Volume 4 Issue 2 Winter 2012

IMR Quarterly

Faculty Spotlight: Gunjan Agarwal, Biomedical Engineering

Gunjan Agarwal joined The Ohio State University in September 2003 as an Assistant Professor with a joint appointment in the Biomedical Engineering department and the Davis Heart and Lung Research Institute (DHLRI). Dr. Agarwal was promoted to the rank of Associate Professor in 2009, and she also directs the multi-user AFM core facility within the Davis Heart and Lung Research Institute. Prior to joining OSU's faculty, Dr. Agarwal was a Research Scientist at the Air Force Research Laboratory at Wright Patterson Air Force Base, and held Postdoctoral Researcher positions with Procter and Gamble Pharmaceuticals and Albert Einstein College of Medicine in New York.

Dr. Agarwal's major research interest is to understand extracellular matrix (ECM) regulation at the cellular and molecular scale and its implications in vascular and bone diseases. She employs techniques such as atomic force microscopy (AFM), electron microscopy and fluorescence microscopy along with biochemical assays for her research. Another vector of her research is the development of novel biomedical applications of AFM. Her research has been funded by the NIH and American Heart Association as well as internally by OSU materials research centers such as the NSF NSEC and MRSEC centers and the IMR.

Extracellular Matrix (ECM) Remodeling

Remodeling of the extracellular matrix (ECM) is important for a variety of physiological and pathological processes. Collagen type 1 is the most abundant ECM protein present in the adult mammalian tissues. Dynamic interactions between collagen and cells via specific receptors and signaling pathways control processes such as cell migration, proliferation and survival. The overall goal of Dr. Agarwal's laboratory is to elucidate the functional role(s) of the widely expressed collagen binding proteins, discoidin domain receptors (DDRs) in modulating collagen structure and mechanics at the molecular, cellular and tissue levels (Figure 1).

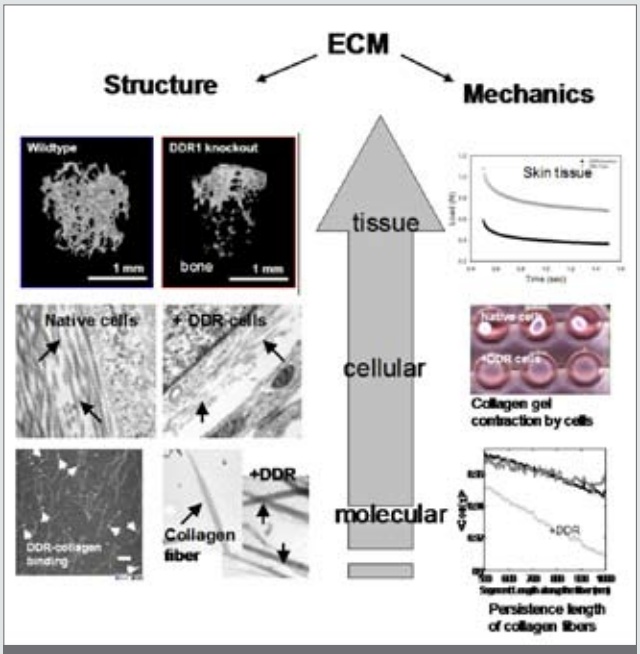

Figure 1 Modification of collagen structure and mechanical properties by the collagen binding proteins, DDR1 and DDR2: (left) DDRs disrupt the D-periodicity of collagen fibers (arrows) and reduce fiber diameter. Bones from mice lacking DDR1 show differences in architecture and quality. (right) Structural changes in collagen fibers caused by DDRs result in 'softer' collagen fibers with reduced persistence length. Skin from mice lacking DDR1 exhibits greater tensile strength.

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IMR Institute For Materials Research

THE OHIO STATE UNIVERSITY

Director's Note

Dear Colleagues,

It has been said before and it will be said again: Materials research is truly entering a renaissance period. With the multitude of new materials and concepts being explored as a result of the converging energy, health, environment, security and sensing needs we face today, there may never have been a period of time with so many new entrants to the field of advanced materials. Ohio State's leadership recently announced its strategic plan precisely along these lines of societal needs, with three Discovery Themes identified as Health and Wellness, Energy and Environment; and Food Production and Security. Our community is uniquely and exceedingly well positioned to work with our colleges and departments toward enabling and achieving their strategic plans through the creation of new opportunities that are now only at the intersections of traditional disciplines. After all, materials science and engineering was born from such connections between various fields of engineering, chemistry and physics, and now the addition of the biological/biomedical sciences, energy technologies, sustainability and security is generating an exciting new era for IMR and Ohio State, much less the nation and world.

