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Materials Challenges In Alternative & Renewable Energy

February 17-20, 2014 | Hilton Clearwater Beach Resort, Clearwater, Florida, USA

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Materials Challenges In Alternative & Renewable Energy

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MCARE 2014 facilitates information sharing on the latest developments involving materials for alternative and renewable energy systems. Emphasis will be on materials challenges and innovations in areas of hydrogen, solar energy, solar power and concentrators, battery and energy storage, nanocomposites and nanowires, nuclear, critical resources, and other energy area. MCARE 2014 is intended for not only scientists and engineers active in energy and materials science research, but also for those new to the field. **Register by January 16th to save!**

PROGRAM ORGANIZERS


Lin


Mathur


Zidan

H.T. Lin, Oak Ridge National Laboratory
Sanjay Mathur, University of Cologne, Germany
Ragaiy Zidan, Savannah River National Laboratory

PLENARY SPEAKERS

M. STANLEY WHITTINGHAM
SUNY Distinguished Professor, State University of New York, Stony Brook, USA

Title: *The LiFePO4 Story: Theory, Experiment and Characterization*

Abstract: The olivine cathode, LiFePO4, presents a quandary. It is a very good electronic insulator and thought to react by a two-phase mechanism, yet has one of the highest power capabilities of any cathode material. NECCES therefore chose it as a model compound to understand the ultimate limitations of intercalation electrodes. A theoretical model was developed that could explain the high rates, based on a metastable single phase. Ex-situ and in-situ tools were employed to determine the kinetic vs thermodynamic pathways. Vanadium was chosen as an aliovalent substituent, because it has a very different neutron scattering factor to iron. Vanadium substitution was found to increase the single-phase regions and the rate capability consistent with a single-phase mechanism. When V+Fe>1>Li, the iron resides on the Li site forming clusters, e.g. sarcopside, keeping the diffusion tunnels open. This "simple" material is now understood, and this understanding will allow us to design new batteries.

D. YOGI GOSWAMI
Director, Clean Energy Research Center, University of South Florida, USA

Title: *Materials and System Aspects of Thermal Energy Storage*

VOLKMAR LUETHEN
Siemens AG, Germany

Title: *TBA*

Hilton Clearwater Beach Resort

400 Mandalay Avenue, Clearwater Beach, FL
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Rates
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Government: Current Per Diem Rate

Cut-off Date: On or before January 15, 2014

BOR Z. JANG
Co-founder and CEO, Angstron Materials, Inc. and Nanotek Instruments, Inc., USA

Title: *Graphene for Electrochemical Energy Storage*

Abstract: Recent advancements in the use of graphene for supercapacitors (including electric double layer and redox-based), lithium secondary batteries, and high-power battery cells will be reviewed. Supercapacitors are now at the center stage for designers in the power electronics and electric vehicle (EV) industries. As compared to current

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lithium-ion batteries, supercapacitors exhibit a much higher power density (can be charged or discharged at a much higher rate), significantly longer cycle life (250,000 vs. 2,000 cycles, for instance), and are much safer. However, conventional activated carbon-based symmetric supercapacitors are capable of storing an energy density of typically < 8 Wh/kg (cell), in contrast to the typically 150 Wh/kg of lithium-ion cells. Significant improvements to the energy density are being made when graphene is used as the electrode active material of a supercapacitor.

TAEK-SOO KIM

Executive Director, Professor, Korea Institute for Rare Metal; Korea Institute of Industrial Technology; University Of Science & Technology

Title: *Recycling & Materialization of Rare Earths with Energy*

Abstract: Rare metal becomes a critical issue due to its drastic increase in industrial demand as well as its rarity. In order to assure it, the recycling among various approaches is vividly conducted in both the scientific and industrial regimes due to a limitation of natural resources with the mass energy consumption. So that convergence in the processes is proposed by these authors, so called RECYMAT (recycling & materialization). It means that the materials in-put for recycling move to industry without disposal. In this investigation, an example of RECTMAT is briefly introduced using the recycling of rare earth (Nd-Fe-B) magnets. Those are widely used in various industries such as voice coil motors in hard disk drive, magnetic generators for magnetic resonance imaging and electrical motors equipped in future vehicles. Looking at the process, Nd among Nd-Fe-B magnet scrap was selectively diffused into Mg in the liquid temperature range. On the other hand, Fe-B remains without any reaction with Mg, being a candidate element for high strength Fe-Nd base metallic glass. The presentation will discuss the result obtained by the reaction parameters such as time, temperature, vacuum, etc.

SUKLYUN HONG

Director, Graphene Research Institute and Dean, College of Natural Sciences, Sejong University

Title: *Theoretical Study of Growth and Electronic Structure of Graphene and Graphene-based Nanostructures*

Abstract: Recently, interesting subjects in the graphene research is graphene growth mechanism on various substrates and band gap engineering of pristine gapless graphene. First, we have performed density functional theory (DFT) calculations to understand the initial stage of graphene growth on the oxide substrates such as sapphire and magnesium oxide. The single carbon atom is found to bind favorably to an oxygen atom on the substrates. By increasing the number of adsorbed carbon atoms, we find that at least one carbon atom of the carbon structure binds to an oxygen atom of the surfaces due to strong bond between carbon and oxygen atoms. Combined with the experimental results, these theoretical findings may imply that carbon atoms on the oxide substrates form the nanocrystalline graphite structure within a limited area. Next, a periodically modulated graphene (PMG) generated by nano-patterned surfaces is reported to profoundly modify the intrinsic electronic properties of graphene. DFT calculations performed on a model of PMG reveals a possible tuning of a band gap by considering both strain caused by periodic bending of graphene and doping through chemical interactions with underlying substrate oxygen atoms.

