades. Additionally, some recent advances in wind energy research that originated within the National Science Foundation-Industry/University Cooperative Research Center for Wind Energy Science, Technology and Research (Windstar) will be presented.

Biography

Niezrecki is Professor and Chair of Mechanical Engineering at the University of Massachusetts Lowell, the Co-Director of the Structural Dynamics and Acoustics Systems Laboratory (http://sdasl.uml.edu/), the Director of the Center for Wind Energy at UML (www.uml.edu/windenergy), and also the Director of the National Science Foundation-Industry/University Cooperative Research Center for Wind Energy Science, Technology and Research (Windstar). He has been directly involved in structural dynamics, acoustics, smart structures and materials, and sensing research for over 23 years, with more than 100 publications. He has conducted over $11M USD of sponsored research through grants from numerous federal and state agencies as well as several companies.

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Yi-Lung Mo, Innov Ener Res 2018, Volume 7
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Yi-Lung Mo

University of Houston, USA

Carbon nanofiber aggregate sensors for sustaining resilience of nuclear power plants to multi-hazards

Multi-hazards such as natural hazards (floods, earthquakes, severe storms and wildland fires) or manmade disasters (nuclear disaster, oil spills, and terrorist attacks) lead to substantial damage on critical infrastructures and communities and have social, economic and environmental consequences. The immediate impacts on multi-hazards include loss of human life and damage to infrastructures. Multi-hazard mitigation for nuclear power plants forms a vital input in disaster management, the design of development strategies and emergency response forecasting. In this lecture, we will present how to develop a robust and cost-effective real-time carbon nanofiber aggregate (CNFA) sensor system that can be embedded at nuclear power plants for damage detection during events such as earthquakes, nuclear disasters, and missile attacks, and for water level monitoring in nuclear power plants during flooding. A real-time multi-hazard alert software system will also be developed to monitor the data generated by the CNFA sensors and produce proper alerts when hazardous events are detected. The CNFA acts as a strain sensor. The stresses in the critical regions of nuclear power plants due to natural or man-made hazards can be determined by taking into account the strains developed on the surface of the CNFA. This strain produces an equivalent stress in the CNFA that can be derived from its electrical resistance variation. The CNFA sensor system determines the stresses and strains in nuclear power plants and transmits the information to immediately provide real-time information to decision makers. We will also develop a predictive computational modeling platform, which incorporates various couplings between mechanical, electrical and thermal effects and provides an accurate coupled response (e.g., displacements, stresses, temperature, electrical fields) of nuclear power plants.

Biography

Dr. Y L Mo, F.ASCE, F.ACI, F.Humboldt is Professor at the Civil and Environmental Engineering Department, the University of Houston (UH). He is also Tsinghua Chair Professor, Institute of Future City and Infrastructure, Tsinghua University, Beijing, China. His technical interests are multi-resolution distributed analytical simulations, large-scale concrete structure testing and field investigations of the response of complex structures, on which he has more than 400 research publications, including 201 refereed journal papers, many conference, keynote and prestige lectures, research reports, books and book chapters, magazine articles and earthquake field mission reports. In the past several years, he has focused on energy material research, especially the application of carbon nanofiber material for sustaining resilience of nuclear power plants to multi-hazards.

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Day 2

Jerzy A Szpunar, Innov Ener Res 2018, Volume 7
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Jerzy A Szpunar

University of Saskatchewan, Canada

Microstructural design in hydrogen fuel generation and storage

Hydrogen has been recognized as a clean and sustainable fuel. However, still many problems have to be to be solved in the area of generation, transport, and storage of this fuel for the future hydrogen-based economy to be realized. The reaction of water with activated aluminum powder is considered as one of the methods to generate hydrogen. The reaction produces also aluminum hydroxide ($Al(OH)_3$ or AlOOH) as the byproduct; these compounds change to alumina (Al_2O_3) after calcination process, and alumina can produce aluminum. Hydrogen production rate can be increased if an effective surface area of aluminum exposed to oxidation is increased. Ball milling process is considered as a method that remarkably changes the microstructure of morphology of aluminum hydroxides and can produce submicron or nano-sized particles. We found that microstructural refinement can be used to promote the reaction and allow increasing the production of hydrogen. The addition of water-soluble salts (potash or salt) also allows increasing the oxidation rate and hydrogen generation. However, we discovered that the presence of salt had much smaller influence than microstructural modifications. The traditional shrinking core model was modified to explain the kinetics of the reaction between aluminum particles and the fluid. The storage of hydrogen will also require structural modification of the storage system. One a storage system that was developed by us will be discussed. We designed a Pd-graphene composite for hydrogen storage with spherical shaped nanoparticles of 45 nm size homogeneously distributed over a graphene substrate. This new hydrogen storage system has attractive features like high gravimetric density, ambient conditions of hydrogen charge and low temperature of the hydrogen discharge. The palladium particles produce a low activation energy barrier to dissociate hydrogen molecules These Pd particles, have to be nano-size and homogeneously dispersed on the graphene surface, to serve as efficient hydrogen receptors and further facilitate a dissociation and diffusion of hydrogen and storage in graphene via a spillover process. The hydrogen storage capacity in such a combined metal-graphene system could be significantly increased compared to storage in graphene or in metal. In this project, we optimized the structure of Pd/graphene to allows a hydrogen uptake at ambient conditions and discharging of hydrogen at low temperature. Detailed analysis of the mechanism of hydrogen storage using ab-into calculation for graphene metal system is presented.

