



MRS and SMM held International Materials Research Congress 2012 in Cancún

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The **XXI International Materials Research Congress (IMRC) 2012**, chaired by **Orlando Auciello** of Argonne National Laboratory, USA; **J. Gerardo Cabañas Moreno** of Instituto Politécnico Nacional, Mexico; **Sandra Rodil Posada** of Instituto de Investigaciones en Materiales (UNAM), Mexico; and **Francesco Stellacci** of École Polytechnique Fédérale de Lausanne, Switzerland, was held in Cancún, Mexico, on August 12–17. IMRC 2012 was a joint effort of the Materials Research Society (MRS) and the Sociedad Mexicana de Materiales (SMM). In-depth coverage of the plenary sessions, technical talks, and other meeting events is available at www.mrs.org/meeting-scene.

For materials researchers who decide to enter the world of the entrepreneur, plenary speaker Carlos A. Paz de Araújo (Symetrix Corp.; University of Colorado, USA) said, “You must try everything to keep your original spirit—your love for science.” Araújo provided a blueprint

for scientists to become technological entrepreneurs. He succeeded in this environment by turning things upside down, he said, starting with “search and development,” a process in which a researcher must find an important problem that is possible to solve. This is then followed by research, development, and marketing. Following this technique, Araújo developed ferroelectric random-access memory devices that are now used in cars, cell phones, televisions, radio-frequency tags, and printers. Even after achieving success, researchers must reinvent themselves periodically to keep their interest in science alive, Araújo said, as he proceeded to explore his next research project, which also addressed memory devices.

Plenary speaker Cecilia Noguez of the Universidad Nacional Autónoma de México in Mexico City discussed the light interaction with metal nanoparticles that have extinction, scattering, and absorption components, all of which differ in relative magnitude depending on the

nature of the material, as well as particle sizes and shapes. Surface plasmon resonances are responsible for absorption of light. All of these variables enable the manipulation of light at the nanoscale for many different applications. In medicine, for example, plasmonic phenomena are involved in the photothermal destruction of cancer cells. In energy, improved photovoltaic devices can be obtained from exploiting plasmonic properties.

The work of Bao-Lian Su’s teams at the Wuhan University of Technology, China, and at the University of Namur, Belgium, on living hybrid materials also finds applications in the energy and health fields. Following his mantra of “do as nature, work as nature, and produce as nature,” Su and his colleagues are working on systems that directly use natural systems in combination with artificial materials. For example, they used silica-based porous systems with chloroplasts, thylakoids, plant cells from *A. thaliana*, and cyanobacteria to produce artificial leaves for clean energy photosynthesis. In the health field, they are trying to synthesize living hybrid materials to treat diabetes and other diseases.

At Rutgers University in New Jersey, Manish Chhowalla and his co-workers are producing two-dimensional sheets of transition-metal dichalcogenides and graphene oxide (GO) using solution



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processable methods, which could lead to large-scale production of these materials for applications in electronics, catalysis, and energy storage. In his plenary address, Chhowalla demonstrated GO films as electrodes in the solution-processable light-emitting diodes and as a hole-transport layer in organic photovoltaics. He also demonstrated that single-layered transition-metal dichalcogenides are excellent catalysts for hydrogen evolution and potentially useful for optoelectronics.

Monica Olvera de la Cruz of Northwestern University, in her plenary address, connected Platonic and Archimedean geometries to materials science. These geometries occur spontaneously in crystalline shells having more than one component. When the two components have different elastic moduli, the shell buckles in ways that depend on the relative concentrations of the components. From the sheer number of different shapes that de la Cruz showed, it appears that the variety of buckling geometries is endless. “Our goal is to explore the consequences of this faceting of ionic membranes and find other shapes,” she said. This experimental and computational work is leading to a deeper understanding of the geometries of various cellular microcompartments including viruses, organelles, and wall envelopes of halophilic organisms, as well as many crystalline materials.

For a change of pace, Luis Rodríguez, Professor Emeritus of the Center for Radio Astronomy and Astrophysics at the National University of Mexico, spoke at the elegant Science Luncheon where he showed the benefits of studying astronomy through the means of radio wavelengths. His images revealed that galaxies viewed through radio wavelengths appear to be much larger than when seen in the visible range. Persuaded to study the universe outside of the optical wavelengths, from radio waves to gamma rays, astronomers and astrophysicists have discovered pulsars, gamma-ray bursts, and the cosmic microwave background, among other interesting phenomena.

Of the over 1200 technical presenta-

tions given by researchers representing 40 countries, some addressed the areas of energy efficiency, organic materials for electronics and photonics, and biomaterials and biomedical devices. Sarbajit Banerjee and his group at the University of Buffalo are using the phase change of vanadium oxide (VO₂) to develop thermochromic window coatings for smart windows. VO₂ undergoes a phase change from a monoclinic crystal structure to a tetragonal one at 67°C over only 300 fs. This change is technologically important because the monoclinic phase is transparent to infrared (IR) radiation, while the tetragonal is IR-reflective. The smart windows always let in visible sunlight. However, at low temperatures they also let in the IR, which warms up a room, while at higher temperatures they block IR, keeping the room cool.

Polymers can also be effective in optoelectronics applications. Specifically, design and synthesis of nonlinear organic chromophores for photonics and optoelectronics is of much interest for their possible applications in photorefractive polymers. In the work presented by J. Apolinar Muñoz-Rodríguez (Centro de Investigaciones en Óptica, León, Mexico), a new Schiff base with a D-π-A architecture was synthesized. Following synthesis and characterization, the films were placed between transparent indium tin oxide deposited on glass slides, and an external electric field was applied. Muñoz-Rodríguez showed how fast, reversible holographic imaging was carried out using these polymer films.

In the biological realm, talks ranged from the nano- to the macroscale. Andrea de Vizcaya Ruiz, a toxicologist in Cinvestav, Mexico reported that although nanomaterials are attractive for a number of medical applications, characteristics such as increased residence time, access to the central nervous system, and their increased surface-to-volume ratio are drawbacks that could lead to their application becoming more harmful than healing. For these reasons, de Vizcaya Ruiz said, there is an increasing need to establish the potential toxicity and health impacts that nanomaterials could impose, from their design and function-

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alization in the laboratory to their application and use.

On the biological macroscale, David Stout of Brown University addressed the search for a cardio-patch or “band-aid” for the heart to help repair it after a heart attack. Using carbon nanofibers, his group worked toward creating a biodegradable, polymer-based cardio-patch that is conductive and would promote growth of heart cells (cardiomyocytes). By adding highly purified carbon nanofibers with diameters ranging 100–300 nm to nonconducting poly(lactic glycolic acid) in various ratios, the researchers formed composite materials that show much promise as a cardio-patch, Stout said.

Further news coverage on the plenary and broad array of technical sessions as well as other special activities can be accessed online through the MRS Meeting Scenes: www.mrs.org/meeting-scene. □

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