For the past 6 years, IMR has intentionally focused much energy to create interdisciplinary research teams, looking for breakthrough research that combines "traditional" fields in synergistic fashions to focus on opportunities at the boundaries, first through our Interdisciplinary Materials Research Grants and now through the more expansive OSU Materials Research Seed Grant program. One such faculty member whose research spans the fields of engineering, physics, biochemistry and medicine is Prof. Gunjan Agarwal, featured in this issue's Faculty Spotlight.

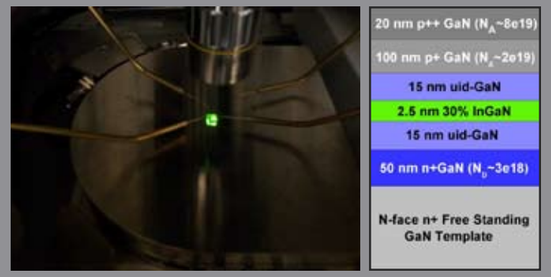
OSU's new Technology Commercialization Office is positioning itself to best meet researchers' current needs and the future challenges of an evolving research process. Under the leadership of Vice President for Technology Commercialization Brian Cummings and myself, the TCO and IMR are developing a process toward zero barrier interactions between IMR member research and commercialization/innovation opportunities. We will co-host a special forum during Spring Quarter 2012 where materials faculty, students and staff can interact with TCO professionals and determine how to use the university's resources to maximize their intellectual property, knowledge transfer and commercialization strategies. In the meantime, this issue includes an overview of the TCO and how it supports research innovations at Ohio State, along with updates from our materials centers and facilities, seed funding announcements, and other "in the news" research by our fine students, staff and faculty researchers.

Warm Regards,

Steven A. Ringel, Ph.D.
Neal A. Smith Chair Professor
Director, The Ohio State University Institute for Materials Research

N-polar GaN Light Emitting Diodes

GaN based light-emitting diodes (LEDs) have been commercialized for lighting and displays due to their higher efficiency and longer lifetimes compared to conventional lighting and display sources. Making efficient emitters in the green wavelength range however, has been very challenging due to several fundamental physical limitations. These emitters have several applications ranging from displays to communications and sensing.



Recently, OSU's Siddharth Rajan (Assistant Professor of Electrical and Computer Engineering and Materials Science and Engineering) and his colleagues have indicated that using a new orientation of the GaN crystal structure, the N-polar orientation, could have significant advantages for making longer wavelength LEDs. The N-polar orientation has been found to be better for making high In-composition InGaN alloy in the crystalline form. In addition, ECE PhD student Fatih Akyol's simulations show that the potential profiles seen by electrons in the N-polar LEDs could improve power and efficiency from these emitters, potentially solving one of the biggest challenges in this area of research.

The Rajan research group's findings have received attention in multiple publications and trade journals. Their work featured in the June 2011 issue of Semiconductor Today (http://tinyurl.com/77fs5gk) used molecular beam epitaxy, a method for synthesizing atomically perfect crystal structures for electronics, to demonstrate the first N-polar light emitting diodes in the green wavelength range [Akyol et al, Japanese Journal of Applied Physics, 50, 052101].

New Commercialization Office Focuses on Change

Vice President for Technology Commercialization, Dr. Brian Cummings

OSU's newly created Technology Commercialization, and Knowledge Transfer Office has been all about change in its first nine months of operation. Led by the new Vice President for Technology Commercialization Brian Cummings, the office is undergoing a substantial overhaul in just about every way possible. "From the organization, to the programs to the culture, we realized that we needed much more streamlined and simpler processes to achieve success," said Cummings. It's our job to ensure that the breakthrough research at Ohio State finds its way to the public sector in the shortest time possible and to do that we need to build creativity, responsiveness and accountability into new programs and partnerships so we can maximize the impact of our research and enhance student and faculty education.

