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News
Kazuo Inamori School of Engineering
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Superstrong glass critical in hunt for elusive neutrinos

AU expertise in glass tapped in critical materials problem

Dr. S.K. Sundaram, Inamori Professor of Materials Science and Engineering, has been chosen to evaluate the mechanical properties of glasses that could be critical to the success of the Long-baseline neutrino experiment (LBNE) being undertaken by the national laboratories.

S.K Sundaram

LBNE will send the world's most intense beam of neutrinos about 800 miles underground from Fermi National Accelerator Laboratory (FNAL) in Illinois to a mine in South Dakota. Brookhaven National Laboratory (BNL) is leading the management, design, and construction of the experiment's two Cherenkov detectors – cylindrical devices, each large enough to hold a 20-story building and filled with ultra-pure water. When a neutrino interacts with these water molecules, it will create light that gets detected by the 50,000 photomultiplier tubes coating the detector's walls.

The detector, containing about 330,000 tons of ultra-pure water and located 4,800 feet below ground in the "Deep Underground Science and Engineering Laboratory" or DUSEL (the former Homestake goldmine in South Dakota), will be about 15 times bigger than the currently largest neutrino experiment, the Super-Kamiokande detector in Japan.

In 2001, the apparent implosion of one photomultiplier detector tube at Super-Kamiokande resulted in a cascading failure of over half of the 11,000 detectors, reducing its usefulness for 5 years until restoration was completed.

Recently, researchers at BNL have found that for a few microseconds following the start of an implosion conducted in a simulator, the pressure of the water closest to the tube soars to 800 psi, or ~ 5.6 MPa, a 10-fold increase above nominal pressure, for several microseconds. The simulation results confirmed their models with real data and suggests two ways to prevent a catastrophic implosion in the detector. The first option is to make

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Conference news

The Inamori School of Engineering MS&T'11 Alumni Event is Tuesday, October 18, in Convention Center room E171, 6:15-7:30 pm. Contact Marlene Wightman in Booth 725 for more information.

Upcoming in 2012 -

S.K. Sundaram, Inamori Professor of Materials Science, is lead organizer of the October 2012 Glass Problems Conference, sponsored by the GMIC, the Glass Manufacturing Industry Council. Contact sundaram@alfred.edu for more information.

New Faculty enhance Nanomaterials, Biomaterials Programs

Dr. Anthony ("Tony") Wren and Dr. Yiquan Wu are newly appointed assistant professors in the Inamori School of Engineering; their research expertise will extend the breadth of research skills and technical expertise within SOE.

Anthony Wren

Yiquan Wu

Tony Wren's interest in novel glasses and glass ceramics for biomedical and bioactive applications is seen in his current research on bioactive glass/ceramic cell scaffolds for customizable, shaped, bone graft applications; antimicrobial glass coatings and antimicrobial glass microparticles for incorporation into biodegradable wound dressings to promote rapid healing; as well as advanced and novel bone cements for strength, anti-cancer response, and biodegradeable applications.

Wren plans to expand his research to include the in-house evaluation of cytotoxity of his novel materials on mammalian cells (bone and cancer cell lines) in the near future.

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CHTC expands capabilities

The Center for High Temperature Characterization (CHTC) offers mechanical, structural, thermochemical, thermophysical and electronic characterization of crystalline materials, glasses and melts at temperatures exceeding 1200˚C and in controlled atmospheres – an important bridge for manufacturers and researchers that complements the novel powder processing and pilot plant fabrication capabilities of the Inamori School of Engineering.

The Setaram thermal analysis system has a new TMA module – and new capabilities for TGA(DTA)/DSC/mass spec and TMA to 2400˚C, with atmosphere control. For larger samples, the new Instron 8802 mechanical test frame will be equipped with a high-temperature (2400˚C) furnace for testing under controlled atmosphere/temperature; delivery is expected in late 2011.

The Probostat High Temperature Test Fixture (for electrical properties and SOFC Button Cells) is now available to characterize advanced electronic materials and devices. Capabilities for automated multisample Seebeck coefficient measurement have also been expanded.

The CHTC X-ray lab has 2 high temperature systems that can reach 1200˚C and one that reaches 1100˚C for the study of thin films, texture and stress at high temperature. The lab also has a new room temperature system for detailed structure analysis using molybdenum radiation as well as a wavelength-dispersive x-ray fluorescence system for chemical analysis. These new x-ray systems complement the existing high temperature XRD that can reach 1600˚C and several of our workhorse powder diffractometers.

CHTC labs and technical support are available to everyone on campus and to off-campus users through our industrial and academic outreach programs. For more information on how the CHTC can help answer your materials questions, contact CACT director **Matt Hall**, **hallmm@alfred.edu.**

Bob Snyder – visionary in powder X-ray diffraction

Robert L. ("Bob") Snyder, professor emeritus of ceramic science, retired from Alfred University in 1996 after 26 years. Snyder then accepted new challenges, first as Chair of Materials Science at OSU and continuing to Georgia Tech in 2003. Snyder remained a close colleague to the Inamori SOE faculty and his former students. His legacy at AU includes the core of present-day CHTC X-ray lab.