CHIKASHI NISHIMURA

Hydrogen Materials Unit Director and Project Leader for Materials for Power Generation & Storage, National Institute for Materials Science (NIMS), Japan

Title: *Non Palladium-based Alloy membranes for Hydrogen Separation and Production*

Abstract: There is a growing interest on hydrogen selective membranes to be applied in hydrogen energy technology. Non-porous membranes for extraction and purification of hydrogen are key components for the establishment of hydrogen energy system. Non-porous membranes, which are essentially 100% hydrogen selective, can serve as a final clean-up mean of hydrogen gas before its use in PEFC, which requires hydrogen gas with ultra high purity. Alloys based on group V elements, vanadium, niobium and tantalum, have attracted the attention of researchers in chemical engineering and materials science, because of their extremely high hydrogen permeability. Japan has been leading the world in the research activities to develop hydrogen separation membranes based on these metals. Some alloy membranes have come to a stage of application test in catalytic membrane reactor systems. Here, I present the current status of development of non palladium-based alloy membranes for hydrogen separation. Mainly, the works on vanadium alloys, in which the authors have long been engaged, will be presented.

NED STETSON

Hydrogen Storage Program Manager, Fuel Cell Technologies Office, DOE, USA

Title: *TBA*

SCHEDULE

Monday, Feb. 17, 2014

8-8:10 a.m.	Welcome and opening remarks, Sanjay Mathur
8:10-8:45 a.m.	Plenary 1: M. Stanley Whittingham,
8:45-9:20 a.m.	Plenary 2: D. Yogi Goswami
9:20-9:40 a.m.	Break
9:40 a.m.-12 p.m.	Breakout Sessions
12-1:30 p.m.	Networking Lunch
1:30-2:10 p.m.	Plenary 3: Volkmar Luethen
2:20-5:40 p.m.	Breakout Sessions (afternoon break from 4-4:20 p.m. Sponsored by Toyota)
6-7:30 p.m.	Welcome Reception

Tuesday, Feb. 18, 2014

8:20-9 a.m.	Plenary 4: Bor Z. Jang
9-9:20 a.m.	Break
9:20 a.m.-12 p.m.	Breakout Sessions
12-1:30 p.m.	Networking Lunch
1:30-2:10 p.m.	Plenary 5: Taek-Soo Kim
2:20-5:40 p.m.	Breakout sessions (afternoon break from 4-4:20 p.m.)
6-8 p.m.	Poster Session and Reception

Wednesday, Feb. 19, 2014

8:20-9 a.m.	Plenary 6: Suklyun Hong
9-9:20 a.m.	Break
9:20 a.m.-12 p.m.	Breakout Sessions
12-1:30 p.m.	Networking Lunch
1:30-2:10 p.m.	Plenary 7: Chikashi Nishimura
2:20-5:40 p.m.	Breakout Sessions (afternoon break from 4-4:20 p.m.)

Thursday, Feb. 20, 2014

8:20-9 a.m.	Plenary 8: Ned Stetson
9-9:20 a.m.	Break
9:20 a.m.-12 p.m.	Breakout Sessions

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TECHNICAL PROGRAM

HYDROGEN

Sessions	Date	Time
Hydrogen I	Feb–17	9:40 a.m. – Noon
Hydrogen II	Feb–17	2:20 – 5:40 p.m.
Hydrogen III	Feb–18	9:40 a.m. – Noon
Hydrogen IV	Feb–18	2:20 – 5:40 p.m.

SOLAR FUELS

Sessions	Date	Time
Solar Fuels I	Feb–18	9:20 a.m. – Noon
Solar Fuels II	Feb–18	2:20 – 5:40 p.m.
Solar Fuels III	Feb–19	9:20 a.m. – Noon
Solar Fuels IV	Feb–19	2:20 – 5:40 p.m.
Solar Fuels V	Feb–20	8:20 a.m. – Noon

SOLAR POWER AND CONCENTRATORS

Session	Date	Time
Solar Power and Concentrators	Feb–17	2:20 – 5:40 p.m.

BATTERIES AND ENERGY STORAGE

Sessions	Date	Time
Batteries and Energy Storage I	Feb–17	9:40 a.m. – Noon
Batteries and Energy Storage II	Feb–17	2:20 – 5:40 p.m.
Batteries and Energy Storage III	Feb–18	9:20 a.m. – Noon
Batteries and Energy Storage IV	Feb–18	2:20 – 5:40 p.m.
Batteries and Energy Storage V	Feb–19	9:20 a.m. – Noon
Batteries and Energy Storage VI	Feb–19	2:20 – 5:40 p.m.
Batteries and Energy Storage VII	Feb–20	8:20 a.m. – Noon

NANOCOMPOSITES AND NANOWIRES MATERIALS FOR PHOTOVOLTAIC AND PHOTONIC TECHNOLOGIES

Sessions	Date	Time
Nano I	Feb–18	9:20 a.m. – Noon
Nano II	Feb–18	2:20 – 5:40 p.m.
Nano III	Feb–19	9:20 a.m. – Noon
Nano IV	Feb–19	2:20 – 5:40 p.m.
Nano V	Feb–20	8:20 a.m. – Noon

NUCLEAR

Session	Date	Time
Nuclear	Feb–17	2:20 – 5:20 p.m.

SOLARGENIX

Session	Date	Time
Solargenix	Feb–17	9:40 a.m. – Noon

OTHER ENERGY ISSUES

Sessions	Date	Time
Other Energy Issues I	Feb–19	9:20 a.m. – Noon
Other Energy Issues II	Feb–19	2:20 – 5:40 p.m.

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