Behind every great new product and discovery is a great researcher. Behind every great researcher at The Ohio State University is the TCO.

The objectives of the new office are as follows:

- Build a culture of innovation, service, responsiveness, creativity and accountability
- Reorganize the structure, systems and programs of the commercialization office
- Create customized initiatives that enhance our research colleges
- Develop a robust start-up culture that drives economic development
- Increase deal flow and revenue while decreasing transaction costs
- Establish unique public private partnerships that facilitate commercialization
- Increase Industry sponsored research and long term partnerships
- Engage students in every aspect of the process to enhance the learning experience and support Ohio State's mission
- Engage Alumni and Friends of Ohio State to participate in commercialization
- Measure success to continually improve

Our ultimate goal is to be a top five office in technology commercialization and create a new model that others can replicate across the country. This requires not only a much greater level of engagement from our faculty but a cultural shift at many levels throughout the campus. In a recent speech, President Gee mentioned the importance of these efforts and stated that, "In order for us to thrive, we need to rethink, recreate, re-examine, redefine, and re-conceptualize a whole new model, a brave new paradigm for the 21st century University. We are missing vital opportunities to transform the magnificent brainpower centered at our University into products and processes that will create new businesses, generate resources, and improve lives."

The Technology Commercialization Office (TCO) is committed to these principles and you will see many new programs over the coming months but it all starts with researchers submitting their ideas to the TCO. **Nothing is more critical than capturing an idea before it is published or presented.**

From there an idea or invention is handed to a team of professionals that begin the commercialization process by:

- assessing the idea or innovation
- developing an intellectual property strategy
- determining a business strategy
- creating a development plan
- finding and connecting to the proper resources and partners
- structuring the deal monitoring its success

We engage students, companies, entrepreneurs and capital partners to provide feedback on an idea and develop a milestone based plan to success. Located at the gateway to the University on 9th and High St, we have an open door policy to all collaborators and serve as the facilitator for all industry and business relations on campus. We've just moved into the new office and encourage all faculty members to come over and see the space. The fast-paced, creative culture at the TCO realizes the importance of celebrating success and highlighting positive outcomes of our faculty.

TCO's new offices at 1524 North High Street

One such success happened when Dr. John Lannutti approached TCO with several new technologies. The TCO assessed the technologies, decided on a strategy and found a a perfect fit with a central Ohio based startup, Nanofiber Solutions (featured in the Winter 2011 issue of IMR Quarterly). The company licensed the technologies and they are now selling product to various research labs. Nanofiber Solutions also recently received notoriety for developing an artificial trachea that was used in a patient in Europe. Dr. Lannutti's story is one of several great success stories from the materials industry and just one example of how we take ideas and innovations into the marketplace. Whether it's forming a new company, fundraising, training student entrepreneurs or protecting Ohio State's vital intellectual property, we help bring your discoveries to life and products to market.

For more information about the Technology Commercialization Office, visit their website at http://tco.osu.edu/ or call (614) 292-1315.

Materials Facilities Updates

Nanotech West Laboratory

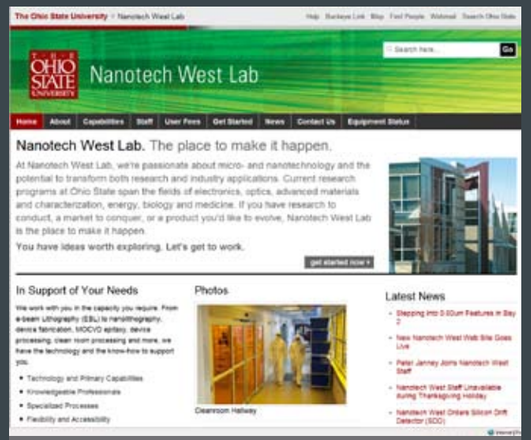
Nanotech West Lab is the largest nanotechnology user facility in the State of Ohio, consisting of a 6,000 square foot class 100 cleanroom facility, a 4,000 square foot Biohybrid Laboratory, and other laboratory and office space in the Science Village Building at 1381 Kinnear Road on the West Campus of the University.