Bob Snyder

Snyder developed many of the details of extracting microstructural and nano-scale information from the peak widths and shapes encountered in powder diffraction and was among the first in the US to demonstrate the remarkable capabilities of high temperature powder diffraction – a direct influence on the designs of the new in-situ instruments now available in our CHTC labs.

Snyder died Sept. 1, 2011, in Atlanta, GA, after a long battle with cancer. Snyder was 70 and at the time of his death was a professor and co-chair of the School of Materials Science and Engineering at Georgia Tech.

New Lab is "Ultrafast"

Dr. S.K. Sundaram has announced the creation of the new "Ultrafast" Materials Science and Engineering Laboratory (U-Lab) focusing on physical phenomena on the femtosecond (10^{-15} s) scale – a real-time approach to materials engineering. Chemical reactions, phase transitions, and surface processes occur on femtosecond to picosecond time scales (1 ps = 10^{-12} s or THz domain). Femtosecond pulsed laser technology can be used to explore carrier dynamics (semiconductors), non-linear optics and ultrafast spectroscopy, and materials processing.

Sundaram's THz/millimeter wave laboratory (T-Lab) is already established as a research and teaching facility.

Center for Advanced Ceramic Technology: We partner with you

Matt Hall

Barry Watkins

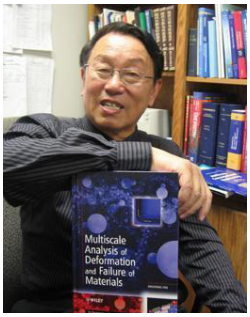
At CACT, our mission is to help New York State companies retain and create jobs, and increase their productivity and profitability. The CACT specializes in applied and technical research that solves real-world problems and converts to practicable, scalable, marketable products and solutions – our mission is to help New York State companies retain and create jobs, and increase their productivity and profitability. Our focus is collaborative research, industry education and training, along with outreach and networking.

The Inamori School of Engineering maintains comprehensive facilities for materials research; our faculty PI's specialize in all aspects of advanced materials, particularly in the areas of ceramics and glass. This unparalleled combination of expertise and research tools can be accessed by industrial partners to develop new or improved materials and processes.

An extensive pool of undergraduate students, graduate students, post-doctoral researchers, senior researchers, and technical staff can be leveraged for your project, while faculty PI's will always have ultimate oversight to ensure appropriate management of resources and completion of deliverables.

Contact CACT Director **Matt Hall**, **hallmm@alfred.edu**, or Deputy Director **Barry Watkins**, **watkinsb@alfred.edu**, for more information.

Fan takes lead in Multiscale Analysis



Dr. Jinghong Fan

Dr. Jinghong Fan, professor of mechanical engineering, has published his textbook, "Multiscale Analysis of Deformation and Failure of Materials" (John Wiley & Sons, NY, 2011), a multidisciplinary text relevant to those working in the areas of materials science, solid and computational mechanics, bioengineering and biomaterials, and aerospace, automotive, civil, and environmental engineering.

A member of the AU faculty since 2000, Fan's research interests include composite and smart materials, micro/macro scale analysis of the mechanics of materials, lightweight and cost-effective alloys, and fracture and damage mechanics.

Fan, well-respected in the international research community of advanced mechanics, has co-chaired all three conferences of the "International Conference on Heterogeneous Materials Mechanics" (ICHMM) series, most recently ICHMM-2012, May 22-26, Shanghai, China.

Processing capabilities now include Spark Plasma Sintering

The nanomaterials processing capabilities within the Inamori School of Engineering at Alfred University have recently been expanded by the acquisition of a spark plasma sintering (SPS) unit. Our SPS equipment (FCT Systeme HP D-25/2) is able to apply 25 tons of load and 10,000 amps during consolidation of a variety of materials under vacuum, He, N_2 or Ar atmospheres.


Olivia Graeve

Dr. Olivia Graeve, associate professor of materials science, states, "This equipment will allow us to expand the repertoire of materials we can produce, moving towards ultra-small grain sizes below 20 nm for both metals and ceramics." Graeve has immediate plans for the utilization of the new technology in optimization of novel nanomaterials processing.

The new SPS facility, located in the McMahon Engineering Building, complements the extensive process technology – including advanced microwave sintering, HIP, and numerous conventional technologies – that are available to AU researchers and their research partners through the CACT.

The new SPS facility will be inaugurated on October 13, 2011. The event, coinciding with the annual John F. McMahon Lecture, will include a 1-day symposium on SPS technology and applications.

New faculty

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Wren has been a member of the AU SOE research community since 2009, coming from the University of Limerick, Ireland. Cross-disciplinary studies characterize his research with ongoing collaborations among the SOE and Alfred University Biology faculty.

Yiquan Wu specializes in the advanced fabrication of materials for application in optics, bioengineering, advanced batteries, and thermoelectric devices using electrohydrodynamic processing methods; and in the fabrication of advanced ceramics. Wu was most recently a member of the research faculty in Mechanical Engineering/Materials Science at the University of Rochester.

