Egypt-MRS 2006 Features a Satellite Workshop on Nanostructures

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The XXVI Conference on Solid-State Physics and Materials Science of the Egyptian Materials Research Society (Eg-MRS) was held in Alexandria, Egypt, September 10–14, 2006. The conference was chaired by Kamal Abd El-Hady of Minia University, Egypt, and it was organized in cooperation with the Arab Academy for Science, Technology & Maritime Transport (AASTMT). The parent organization of Eg-MRS, the Egyptian Society of Solid-State Science and Applications, was founded in 1978 and renamed in 2003 to reflect the interdisciplinary approach and the wide scope of its subject area within the materials community. The official publication of the Eg-MRS is the *Egyptian Journal of Solids*, which is published twice a year.

The aim of this conference was to provide a forum for scientists working in academia and applied research in the fields of solid-state science and materials physics. A satellite workshop on a selected specific topic is normally organized within the conferences as a basic part of the scientific activities. This year, the topic was nanostructures.

H.U. Habermeier (Max Planck Institute, Germany), international organizer of the workshop, presented a plenary lecture on education with special attention to materials science. Habermeier recommended that developed countries focus on knowledge while the developing ones focus on education and technology.

Ten lectures were given in the satellite workshop, "Nanostructures: Science, Fabrication, Characterization, and Devices," which covered the state of the art in the field. Topics included magnetic properties of materials for spintronic applications, semiconductor nanoparticle-based gas sensors, nanostructured oxides, and nanocomposites, as well as smart and multifunctional nanoparticles for biological and medical applications. It was concluded that novel materials physics is emerging, with a broad range of potential applications, including controlled drug delivery through the use of environment-sensitive nanoparticles and improvement of sensor sensitivity to very low levels of pollutants (CO, NO, NO_2, O_3) in air through the use of nano-sized metal oxide particles. Detection thresholds have been decreased by a factor of 3–5 compared with currently available commercial chemical sensors. Preparation of materials by chemically and mechanically induced solid-state reactions was presented. The requirements for investigating the chemical reactivity, nucleation, growth termination, and surface functionalization in order to find the right physicochemical conditions to generate clusters, nanocrystals, and self-assembled nanostructured oxides were addressed. Different characterization techniques such as single-molecule fluorescence resonance energy transfer and femtosecond laser spectroscopy were also presented.

There were about 110 attendees, 40 oral presentations, and 20 posters. The presentations covered nanomaterials, metal and polymer physics, crystallography and amorphography, magnetism, transport, and optical properties. Furthermore, school/university/research relations and problems, especially for developing countries, were considered in a special seminar on pre-university science education. It was organized to make a link with education leaders to improve both the quality of science teachers and of graduating students.

The schedule included visits and excursions to the Integrated Simulator Complex and Regional Informatics Center in AASTMT as well as Bibliotheca Alexandrina (Alexandria Library), Qaitbay Fort, and the National Museum in Alexandria.

Invited speakers and some members of the Egypt-MRS 2006 Board (left to right): ***Hassan Talaat*** *(Ain Shams University, Egypt),* ***Ahmed Ramadan*** *(Helwan University, Egypt),* ***Abdelrazek Kandeil*** *(Arab Academy for Science & Technology and Maritime Transport),* ***Mamoun Muhammed*** *(Royal Institute of Technology, Sweden),* ***Marie-Isabelle Baraton*** *(University of Limoges , France),* ***Colin Heyes*** *(University of Ulm, Germany),* ***Mona Bakr*** *(Cairo University, Egypt),* ***Hanns-Ulrich Habermeier*** *(Max Planck Institute, Germany),* ***Abdelkarim Chemseddine*** *(Hahn-Meitner-Institute, Germany),* ***Kamal Abd El-Hady*** *(Minia University, Egypt),* ***Hartmut Zabel*** *(Ruhr-University, Germany), and* ***Fayez Shahin*** *(Beni-Suef University, Egypt).*

Participants and invited speakers attending the Egypt-MRS 2006 Conference.

