

May 2011
Volume 11 • Issue 9**In this Issue!**

Materials News

Happenings at MRS

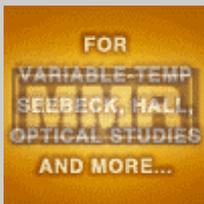
Meetings Update

Just Published

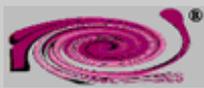
Diversions

New Product Focus

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Sponsors[MMR Technologies](#)Microcryogenic and
Thermal Stage Systems[ULVAC Technologies](#)

Mini RTA Systems

[SPI Supplies](#)Sample Preparation Equipment
and
Consumables for Electron,
Scanning Probe and**IN FOCUS**[2011 MRS Fall Meeting & Exhibit](#)November 28 - December 2, 2011
Hynes Convention Center, Boston, MA

The 2011 MRS Fall Meeting will host 46 technical symposia, an international exhibit and more. The [Calls for Papers](#) are now available, and the abstract submission site is Open, with abstracts being accepted until June 21, 2011.

[MRS Communications](#)[Call for Papers](#)

[MRS Communications](#), a new journal focused on rapid communications and high-quality, high-impact review articles across the broad materials spectrum, is published by MRS in partnership with Cambridge University Press. MRS Communications is a full-color, online-only publication with accepted papers appearing immediately on Cambridge Journals Online (CJO).

NEWS FROM THE WORLD OF MATERIALS

Keep up with materials research news through MRS!

[Materials News Web Page](#) | [RSS feed](#) | [Twitter feed](#)**Materials in Focus**[Cloaking Device Not Seeing Red](#)

(Karlsruhe Institute of Technology)

Scientists at the Karlsruhe Institute of Technology have produced the first 3D “invisibility cloak” that operates in the visible region of the electromagnetic spectrum, approximately a year after demonstrating the cloaking power of metamaterials in the infrared region.

Light Microscopy



[Agilent Technologies](#)

The first *compact* FE-SEM



Metamaterials consist of regularly arranged elements of identical shape that interact with electromagnetic waves. Joachim Fischer and Tolga Ergin, researchers in Martin Wegener's group that was responsible for last year's discovery, report in an upcoming issue of *Optics Letters* that they have refined the direct laser writing method by a factor of two to produce metamaterial structures capable of

interacting with visible red light with a wavelength of 700 nm, about half that of the 1500 nm IR radiation cloak reported in 2010. In order to achieve cloaking properties, the surface structures of the metamaterial must be smaller than the wavelength of the light that is to be deflected. In this case, the invisibility cloak consists of "logs" made of plastic and air (blue in the micrograph), with a diameter thinner than a human hair. These logs make the curvature of a metal mirror appear flat, so that an object hidden underneath becomes invisible. Light waves that are normally deflected by the curvature are influenced and guided by these logs such that the reflected light corresponds to that of a flat mirror. Having demonstrated 3D cloaking in one part of the visible spectrum, the researchers at Karlsruhe are looking to expand the effective wavelength range. "If we would succeed again in halving the log distance of the invisibility cloak, we would obtain cloaking for the complete visible light spectrum," says Fischer. [*Optics Letters*, in press]

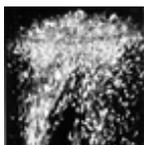
[Helium-4 Supersolid Not So Super](#)

(Los Alamos National Laboratory)



[Ted Pella, Inc.](#)

Microscopy Supplies and Specimen Preparation Tools



The case for helium-4 undergoing a phase change to a "supersolid" under pressure at 4.3 K has suffered a setback, according to research reported recently in *Science*. Los Alamos National Laboratory researchers Alexander Balatsky and Matthias Graf, along with Cornell University physicist J. C. Séamus Davis and others, have proposed a more prosaic explanation for the previously held view that the frictionless

"superfluid" helium-4 could experience a phase change to a frictionless "supersolid" when pressurized near absolute zero.

Previous arguments for the supersolid hypothesis were based on nearly 40-year-old experiments that showed an increase in oscillation speed as helium-4 changed from a superfluid to a supersolid. This increased oscillation rate seemed to indicate a frictionless solid state. However, instead of becoming an exotic, and heretofore theoretical, supersolid, the researchers now believe that imperfections in the helium-4 lattice are merely "frozen out" under these temperature and pressure conditions. Just as a frozen egg rotates more rapidly than a room-temperature egg because the freezing eliminates the friction between the internal fluid components and the shell, the freezing out of imperfections in the helium-4 lattice causes it to oscillate more rapidly, the researchers now postulate. Their experiments using a torsional oscillator 10,000 times more sensitive than those available to previous investigators showed no evidence for the superfluid-to-supersolid phase transformation. Also missing was evidence of a critical temperature corresponding to relaxation of microscopic defects in the lattice that should be present if a phase change were occurring. [[Science](#)]

[Nano Focus](#)

[3D Mapping of Internal Nanoparticle Grains](#)

(Risø DTU, Denmark)



[MaterialsViews](#)

Stay ahead in Materials Science!