New X-Ray Materials Analysis Capability at Nanotech West Lab

In January 2012, Nanotech West Lab installed a new Oxford X-Max 50mm2 silicon drift detector on the Zeiss Ultra Plus field-emission scanning electron microscope (FESEM, tool code SEM02) in Bay 2 of the cleanroom. Silicon drift detectors (SDD) are advanced detectors for energy dispersive x-ray spectroscopy (EDS) which allow for chemical (elemental) analysis of surface features. SDDs can utilize the high x-ray count rates that result from the high brightness of a field-emission SEM electron source, which in turn allows for elemental mapping in a much shorter time frame than earlier detectors (often minutes instead of hours), and has the ability to give materials composition maps overlaid on SEM images. Furthermore, unlike traditional EDS detectors, the Oxford X-Max (like other SDDs) is cooled by a Peltier cooler and does not have to be filled with liquid nitrogen. Potential users should contact Aimee Price (price.798@osu.edu) to schedule a training session. The existing EDS system that is on SEM01 (the Hitachi S-3000) will continue to run. The new SDD was purchased with capital funds from the Ohio Wright Center for Photovoltaics Innovation and Commercialization (PVIC), funded by the Ohio Third Frontier Program of the Ohio Department of Development.

New Nanotech West Web Site Goes Live

The new Nanotech West Lab web site went live in December after months of design and content work. The site is based on the WordPress content management system and is modeled closely after IMR's web site. The new set up allows Nanotech West Lab staff to easily change and add content to quickly update users, and offers a "News" feature that both users and staff will find useful. The website can be seen at: http://nanotech.osu.edu/

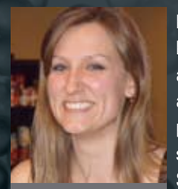


Nanotech West lab's new website

ENCOMM NanoSystems Laboratory (ENSL)

The ENCOMM NanoSystems Laboratory (ENSL), located in the Physics Research Building, provides advanced material characterization and fabrication tools for research and development applications.

ENSL Welcomes New Staff



ENSL's newest staff member, Rachel Page

ENSL recently welcomed a new staff member, Rachel Page, as a Program Assistant. Rachel is a recent graduate of the Ohio State University, and her primary responsibility at ENSL is to provide customer service to ENSL-affiliated students, staff, faculty and general public. She will also work on instrument and training scheduling, purchasing, financial management and other administrative and technical duties.

In order to facilitate contact with ENSL customers, Rachel's office is located in an open kiosk on the walkway on the second floor of the Physics Research Building (PRB) on the office side. This position is jointly supported by the OSU Center for the Electronic & Magnetic Nanoscale Composite Multifunctional Materials (ENCOMM) and the Institute for Materials Research (IMR). Rachel can be contacted via e-mail at page.257@osu.edu or via phone at (614)688-1158.

In other developments, the newly acquired Physical Properties Measurement System (PPMS) by Quantum Design USA has been delivered to OSU and is currently being installed in room 0177 Physics Research Building. The system will feature a 14 T superconducting magnet and capabilities for electrical and magnetic measurements, and will be available to ENSL users in April 2012.

Center for Chemical and Biophysical Dynamics (CCBD)

The Center for Chemical and Biophysical Dynamics (CCBD) has been working on upgrades for multiple instruments this quarter. CCBD is located in Newman and Wolfrom Laboratory, and integrates all the equipment necessary to measure transient UV/Vis, fluorescence, infrared, and Rama spectra over a range of time scales from femtoseconds to milliseconds.

- The femtosecond time-resolved infrared spectrometer was recently upgraded to extend its infrared probe spectral coverage from 3 – 9 μm to 3 – 14 μm with the low frequency limit of ca. 700 cm-1 was thoroughly tested and confirmed to be working excellent. During a six-week visit, the upgrade was tested by an international team of researchers from Poland who experimented on a series of photochemically-labile diazo compounds, the first experiments on real samples. CCBD is proud to be among very few groups in the world capable of doing such experiments, and the results are being analyzed and prepared for publication.
- A subnanosecond pulsed LED of EPLED series from Edinburg Instruments emitting at 360 nm was loaned to CCBD by Prof. Claudia Turro's research group in the Chemistry department. The LED is extremely easy to operate and, in contrast to a laser, it does not require any alignment and is ready to fire in 60 seconds. It is currently being tested as an excitation source for Time-Correlated Single Photon Counting setup. If successful, LEDs for various excitation wavelengths may be purchased by CCBD, contingent upon funding options and the success of the trials.
- An upgrade of the femtosecond transient UV/Vis absorption spectrometer is in progress to integrate a 512-pixel InGaAs array detector into the data acquisition system, extending its spectral coverage into the near IR range (1100 – 1300 nm). A visiting student from Japan is working on timed communication with the InGaAs detector via LabView software and the estimated time of completion is April 2012.
- The kinetic detection experimental setup at the CCBD is being adjusted to use single-wavelength excitation and detection in the 1500-2600 nm spectral range. Optical elements will be replaced and set up as well as an InSb detector. The estimated time of completion for this project is March 2012.

