

ENGINEERING News

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New Center for High Temperature Characterization to enter construction phase

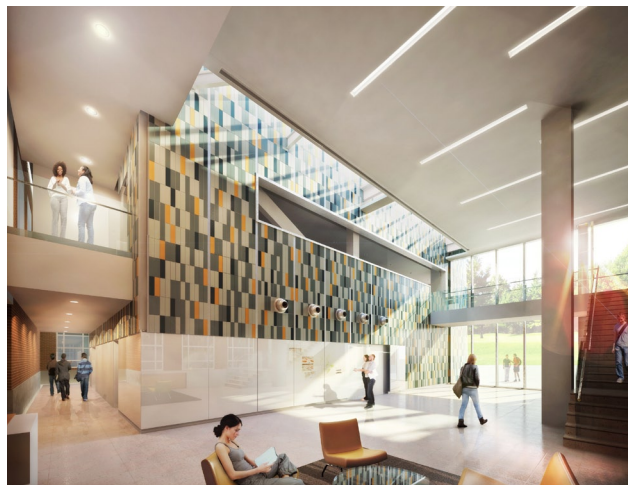
NY State-University-Industry partnership creates unique research facility

The Inamori School of Engineering at Alfred University is again bracing for major construction upheavals, as plans for a major new research facility for high-temperature (HT) materials characterization are entering the final stages of a collaboration between AU, NY State, and Corning Incorporated begun in 2008.

The new state-of-the-art Center for High Temperature Characterization is designed to facilitate an integrated approach to HT materials characterization, bringing together laboratories for microstructural, thermal, electronic, optical, X-ray, and spectroscopic HT characterization, now distributed throughout the School.

Known as the "McMahon Infill," the facility will occupy the area of the "U" at the rear of McMahon Engineering Building, and is envisaged to connect seamlessly with the spaces of the existing structure. The structure will have a vibration-free foundation to provide suitable areas for advanced electron microscopy.

The facilities now in place are being widely used by large NYS companies such as Corning, Delphi, Kodak, and General Electric, as well as smaller companies with a potential for growth, such as Solid Cell in Rochester, and TAM Ceramics in Niagara Falls. The NY BEST Consortium will make extensive use of the facilities in its battery initiative.



Architects' concept of new Center for High Temperature Characterization interior. More pictures on page 4.

continued on page 4

MS&T'12 Conference News

The Inamori School of
Engineering
Alfred University
Alumni Event

Tuesday, October 9
6:00-7:30pm
Room 338
David L. Lawrence
Convention Center

Join us to relax and
reconnect!

Contact Matt Hall or
Marlene Wightman in
Booth 425 for more
information.

Faculty gain Federal support for advanced energy materials research

The Inamori School of Engineering is taking a lead in materials research for advanced energy technologies. New US Department of Energy (DOE)-funded projects and collaborations have recently been announced, with funding of over \$2.5M for the upcoming 3-4 years.

DOE's Nuclear Energy University Programs (NEUP) has recognized SOE's expertise in awarding 2 of its 32 awards for 2012 to our faculty and collaborators.

Principal investigator **Dr Nathan Mellott**, assistant professor of materials science and engineering, and **Dr Scott Mixture**, MSE Inamori Professor, will conduct studies on "Surface Layer-Bulk Glass Interface Evolution with Aqueous Corrosion" - research on morphology, structure and chemistry of surface layer-bulk glass interface and the long-term corrosion-reaction kinetics to develop improved models for long-term predictive behavior of high-level-waste glasses under repository conditions. Collaborators include Dr Joseph Ryan, Pacific Northwest National Laboratory (PNNL), and Dr Glenn Waychunas, Lawrence Berkeley National Laboratory (LBNL).



Nathan Mellott



Scott Mixture

continued on page 3

CACT facilitates NY Industry-University research

The Center for Advanced Ceramic Technology (CACT) promotes job creation in New York State by facilitating academic-industrial research partnerships to promote innovation. These latest partnerships include projects on advanced materials for energy production and storage.