His expertise extends to 3-D controlled fabrication using rapid-prototyping technology and aerosol-assisted vapor deposition for the creation of functional films and coatings.

Wu is expanding into laser-assisted processing of nanomaterials for biomedical and other devices and to extend his fabrication expertise to more complex oxides and rare earth oxides for laser and thermoelectric applications.

Superstrong glass

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the glass itself stronger – thus calling in the expertise of glass scientists at the Inamori School of Engineering at Alfred University to search for a material strong enough to withstand the impact of a nearby implosion.

The second option is to design phototube enclosures that in the case of an implosion would deflect or absorb the shock wave, a technique applied using acrylic shields in the 2002 partial restoration of the Japanese Super-K.

"[LBNE] is a huge particle physics experiment," remarked Matt Hall, director of AU's Center for Advaced Ceramic Technology. "There is no obvious linkage between glass science and 'Big Physics' but in this instance the durability of the glass is critical to the success of the experiment. The fact that BNL chose Dr. Sundaram to test the mechanical properties of the glass speaks to Dr. Sundaram's and AU's reputation in this field."

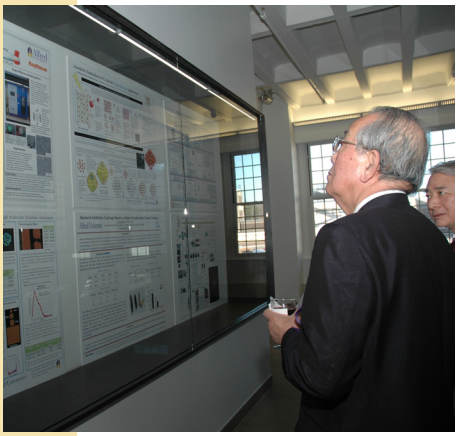
Inamori Kyocera Fine Ceramics Museum Dedicated

Advanced technological ceramics in everyday devices brought to the forefront in new BMH educational facility

"As ubiquitous as ceramic materials are in nearly every aspect of modern life, their full potential has not yet been reached," said Dr. Kazuo Inamori, founder and chairman emeritus of Kyocera Corp., at the May 10, 2011 dedication of the Inamori Kyocera Museum of Fine Ceramics at Alfred University.

Displays within the museum highlight the history of ceramic materials, which can be traced back to 24,000 BCE (Before Common Era) to today, where fine (also known as advanced or engineered) ceramics are an enabling technology in countless everyday items – from computers and cell phones to more specialized applications like fuel cells, solar panels and biomedical implants.

Dr. Alastair Cormack, who is the founding dean of the Inamori School of Engineering and who worked with Kyocera Corp. to create the Museum, called it an "extraordinary facility. It is unique, much more than a collection of artifacts or specimens." It is, he said, an "educational facility in the truest sense of the word. It charts the historic development" of ceramic components that are "found in virtually every aspect" of our lives today. Visitors to the Museum will be "staggered by their pervasiveness."



Dr. Inamori examines posters on current research in the Inamori SOE

The Museum is also a testament to the impact Inamori's work and Kyocera Corp. have had on our lives today, Cormack noted.

The Inamori Kyocera Museum of Fine Ceramics was established to recognize a $10 million gift to the School of Engineering in Dr. Inamori's honor by Kyocera Corporation. Actual funding to create the museum came from New York State as a partial match for the gift from Kyocera Corporation.

The Museum, located on the 2nd floor of Binns-Merrill Hall is the focal point of an educational center that also includes the Schein-Joseph International Museum of Ceramic Art gallery space and the new Discovery Lab, which will be AU's center for science and technology outreach activities involving students from kindergarten through 12th grade and their teachers.

A message from the Dean's Office

Doreen Edwards

Friends,

The Inamori School of Engineering is undergoing an extraordinary transformation. Over the past two years, approximately one-quarter of the faculty has elected to retire. With sincere gratitude, I wish to acknowledge the long-lasting contributions of Dr. Vasantha Amarakoon, Dr. Carlson Pian, Dr. James Shelby, Dr. Walter Schulze, Dr. James Varner, and Dr. Arun Varshneya. Collectively and individually, they have left an indelible impression upon the School and the students they taught. While this exodus will undoubtedly lead to changes in the School, we remain committed to our core competencies in ceramics, glass, and biomaterials with a strategic emphasis on energy, environment, and healthcare.

In the past year, three faculty have joined the Alfred University family, including Dr. S.K. Sundaram, Dr. Anthony Wren, and Dr. Yiquan Wu. Over the next few years, we plan to recruit several new faculty members with expertise in electron microscopy, high temperature structural materials, renewable energy, advanced manufacturing, and rapid prototyping.

If you're interested in glass, ceramics or biomaterials, I encourage you to visit our campus to take in the Inamori Kyocera Fine Ceramic Museum, to learn more about our graduate programs, to explore research collaboration with our faculty, or to rekindle your connection to Alfred University. Feel free to drop me a line at **dedwards@alfred.edu**.

Doreen Edwards

Dean, Inamori School of Engineering

Comments on or suggestions for **Engineering News** may be sent to **soeenews@alfred.edu**.