The CCBD has also been busy this quarter engaging in activities within the larger research community. A CCBD Advisory Committee was formed to facilitate the alignment of CCBD capabilities to the needs of OSU and external researchers from throughout the materials community. The advisory committee has identified priority experiments and prospective users for the CCBD, and will continue to meet monthly. Finally, on February 8th, CCBD participated in a webinar organized by the National Science Foundation Division of Materials Research regarding future instrumentation and facility needs in the national materials research community. As members of the chemistry community, CCBD and the Department of Chemistry's Research Support Services staff shared their input based on their long-term expertise running mid-size multiuser facilities.

Fall 2011 Facility Grants Awarded by the OSU Institute for Materials Research (IMR)

Eleven new research projects were awarded by the IMR in December 2011, for a total investment of $22,000 in nascent materials research. The eleven projects support faculty researchers from seven departments within the College of Engineering, College of Food, Agricultural, and Environmental Sciences, and the Division of Natural and Mathematical Sciences.

Full abstracts for each of these new research projects can be found on IMR's website at http://imr.osu.edu/files/2009/04/Fall-2011-FY-2012-Facility-Grants-Awards.pdf

Detecting Iron-Bound Proteins with MFM and SQUID Magnetometry, Lead Investigator: Gunjan Agarwal, Biomedical Engineering

Self Patterning of Zirconia Substrate Surfaces for Biological Applications, Lead Investigator: Sheikh Akbar, Materials Science and Engineering; Co-Investigator: Jessica Winter, Chemical & Biomolecular Engineering

Steep Sub-Threshold Si/SiGe and III-V Quantum Tunneling Transistors, Lead Investigator: Paul R. Berger, Electrical and Computer Engineering

Nanoscale Tribocharging Mechanism and Mechanical Properties Investigation of Novel Organic and Inorganic Nano-Object-Petroleum Hybrid Lubricants, Lead Investigator: Bharat Bhushan, Mechanical and Aerospace Engineering

High Temperature Irradiation Effects on Optical Fiber Dopant Migration, Lead Investigator: Thomas Blue, Mechanical & Aerospace Engineering; Co-Investigator: Wolfgang Windl, Materials Science and Engineering

Ant Neck Joint Testing and Characterization, Lead Investigator: Carlos Castro, Mechanical and Aerospace Engineering; Co-Investigator: Blaine Lilly, Mechanical and Aerospace Engineering

Evaluation of Nano, Micro and Macro Biobased Fillers in Elastomeric Applications, Lead Investigator: Katrina Cornish, Horticulture and Crop Science

Mechanistic Study of TIO2 Nanowires Grown by Thermal Oxidation of Titanium Alloys, Lead Investigator: Suliman Dregia, Materials Science and Engineering; Co-Investigator: Sheikh A. Akbar, Materials Science and Engineering

An Oxygen Release System to Improve Neural Stem Cell Survival During Transplantation, Lead Investigator: Jianjun Guan, Materials Science and Engineering

Proposal to Fabricate and Characterize Nanochannel Electroporation Devices Using Semiconductor/Cleanroom Technologies, Lead Investigator: Gregory Lafyatis, Physics

Transformation Optics from Focused Ion Beams, Lead Investigator: Ronald M Reano, Electrical and Computer Engineering

Faculty Spotlight: Gunjan Agarwal, Biomedical Engineering

(continued from page 1)

Novel Biomedical AFM applications

Another vector of Dr. Agarwal's research is to develop novel biomedical applications of AFM. The Agarwal research group has been pursuing two projects in this direction: (1) development of magnetic force microscopy (MFM) (Figure 2) for detection of superparamagnetic nanoparticles encountered in biological smaples and (2) development of dip-pen nanolithography (DPN) for creating desired assembly of proteins/nanoparticles on surfaces. In addition, the AFM core facility enables users to image single-molecules, cells and tissues in a fluid environment and perform force measurements using the AFM.

