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Welcome to the McClellan Nuclear Research Center (MNRC)

Greetings!

Welcome to the Second Edition of the McClellan Nuclear Research Center (MNRC) at the University of California, Davis (UC Davis) newsletter. You will notice in this edition that we have highlighted a UC Davis researcher that collaborates with the MNRC, a lithium-ion battery research project, a Nuclear Science and Security Consortium (NSSC) Summer School that took place at the end of June, and a recent list of publications from researchers that collaborate with the MNRC.

We look forward to continuing to provide updates on the accomplishments of our user community in academia and industry, and to promoting and increasing a collaborative environment.

Please feel free to forward along our newsletter to your colleagues using the link at the bottom left or please have them email us at mnrc@ucdavis.edu if they would like to join our mailing list to receive our newsletters in the future.

~Barry M. Klein, Ph.D. MNRC Director

MEET THE RESEARCHER

Dr. Jae Wan Park is an *Assistant Professor in the Department of Mechanical and Aerospace Engineering (MAE) at the University of California, Davis.* He received his B.S. (1997), M.S. (1999) and Ph.D. (2005) at the Pohang University of Science and Technology (POSTECH), Pohang, South Korea. Then he went to the University of Waterloo, Ontario, Canada to work as a postdoctoral fellow as well as a lecturer. He joined the UC Davis MAE Department in September 2008. His research interests include green energy

systems with batteries and proton exchange membrane (PEM) fuel cells. He is the Director of UC Davis Green Transportation Laboratory, Kor-US Transportation Study Program at ITS-Davis, and the UC Davis Formula Hybrid racing team. He is actively contributing to the fuel cells, batteries, and hybrid power system area as a reviewer for and on the editorial board of many journals.

Dr. Park's research team has recently developed a neutron radiography/tomography system for fuel cells and batteries at the ***UC Davis McClellan Nuclear Radiation Center***. Using the developed system he has been performing various experiments to investigate heat and mass transport phenomena in the fuel cells and batteries. Additional capabilities can be found at: http://mae.ucdavis.edu/jwpark/DavisSite/pages/capabilities.html.

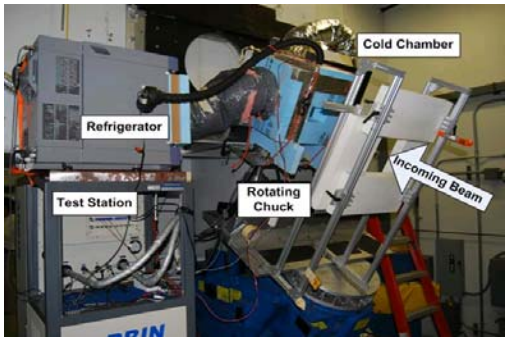

Figure 1: A neutron radiography and tomography setup is available for imaging of battery and fuel cell systems. Extreme environmental testing can be conducted for in-situ and ex-situ studies.

Research topics:
1. Electrical Systems (Fuel Cells and Batteries)
2. Energy Storage and Solar (Grid Tie and PV Charging)
3. Advanced Powertrains (Series Hybrid and Vehicle Modeling)

Dr. Park has published over 50 academic articles including two book chapters and 55 peer-reviewed journal articles and proceedings.
A complete list of publications can be found at:
http://mae.ucdavis.edu/jwpark/DavisSite/pages/publications.html

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RESEARCH HIGHLIGHTS

The following is highlighted on Dr. Jae Wan Park's research website -
http://mae.ucdavis.edu/jwpark/DavisSite/pages/research.html
Overcharge of **lithium-ion batteries** can lead to the deposition of lithium ions on the surface of graphite electrodes. The phenomenon of lithium deposition causes reduced electrochemical performance

and presents safety concerns for lithium-ion batteries in high-power applications.

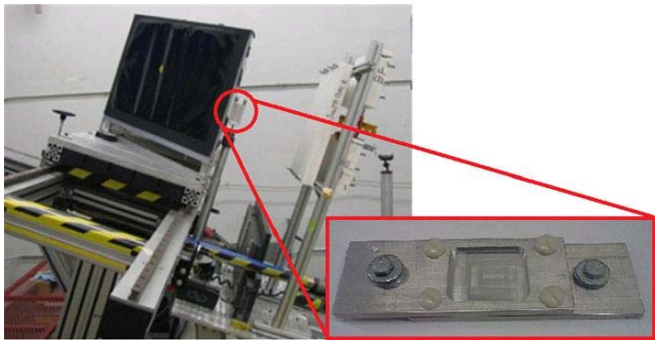


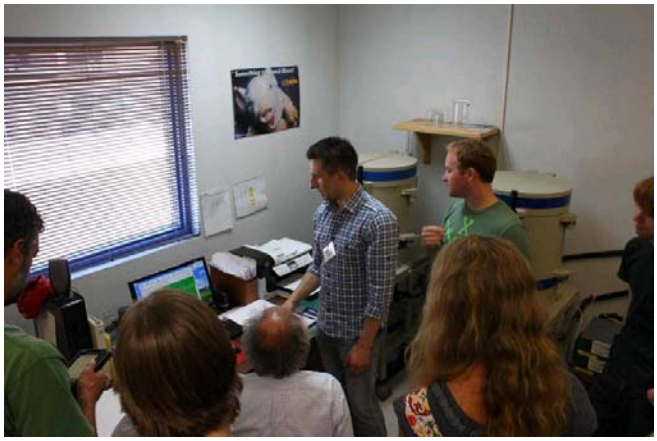
Figure 2: Neutron radiography imaging at MNRC Bay 3 - J.W. Park et. al. In situ neutron radiography analysis of graphite/NCA lithium-ion battery during overcharge. *J. Appl. Electrochem*., Nov. 2011.