ADVANCED BATTERY MATERIALS

The AU SOE and General Electric have signed a contract to develop a new generation of sodium metal halide batteries.

The batteries will be developed by a consortium including AU and led by GE Global Research. The consortium, which includes Clarkson University, Columbia University, SUNY-Stony Brook and Brookhaven National Laboratory, was awarded a three-year, \$2.5 million NYSERDA grant.

The research goals are enhanced battery reliability, cycle life and performance for heavy-duty transportation and stationary power applications like hybrid locomotives and back-up power for telecommunication sites.

At AU SOE, the focus is on developing a stronger and more conductive ceramic beta'-alumina solid electrolyte (BASE) and a more robust corrosion-resistant glass. A theoretical computational model is being developed to accelerate further improvements.

The BASE physically separates the anode from the cathode while

providing the pathway for the sodium ions to shuttle between them.

The AU team includes **Dr Doreen Edwards**, SOE Dean and professor of materials science and engineering; **Dr Alastair Cormack**, Fréchet professor of ceramic science; **Dr Scott Misture**, MSE Inamori Professor; **Dr Matt Hall**, CACT director and MSE professor; and **Dr Bill Carlson**, professor of systems engineering (not pictured).

Applying SOE expertise in synthesis and characterization, BASE samples will be prepared for evaluation of their conductivity and strength - the results being used for meso-scale computer simulations to further refine sample properties and improving composition design.

IMPROVED SOLID OXIDE FUEL CELLS

Solid Cell of Rochester, NY, and AU SOE will be collaborating on a NYSERDA-funded project to improve solid oxide fuel cells (SOFC). The work will include development of ceramic interconnects, innovative ceramic circuits, for the SOFC.

Dr Olivia Graeve, MSE professor, is heading up the research project. Her team performed the necessary proof-of-concept research on ceramic interconnects during 2011.

Current interconnect technology uses metallic alloys which are susceptible to degradation at the typical 800°C temperatures and chemically aggressive environment of SOFC's operation. Unlike metals and their alloys, ceramics are much more durable at high temperatures and in caustic environments.

Solid Cell is providing \$70K for the one-year project; partial matching funds are being provided by both NYSERDA and the CACT.

THERMOELECTRIC DEVICES : CONVERT WASTE HEAT TO USABLE ELECTRICITY

AU SOE is working with TAM Ceramics of Niagara Falls and ENrG Inc. of Buffalo to develop ceramic oxide thermoelectric (TE) devices that could lead to more fuel-efficient cars. TE devices convert waste heat to usable electricity; using ceramic oxides will enable these devices to work at much higher temperatures.

Recipient of a \$200K NYSERDA grant to improve the TE device's performance, TAM is developing the ceramic powder while ENrG is incorporating the materials into ceramic sheets. AU SOE will sinter the powders TAM develops and characterize the powders and sintered product.

Olivia Graeve will oversee spark plasma sintering (SPS) fabrication; **Doreen Edwards** will oversee the characterization, using equipment in the Center for High Temperature Characterization

allowing researchers to measure properties of the materials at temperatures up to 1000°C.

CACT is contributing partial match funding to the AU SOE-based part of the project.



Doreen Edwards



Alastair Cormack



Matt Hall



Scott Misture



Olivia Graeve

CACT's Watkins named to NY-BEST Board

Barry Watkins, deputy director of the Center for Advanced Ceramic Technology at Alfred University, has been named to the board of directors of the New York Battery and Energy Storage Technology Consortium (NY-BEST).



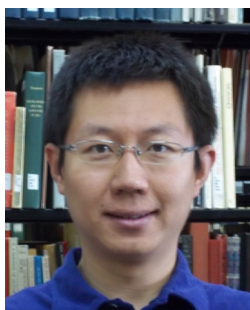
Barry Watkins

Watkins is among the 4 members representing NY's academic sector on the 16-member board; this appointment represents an important connection between NY-BEST and AU's CACT and research programs in ceramics, glass and other materials.

