MRS and SMM held International Materials Research Congress 2013 in Cancún

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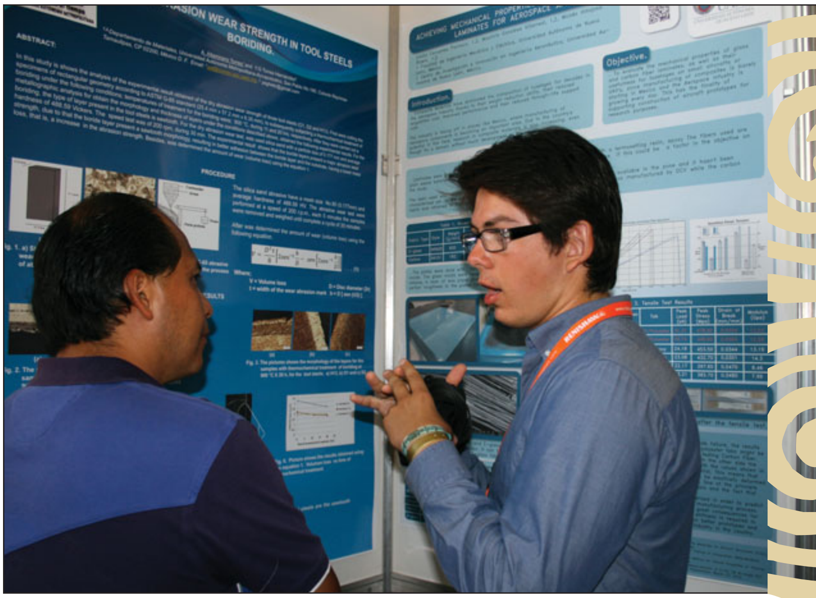
The **XXII International Materials Research Congress (IMRC) 2013**, chaired by **Claudia Gutiérrez Wing** of Instituto Nacional de Investigaciones Nucleares, Mexico; **David Lederman** of West Virginia University, USA; **Xavier Mathew** of Universidad Nacional Autónoma de México (UNAM), Mexico; and **Fiona Meldrum** of the University of Leeds, UK, was held in Cancún, Mexico, on August 11–15. IMRC 2013 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.

During the opening ceremony, the General Chair of the Congress Armando Salinas of CINVESTAV—Unidad Saltillo, Mexico, announced that SMM and MRS signed a Memorandum of Understanding that will continue this joint effort through the year 2020. Orlando Auciello of the University of Texas at Dallas, and President of MRS, said the Congress is "a fantastic chance to exchange ideas, meet new friends, and learn about all the latest discoveries in materials research." This year, over 2000 talks were given by researchers representing 49 countries, addressing the topics of nanoscience and nanotechnology, biomaterials, materials for energy, fundamental materials science, materials characterization, materials for environmental applications, magnetic and electronic materials, archaeological issues in materials science, and strategies for academy–industry relationship.

During the Science Luncheon geared toward the broad materials community, Yury Gogotsi of Drexel University, USA, discussed MXenes, which are two-dimensional early transition metal carbides and carbonitrides. "MXenes are really exciting—an entirely new class of materials," Gogotsi said. "Graphene is not alone in the 2D world." To back up such bold declarations, Gogotsi described the work his group is doing with MAX phases of ternary carbides and/or nitrides. These are layered hexagonal materials of composition $M_{n+1}AX_n$, where $n = 1, 2,$ or 3. Examples of these in the carbide family include Ti_2AlC and Ti_4AlC_3. Structurally, these materials are layered in the order M/X/M/A/M….

Gogotsi has figured out a simple way to remove the "A" layers using an HF treatment, thereby converting MAX to MX. Sonication of MX results in MXenes. For example, Ti_3AlC_2 etched in HF for two hours eliminates the Al layer, leaving Ti_3C_2. Sonication of Ti_3C_2 produces two-dimensional sheets of the MXene Ti_3C_2. Gogotsi's group has published papers on nine MXene phases so far.

Among the excellent plenary presentations, one was given by Ron Naaman of Weizmann Institute of Sciences. "Organic electronics is a well-established technology," he said; "but this is not the case with [organic] spintronics." The main advantage of spintronic devices includes the possibility of using less energy for data processing by utilizing the spin rather than the charge property of the electron. Typically, spintronics is associated with inorganic magnetic materials. Naaman proposed the attribute of chirality as a completely different paradigm for achieving spin polarization.