NAE/Penn State Meeting Showcases Role of Microwaves

www.mri.psu.edu/centers/mpec

The National Academy of Engineering (NAE) held its Northeastern Regional Meeting at the Pennsylvania State University June 15–16, 2006. Organized by local NAE members led by Rustum Roy (Penn State), the meeting focused on the use of microwave fields as energy sources for the most energy-intensive industries, including high-temperature materials processing.

The first part of the conference focused on the relevance of these technology-driven guiding principles to national and world energy policy. The leaders of microwave processing research from the United States, Japan, and Europe presented data on the savings—up to 90% in some industries—made possible by substituting microwave energy for thermal energy.

M. Sato (National Institute for Fusion Science, Japan) gave some background on the Japanese government's funding of research into industrial uses for microwaves, which led to the formation of a consortium that proved microwaves could be successfully used in converting iron ore to pig iron. Japan has since built large commercial microwave systems for ceramics and metals. Sato made two key points that he believes were critical to the successful commercialization of high-temperature microwave technology in Japan: an energy savings of 80% in the production of pig iron, due to the speed of microwave heating; and a 50% reduction in CO_2 emissions compared with processing iron in a furnace.

R. Varma (U.S. Environmental Protection Agency) said that U.S. industry spends $200 billion a year to comply with environmental regulations. Much of that expense could be saved, he said, because microwave is a "greener" technology, allowing for solvent-free chemical synthesis through microwave irradiation. The process is solvent-free because the reaction takes place in a solid state with no liquid phase. In addition, the process takes only seconds or minutes, cuts waste, and saves energy.

When it comes to industrial uses, however, the manufacturing sector—especially in the United States—has been slow to accept the benefits of microwave technology, according to discussions at the meeting. R. Schiffman (R.F. Schiffmann Associates Inc., New York), an energy consultant for government and industry, cited two reasons for the slow acceptance of microwaves in the United States. First, he said, is industry's reluctance to abandon existing equipment and processes with which the company is already familiar, and second is a lack of knowledge of the energy costs of the manufacturer. In his experience consulting with industry, Schiffman said, he finds that executives may have a sense of their annual oil or electric bill, but rarely do they try to determine the energy cost of producing each unit.

D. Agrawal (Penn State), however, believes that the future of microwave energy is bright. In China, Japan, and India, companies are building cheaper microwave systems that will lower the cost of capital investment, he said. And microwave processing is expanding into new areas, including metallic materials, recycling of tires, pretreatment of coal to reduce emissions, and possible new sources of fuel, such as oil shale and oil sands that otherwise might not be economically and environmentally feasible sources of cheap oil.

The second part of the meeting covered the areas of research on microwave-based technologies occurring in a host of institutions (Agrawal) to an expansive survey of the university and corporate programs in Germany (M. Willert-Porada, Univ. of Bayreuth, Germany).

R. Roy (Penn State) discussed research resulting from the study of electric- and magnetic-field separation. In order to understand how microwaves create their unusual effect on metals and ceramics, Penn State researchers in 2001 split the electromagnetic field of microwaves into separate electric (**E**) and magnetic (**H**) fields. Since that time, researchers in the Penn State Microwave Processing and Engineering Center have explored irradiating various materials in a pure **E** field and a pure **H** field, with some significant results. "The most important findings include the major error of theorists who ignored the magnetic-field effects—which are shown to be profound—and the ability of such 2.45-GHz ac magnetic fields to cause matter to de-crystallize," said Roy.

The program, abstracts, and other details are available at www.mri.psu.edu/centers/mpec by clicking on the link for the NAE Regional Meeting. □

Participants in the National Academy of Engineering Northeastern Regional Meeting included (left to right) ***R. Varma*** *(U.S. Environmental Protection Agency),* ***R. Roy*** *(Penn State),* ***M. Sato*** *(National Institute for Fusion Science, Japan),* ***D. Agrawal*** *(Penn State), and* ***H. Peng*** *(Changsha Syno-Therm Co., China).*