Biography

J.A. Szpunar received his PhD and DSc. degrees from Academy of Mining and Metallurgy in Cracow. He joined the Department of Mechanical Engineering at the University of Saskatchewan in August 2009, as Tier I Canada Research Chair. He came from McGill University where he was Professor of Materials Science and Birks Chair in Metallurgy. His research interests extend to various areas of materials related investigations. In particular he has longstanding interests in deformation and recrystallization processes in metals; in structure and properties of thin films; in electronic interconnects; in high temperature oxidation and corrosion; in synergy of wear, erosion and corrosion; in the applications of X-ray and neutron diffraction techniques to structure of grain boundaries and other interfaces; in hydrogen ingress into nuclear materials; in hydrogen generation and storage: in intergranular fractures; in fatigue and failure; properties of nanocrystalline materials and properties of nuclear materials and nuclear fuel. He was a leader of 49 major research projects – mostly materials related investigations. The results of his research are presented in more than 950 research papers including about 600 journal publications.

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Sanjeev Mukerjee, Innov Ener Res 2018, Volume 7
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Sanjeev Mukerjee
Northeastern University, USA

Enabling cost effective hydrogen at low temperatures

This presentation will focus on durable, high-performance materials and interfaces for advanced water splitting, enabling a clear pathway for achieving <$2/KgH$_2$ (on scale) with efficiency of 43 KWh/Kg using anion exchange membrane interface. Advances via fundamental understanding of both hydrogen and oxygen evolution reactions (HER/OER) leading to novel materials will be in conjunction with critical improvements in membrane and ionomers and gas evolution electrodes with corresponding characterization and testing. Progress towards these goals under a three-year multifaceted and comprehensive effort will be described wherein Northeastern University (NEU) will present catalyst development and characterization (both *in situ* and *ex situ*). University of Delaware (UD) will showcase improvements in ionomer and membrane materials. In addition, close collaboration with National Laboratory partners with Lawrence Berkeley National Lab (LBNL) participating in multiscale modeling and computation in close concert with Sandia National Laboratory (SNL) providing MD simulations of the membrane catalyst interface and National Renewable Energy Laboratory (NREL) providing advanced ionomers, durability protocols and validation will be described. Anion exchange membrane electrolyzers (AEMELs) are ideally suited with a low-cost profile enabled by platinum group metal (PGM)-free catalysts, low fluorine content membranes, and a less corrosive environment for cell separators. This presentation will showcase state of the art stable, high-conductivity, and high-strength AEMs, stable and active PGM-free catalysts for hydrogen and oxygen evolution reaction (HER/OER), and high performance electrode architectures that together can unlock the cost advantages of AEMELs. If successful, the developed technology can meet FCTO efficiency targets, delivering carbon-neutral hydrogen at $2/kg while simultaneously enabling higher penetrations of wind and PV electricity on the grid. The overall goal is cell level performance of 1.62 V at 1 A/cm^2, which meets the FCTO efficiency target of 43 kWh/kg. Component performance targets have been established using a porous electrode model to support the overall cell performance target. This is at the modeled scale of 50,000 kg/day and operating at 1 A/cm^2 resulting in hydrogen cost at $2.15, $1.82, or $1.76/kg, respectively (2, 20, 200 plants). In the low-volume manufacturing case, it is still possible to meet the cost target by operating near 2 A/cm^2, sacrificing some efficiency.

Biography

Sanjeev Mukerjee is a college distinguished professor in the department of chemistry and chemical biology and heads the Renewable Energy Technology Center at Northeastern University. He has authored 160 papers in peer reviewed journals and has an H-factor of 65. He holds 9 patents and has enabled several start up companies with membership on their scientific advisory committee.

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Eric L Miller, Innov Ener Res 2018, Volume 7
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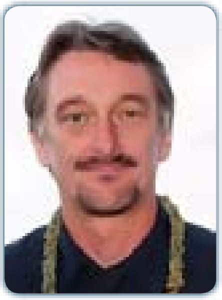

Eric L Miller

U.S. Department of Energy, USA

U.S. Department of Energy Hydrogen and Fuel Cell Technology Perspectives

Today the technology around generating efficient and sustainable energy is rapidly evolving and hydrogen and fuel cells are versatile examples within a portfolio of options. The U.S. Department of Energy (DOE) Office of Energy Efficiency and Renewable Energy's Fuel Cell Technologies Office (FCTO) addresses key technical barriers faced by hydrogen and fuel cell technologies through a comprehensive portfolio of early-stage research and development (R&D) with the potential to meet DOE technical, economic and energy security targets that ensure competitiveness with incumbent technologies in the market and alignment with national priorities. This presentation will provide an overview of DOE FCTO early-stage R&D activities in hydrogen and fuel cells, highlight technology status versus targets and identify recent achievements and market trends. The presentation will also offer insight into future prospects of hydrogen and fuel cells to enable energy security and resiliency across the transportation and energy generation sectors. Examples include the value proposition of hydrogen and fuel cell technologies as well as the potential of DOE's H2@Scale concept to utilize hydrogen as a large-scale energy carrier to enable benefits across multiple sectors. Supporting foundational materials research in hydrogen and fuel cell technologies being conducted through FCTO's Energy Materials Network Consortia will also be described.

Biography

Dr. Eric L. Miller serves as Hydrogen Production and Delivery Program Manager at the Fuel Cell Technologies Office of the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy. His professional career in alternative energy research has spanned more than 25 years, centering on solar energy conversion and on hydrogen and fuel cell technologies. He is widely recognized as a world leader in photoelectrochemical hydrogen production for his pioneering research in this field. Recently, Dr. Miller has played an instrumental role in the launch and management of DOE's Energy Materials Network, which aims to accelerate materials discovery and development critical to a broad spectrum of key clean energy technologies.

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