For more information about Dr. Agarwal's research, contact her at Gunjan.Agarwal@osumc.edu

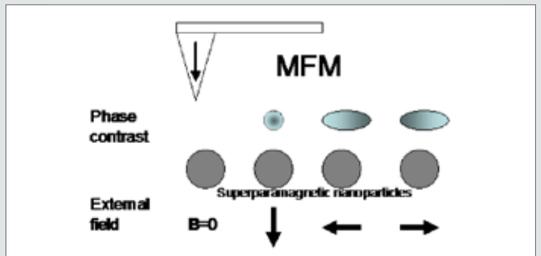


Figure 2 Magnetic force microscopy (MFM) of superparamagnetic nanoparticles (SPNs). An external magnetic field (arrows) introduces a stable magnetic moment in the SPNs (gray circles) which is detected by a magnetically coated AFM probe. The MFM phase contrast (shaded) is dependent on the orientation of the magnetic moment in the SPNs. Quantitative analysis of phase shifts can reveal magnetic moment of the SPNs.

Recent Publications:

ECM Remodeling

"Collagen type I induces aggregation and internalization of preformed DDR1 dimers", Mihai C, Chotani M, Elton TS and Agarwal G. J. Mol. Biol. 2009 Jan 16;385(2):432-45.

"Regulation of Collagen Fibrillogenesis by Kinase-Dead DDR2", Blissett AR, Garbellini D, Calomeni E, Mihai C, Elton TS and Agarwal G. J. Mol. Biol. 2009, Jan 23; 385(3): 902-911.

"Inhibition of Collagen Fibrillogenesis by Cells Expressing Soluble Extracellular Domains of DDR1 and DDR2", Flynn LA, Blissett AR, Calomeni E and Agarwal G. J. Mol. Biol. (2010) 395(3):533-43.

"The influence of discoidin domain receptor 2 on the persistence length of collagen type I fibers" Sivakumar L and Agarwal G. Biomaterials (2010), 31(18): 4802-4808

AFM

"Magnetic Force Microscopy of Superparamagnetic Nanoparticles" Mayur Savla, Sharon Schreiber, Camelia Selcu, Denis Pelekhov, P. Chris Hammel and Gunjan Agarwal* Small, 2008, Feb;4(2):270-8.

"Changes in surface topologies of chondrocytes subjected to mechanical forces: an AFM analysis" Iscru DF, Angelhina M. Agarwal S, Agarwal G* J. Struct. Biol. 2008 Jun;162(3):397-403.

"Magnetic force microscopy of an oxygen-sensing probe" M. Savla, R. Pandian, P. Kuppusamy and G. Agarwal* invited article for special edition of Israel J. of Chemistry (2008) 48 (1) 33-38. (Figure published on cover page)

Investing in the STEM Pipeline

The Center for Emergent Materials, a National Science Foundation (NSF) supported Materials Research Science and Engineering Center (MRSEC) at OSU, welcomed Professor Jan Jacob from the University of Hamburg to teach a three-week LabView short course to undergraduate and graduate students as well as post doctoral researchers and staff during the month of February. CEM also hosted 6th and 7th grade students from Columbus City Schools for the annual Breakfast of Science Champions event on campus.

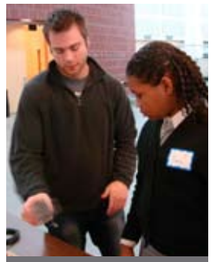
LabView Short Course presented by Dr. Jan Jacob

In February, Dr. Jan Jacob from the University of Hamburg taught a LabView short course for undergraduate and graduate students as well as post doctoral researchers and staff. Twenty-nine students regularly attended these sessions, taught 3 days per week for 3 weeks. Specific topics that were taught included: general approaches to software development, debugging and error handling, datatypes, basic constructs and concepts, modular applications, data acquisition, user interface control and executables and installers. This hands-on short-course taught students programming in the LabView environment and ways that it could be used to enhance their current research.