NY-BEST Consortium was created in 2009 and brings together NY's energy storage companies, universities, and government partners to position NY as a global leader in energy storage technology, including applications in transportation, grid storage, and power electronics.

Liu will increase depth in advanced materials for clean energy

Dr Dawei Liu, assistant professor of materials science and engineering, joined the Inamori School of Engineering faculty for Fall 2012.



Dawei Liu

Liu received his BS degree from the Department of Physics in Nanjing University (China) in 2004 and obtained his PhD from the University of Washington's Department of Materials Science and Engineering in 2010. He was a postdoc research associate in the same research group at the University of Washington from 2010 to 2011 before moving to Brown University as a postdoc research associate.

Liu's research centers on nanostructured materials for electrochemical energy storage and biosensors as well as mechanical property studies of oxide thin films as Li-ion battery electrodes and fuel cell electrolytes. He is author or coauthor of almost thirty publications.

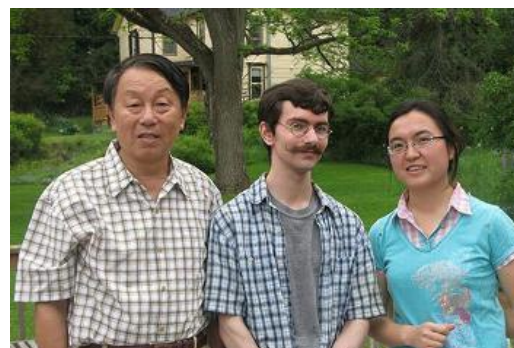
Other new SOE appointments include Dr Marcos Ortiz, adjunct instructor; and Matthew Degges, visiting instructor; both in mechanical engineering.

The Inamori SOE will soon be opening faculty searches for tenure-track candidates in mechanical engineering (1) and materials science (2). Expertise is sought in high temperature mechanical properties of metals and composites and to expand our current expertise in advanced materials processing.

Students and faculty recognized for outstanding research and scholarship

Dr Jinghong Fan, professor of mechanical engineering, and two of his graduate students, Long He and Ross Stewart, received the American Society of Mechanical Engineers' Orr Best Paper Award from the editorial board of the Journal of Engineering Materials and Technology (JMET) and the ASME-Materials Division.

The award was for their article, *Concurrent and Hierarchical Multiscale Analysis for Layer-Thickness Effects of Nanoscale Coatings on Interfacial Stress and Fracture Behavior* (J. Engineering Materials and Technology, 134 [3] 031012/1-/10 (2012). [<http://dx.doi.org/10.1115/1.4006498>]).



Advanced energy materials *continued from page 1*

In the second NEUP grant "Alternative High-Performance Ceramic Waste Forms," co-investigators

Dr S. K. Sundaram, MSE Inamori Professor, and **Misture** will aim to advance fundamental understanding of the kinetics of structural evolution of crystalline ceramic waste forms.



S.K. Sundaram

The structure/property relationships identified in this work will help to reveal new formulations, improved processing routes, and strategies for improved performance of ceramic waste forms. Collaborators are Dr Kevin Fox and Dr Kyle Brinkman, both at Savannah River National Laboratory (SRNL).

Misture is also a collaborating investigator on the DOE's Solid-State Energy Conversion Alliance

(SECA) project "Role of Systems Operation Conditions and Exposure Atmospheres on the Chemical and Structural Integrity and Durability of Doped Lanthanum Manganite Cathode Materials" with lead investigator Dr Prabhakar Singh, Director of the Center for Clean Energy at the University of Connecticut.

The research goals are to increase reliability, robustness, and durability in advanced fuel cell and stack technology to enable the generation of efficient, cost-effective electricity from domestic coal and natural gas with near-zero atmospheric emissions.

Federal National Science Foundation (NSF) support has been awarded to principal investigator **Dr Olivia Graeve** for "Scalable Manufacturing of Unique Hexaboride

Nanomaterials – Model Systems for Advanced Hydrogen Storage and Gas Separation Technologies."