Testing was carried out at the UC Davis McClellan Nuclear Research Center (MNRC) in North Highlands, CA. where there are three neutron imaging bays. The experiment, highlighted in this *J. Appl. Electrochem.* paper, was carried out in MNRC Bay 3, shown in the figure above. The average neutron beam intensity in this bay is 107 n/cm2s. The length-to-diameter ratio of the neutron beam is 140, which yields a spatial image resolution in radiograph images of approximately 0.1 mm.

To continue reading about this research - J.W. Park et. al. In situ neutron radiography analysis of graphite/NCA lithium-ion battery during overcharge. *J. Appl. Electrochem.*, Nov. 2011 or http://mae.ucdavis.edu/jwpark/DavisSite/pages/research.html.

2012 Nuclear Science and Security Consortium (NSSC) Summer School: Nuclear Analytical Techniques (June 25-July 6, 2012)

The 2012 Nuclear Science and Security Consortium (NSSC) Summer School, a no-cost* program, organized and run by Dr. Robert Svoboda, Professor of Physics from the UC Davis, covered a variety of topics including: nuclear science, reactor physics, non-proliferation policy, and imaging techniques. Seventeen students (13 graduate and 4 undergraduates) from across the United States, hailing from California, Oregon, Colorado, and Nevada, performed hands-on Neutron Activation Analysis using the McClellan Nuclear Reactor Center and gained experience and skills in counting, proton scattering, neutron imaging, and other analysis techniques important across a broad range of science and industry. These students having backgrounds in physics, nuclear engineering, nuclear chemistry, electrical engineering, and radiation health were also afforded the opportunity of visiting the UC Davis Cyclotron Facility, Lawrence Livermore National Laboratory (Livermore, CA), and Sandia National Laboratories (Livermore, CA).



To read more, click on http://lux.physics.ucdavis.edu/nssc_summerschool/doku.php?id=home or http://lux.physics.ucdavis.edu/nssc_summerschool/doku.php?id=schedule (link to summer schedule) or http://lux.physics.ucdavis.edu/nssc_summerschool/doku.php?id=talks

(link to talks)

*The cost of transportation and lodging was the responsibility of the participant.

Figure 3: Teaching Assistants, Jeremy Mock and Chris Grant, assist the NSSC students in the analysis of NAA samples after irradiation in the MNRC reactor; photo taken in the MNRC counting Lab.

PUBLICATIONS

1. Anthony Santamaria, Hong-Yue Tang, Jae Wan Park, Gu-gon Park, Young-Jun Sohn,: 3D Neutron Tomography of a PEM Fuel Cell under Sub-Zero Conditions, International Journal of Hydrogen Energy, (accepted)

2. Adam Same,Vincent Battaglia,Hong-Yue Tang and Jae Wan Park: In situ neutron radiography analysis of graphite/NCA lithium-ion battery during overcharge. J Appl Electrochem 42,1-9 (2012)

3. Yung-Tsi Bolon, William J. Haun, Wayne W. Xu, David Grant, Minviluz G. Stacey, Rex T. Nelson, Daniel J. Gerhardt, Jeffrey A. Jeddeloh, Gary Stacey, Gary J. Muehlbauer, James H. Orf, Seth L. Naeve, Robert M. Stupar, and Carroll P. Vance: Phenotypic and Genomic Analyses of a Fast Neutron Mutant Population Resource in Soybean,
Plant Physiology, 156, 240-253 (2011)

4. Hong-Yue Tang, Anthony Santamaria, Jae Wan Park, Changwoo Lee, Woonbong Hwang: Quantification of water in hydrophobic and hydrophilic flow channels subjected to gas purging via neutron imaging,
Journal of Power Sources 196, 9373- 9381 (2011)

5. J.T. Cremer, D. L. Williams, M. J. Fuller, C. K. Gary, M. A. Piestrup, R. H. Pantell, J. Feinstein, R. G. Flocchini, M. Boussoufi, H. P. Egbert, M. D. Kloh, and R. B. Walker: Periodic magnetic field as a polarized and focusing thermal neutron spectrometer and monochromator, Rev. Sci. Instrum. 81, 013902 (2010)

6. Hong-Yue Tang, Anthony Santamaria, Jonathan Kurniawan, Jae Wan Park, Tae-Hyun Yang, Young-Jun Sohn:
Developing a 3D neutron tomography method for proton exchange membrane fuel cells Journal of Power Sources 195, 6774-6781 (2010)

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