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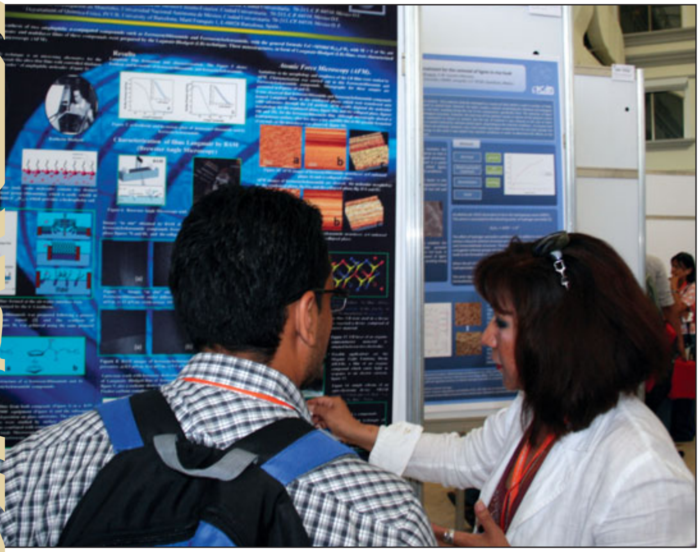

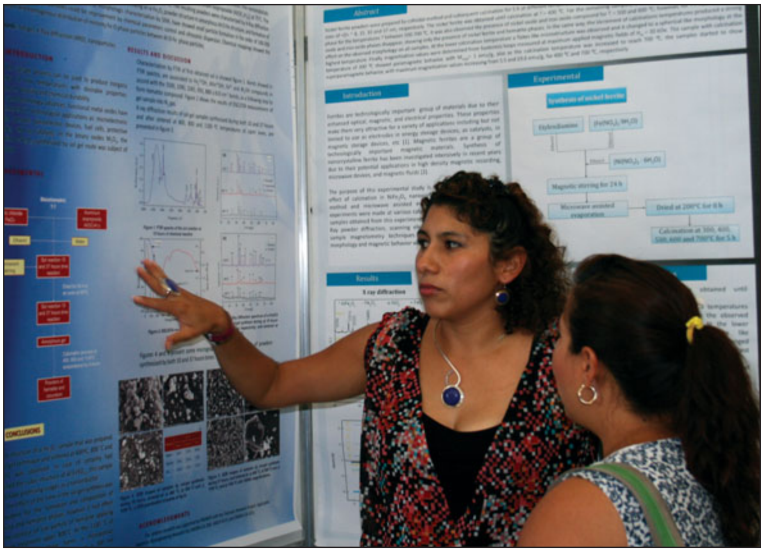

In an early experiment, a self-assembled monolayer of chiral molecules was created on gold. Naaman and his team found that injecting electrons into the gold layer yielded spin-polarized current out of the organic monolayer. The next variation in their experiment utilized a helical 22-amino-acid polyalanine bound to gold by a thiol group, with a dipole either up or down with respect to the gold layer, depending on whether the C- or N-terminus displayed the thiol group. The researchers were able to achieve even greater spin polarization in this experiment.

Naaman then extended his hypothesis of spin transport in chiral molecules to DNA, achieving up to 60% spin selectivity in a single monolayer of DNA. Even proteins can achieve spin selectivity, as was demonstrated with bacteriorhodopsin with a spin selectivity of 13%. Importantly, heating and subsequent denaturing of the helix structures in proteins resulted in the complete loss of spin selectivity.

Among the presentations on research being conducted in industry, one was by Stig Helveg of Haldor Topsøe A/S. Understanding the fundamental principles of heterogeneous catalysis has significant implications, ranging from "nano to mega domains." But how exactly does a surface provide catalytic properties? Electron microscopy is one of the only techniques that can probe the length scales necessary to answer this question. Helveg also pointed out the need for *in situ* studies of catalysts at real industrial conditions, which would provide a truer picture of the phenomena occurring at the catalyst surface than studies done at milder laboratory conditions. Moreover, low dose-rates of electrons are crucial to suppress gas-sample excitations. A Co_3O_4 photocatalyst was studied with low dose-rate high-resolution transmission electron microscopy both before and after CO gas introduction, and the team was able to visualize the result.

In the medical area, C. Velasquillo of Instituto Nacional de Rehabilitación, Mexico, presented research on microtia, which is a medical condition in which ear growth stops while a baby is still in the womb, resulting in deformed ears with no cartilage. This condition is a public health problem in Mexico. In 1999, one in 15,000 Mexican children suffered from microtia, with symptoms that included hearing loss along with the deformity. Velasquillo reported on efforts by her team of researchers and medical doctors to develop a synthetic scaffold to support the growth of the patient's own cells to form new auricular (ear) cartilage. She described an alternative treatment that uses cells from the patient's ear remnant to preserve the phenotype of the cartilage. Her goal is to analyze the viability, tissue organization, and cellular adhesion of auricular chondrocyte cells seeded on a tissue scaffold. Specifically, her team is investigating the use of chitosan/polyvinyl alcohol/epichlorhydrin (CTS-PVA-ECH) polymers as the basis for a scaffold. One reason for choosing this polymer system is that a CTS-PVA-ECH hydrogel has roughly the same Young's modulus as ear cartilage. In studies on animal models, auricular chondrocyte cells adhered to and proliferated on a CTS-PVA-ECH scaffold. Much more research needs to be done before tests can be performed in human patients, she said.

These are just a few of the highlights from the Meeting. Further news coverage on the plenary sessions and broad array of technical sessions as well as other special activities can be accessed online through the MRS *Meeting Scene*®: www.mrs.org/meeting-scene.

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