Co-investigators are **Misture**; **Dr Doreen Edwards**; **Dr Yiquan Wu**,



Yiquan Wu

MSE assistant professor; and Dr Victor Vasquez, University of Nevada, Reno.

This research explores the scalable manufacturing and fundamental behavior of unique nanoscale boride materials for applications in several industrially-relevant and critical technologies, with a special emphasis on energy generation and gas storage applications.

HT Characterization Center *continued from page 1*



Architects' concept of new Center for High Temperature Characterization - east entrance.



Architects' concept of redesigned entry to McMahon Engineering Building as seen from southwest.

The first \$4M phase of the HT initiative was announced in 2008 by State Senator Catharine Young. By 2010, HT characterization laboratories for HT thermal property measurement and multifaceted HT X-ray characterization had new equipment acquired, installed and operational.

In 2011, an additional \$2.8M grant to purchase equipment and renovate facilities further in the HT materials characterization was obtained from NY State's Regional Economic Development Council, part of a \$785M initiative. These funds are expected to enable the addition of terahertz imaging and mm-wave testing, new diagnostic equipment for renewable energy systems and for the characterization of high-temperature batteries, and a new transmission electron microscope for the new facility.

A spark plasma sintering (SPS) unit was acquired with the help of Corning Incorporated, installed and tested by October 2011. This new capability has already attracted TAM Ceramics of Niagara Falls and ENrG Inc. of Buffalo; the companies are recipients of NYSERDA funding to develop ceramic oxide thermoelectric devices that could lead to more fuel-efficient cars. With SOE researchers, they are using SPS to fabricate unique materials for further HT property characterization.

The latest HT characterization unit is the new HT mechanical testing suite in the McMahon Building. Senator Young will officially dedicate the testing facility in October 2012.

Ground-breaking for the multimillion dollar facility is anticipated for May 2013, with a planned completion in September 2014. The School will appoint a research scientist/manager to oversee both technical and administrative operations. It is also conducting a search for new faculty with HT characterization expertise.

For more information on the capabilities of the AU SOE high temperature materials characterization facilities, contact **Dr Matt Hall**, director of the Center for Advanced Ceramic Technology (HALLMM@alfred.edu).

Faculty news and notes

Dr Jalal Baghdadchi, professor of electrical engineering, and **Dr Olivia Graeve** have recently been promoted to full professor in the Inamori School of Engineering.



Jalal Baghdadchi

Dr Alastair Cormack is noted as coauthor of one of the top-ten downloaded articles for 2011 in Proc. of the Royal Society A. (*The initial stages of bioglass dissolution: a Car-Parrinello molecular-dynamics study of the glass-water interface*, with A. Tilocca)

Cormack is also editor of the Proceedings of the 17th International Conference on Solid State Ionics (Solid State Ionics, **192** (1) (2011)).

Cormack, a member of the International Advisory Committee for the Physics of Non-Crystalline Solids (PNCS) conference series, will be the organizer and conference chair of its 2015 conference.

Dr Doreen Edwards, Dean of the Inamori School of Engineering, has been named a Fellow of the American Ceramic Society. Edwards is recognized not only for her outstanding research on oxides for electrical, optical, and energy conversion applications, but also for her years of service to the Society's Basic Science Division.

Dr Linda Jones, Alfred University VP for statutory affairs and professor of materials



Linda Jones

science, and **Dr Olivia Graeve**, professor of materials science, joined WXXI AM 1370 radio guest host David Cay Johnston on "1370 Connection" on Tuesday, Aug. 7th, to discuss new developments in the world of advanced materials. The mid-day talk show features in-depth discussion of issues in the news, with expert guests from WNY and across the nation.

Dr S.K. Sundaram, Inamori Professor of Materials Science and Engineering, has been appointed a member of the International Materials Reviews Committee. He will serve until 2015.

Sundaram was organizer of the recent Glass Problems Conference, sponsored by the GMIC, the Glass Manufacturing Industry Council.