Dr. Jan Jacob of the University of Hamburg taught a LabView short course over three weeks for OSU students and staff.

Dr. Jan Jacob received his PhD from the University of Hamburg, Germany. He currently leads the semiconductor spintronics research team within the nanostructure physics group of Dr. Ulrich Merkt at the University of Hamburg. In his current work, he employs modern hardware technologies like multicore-, GPU-, FPGA-, and distributed computing and is closely involved in the development and beta testing of new software modules from National Instruments to further expand the LabView platform.

Breakfast of Science Champions at Ohio State



CEM Fellow Kurtis Wickey demonstrates an experiment for a middle schooler at the CEM Breakfast of Science Champions event

CEM participated in the annual Breakfast of Science Champions event at the Ohio State University. In this program, gifted and talented middle school students from Columbus City Schools come to campus to visit different Centers and learn about the exciting research taking place at Ohio State. On February 8, 2012, nineteen 6th and 7th grade students visited the CEM. During their visit, students learned about 3D Imaging of Materials from Materials Science and Engineering (MSE) graduate student John Sosa. Following his presentation, the students spent the remaining time learning about scientific phenomena including magnetism, computers, and superconductors through hands-on stations facilitated by CEM graduate students and Faculty.

IMR Member News

The OSU Center for Automotive Research (CAR) was awarded the Outstanding Technology Team award at TechColumbus' 2011 Innovation Award. The program recognizes forward-thinking individuals, companies and technology teams from central Ohio for their achievements and contributions in technology leadership and innovation. CAR has served as an incubator for two companies that are currently housed at TechColumbus: PlugSmart and CAR Technologies LLC. The Outstanding Technology Team included Mechanical and Aerospace Engineering faculty Yann Guezennec and Giorgio Rizzoni; CAR researchers Simona Onori, Shawn Midlam-Mohler, and John Neal; and Ken Dudek, Robert Lane and Eric Schacht of CAR Technologies LLC.

Gerald Frankel, Professor, Materials Science and Engineering, received the 2011 U.R. Evans Award from the Institution of Corrosion at Electrochem 2011, a meeting of the Royal Society of Chemistry. The award is given for outstanding international achievement in pure or applied corrosion science.

Roberto Myers, Assistant Professor of Electrical and Computer Engineering and Materials Science and Engineering, rececent received a Faculty Early Career Development (CAREER) award from the National Science Foundation. Myers was awarded $530,000 for his research on "Extreme Band Engineering in Polarization Graded Nanowire Heterostructures for High Efficiency Photonics." In this work, Myers is growing and studying nitride nanowires that increase the design flexibility of semiconductor photonics to enable enhanced performance of LEDs and photodetectors across the ultraviolet to visible spectrum.

In December 2011, twenty Ohio State faculty were elected to the prestigious role of Fellows of the American Association for the Advancement of Science, the world's largest general scientific society. New AAAS Fellows include three active IMR members, as detailed below:

Joseph Heremans, professor and Ohio Eminent Scholar of Mechanical and Aerospace Engineering, was honored for his distinguished contributions to the field of thermal engineering, specifically the development of high-efficiency thermoelectric materials and the discover of thermal spin-polarization in semiconductors.

T.V. RajanBabu, professor of Chemistry, was elected AAAS Fellow for distinguished contributions to the field of organic synthesis and asymmetric catalysis mediated by transition metal complexes.

Claudia Turro, professor of Chemistry, was selected for distinguished contributions to the understanding of photoinduced processes of inorganic complexes, including excited states and reactive intermediates important in solar energy and photodynamic therapy.

OSU Materials Week

Spring 2013

Materials Week is moving! Due to The Ohio State University's academic calendar changing from quarters to semesters in 2012, the next OSU Materials Week will be scheduled for Spring 2013. Announcements of dates, events, and registration will be posted on IMR's website: imr.osu.edu and in future issues of IMR Quarterly newsletter.

A program planning committee has been created and has begun planning technical sessions for the next Materials Week. If you would like to share feedback on past Materials Week conferences or suggestions of topics, speakers, or events for 2013, please send your ideas to Layla Manganaro, IMR Program Manager, at manganaro.4@osu.edu

Winter 2012

The IMR Quarterly is a free publication from The Institute for Materials Research at The Ohio Sate University.

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