Researchers from Risø DTU in Denmark, working with colleagues in China and the United States, have developed a new technique based on transmission electron microscopy to obtain a 3D view of the internal structures of nanomaterials with a resolution of 1 nm. This is 100 times better than existing non-destructive 3D techniques, according to the researchers. As reported recently in *Science*, this technique, called 3D orientation mapping in the TEM (3D-OMiTEM), collects data based on conical-scanning dark-field imaging. By recording images at many tilt angles—more than 100,000 images may be required for one nanoscale orientation map—the researchers are able to simultaneously reconstruct a complete 3D orientation map of all grains in a sample.



Carl Zeiss

Microimaging

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The accompanying figure shows such a 3D map of the arrangement of crystals in a 150-nm-thick aluminum film. The crystals have identical lattice structure but different orientations (see labels 1 and 2). The colors represent the orientations of the crystals and each crystal is defined by volumes of the same color. Crystals of various sizes (from a few nm to about 100 nm) and shapes are shown with a resolution of 1 nanometer. [\[Science\]](#)

Bio Focus

[Microchannels in Artificial Tissue Promote Healing](#)

(Cornell University)

Microchannels in experimental tissue scaffolds promote faster wound healing because of increased vascularization of the artificial tissue grafts, according to a paper published by Cornell scientists in the journal *Biomaterials*. Abraham Stroock, associate professor of chemical and biomolecular engineering at Cornell and member of the Kavli Institute at Cornell for Nanoscale Science, in collaboration with Dr. Jason A. Spector, assistant professor of surgery at Weill Cornell Medical College, and their colleagues developed these “dermal templates” to minimize the pain and disfigurement, and shorten the healing time, of burn victims. “The challenge was how to promote vascular growth and to keep this newly forming tissue alive and healthy as it heals and becomes integrated into the host,” Stroock said.

Made of type 1 collagen, the grafts promote the ingrowth of a vascular system -- the network of vessels that carry blood and circulate fluid through the body -- to the wounded area by providing a template for growth of both the tissue (dermis, the deepest layer of skin), and the vessels. A key finding of the study is that the healing process responds strongly to the geometry of the microchannels within the collagen. [\[Biomaterials\]](#)



National

Electrostatics Corp.

Ion Beams, RBS, PIXE,
AMS, MeV Implant

Energy Focus

[Liquid Ga Electrodes Heal Themselves](#)

(Empa, the Swiss Federal Laboratories for Materials Science and Technology)



In order to solve the problem of cracking of the negative electrode of lithium-ion batteries (LIBs) during electrochemical cycling, which substantially limits the capacity and lifetime of these advanced battery systems, researchers at the University of Kentucky and the General Motors Research and Development Center in Warren, Michigan, are investigating liquid metal alloys as self-healing electrodes. In a paper published recently in the *Journal of the Electrochemical Society*, Yang-Tse Cheng and his coworkers reported that liquid Ga at 40 C, as part

of an electrochemical cell cycled repeatedly between 2.0 V and 0.005 V, experienced lithiation from the Li electrode during charging and delithiation during discharging. The reversible lithiation process involved three intermetallic phases: Li₂Ga₇, LiGa, and Li₂Ga. The Coulombic capacity of the electrode was 700 mAh/g, about 91% of the theoretical capacity for this system. Morphologically, the negative electrode experienced solidification and surface roughening during lithiation and cracking during delithiation, but the cracks self-healed when the electrode was fully delithiated back to the liquid Ga state at the end of each cycle. This proved the concept of using low-melting point metals as LIB electrodes. Recognizing that Ga is on the list of “energy critical elements,” Cheng noted that the research group is “exploring several binary, ternary, and multicomponent liquid metals that may be less costly alternatives.” [\[Journal of the Electrochemical Society\]](#)

[MATERIALS FOR ENERGY BLOG](#)

Recent Posts

[From a Single-Band Metal to a High-Temperature Superconductor via Two Thermal Phase Transitions](#)

The nature of the pseudogap, which exists above the superconducting transition temperature (T_c) of high- T_c cuprate superconductors, is one of the most important unsolved problems in condensed matter physics. Many possible origins for the pseudogap, such as fluctuating superconductivity and competing order, have been proposed, however, since its discovery two decades ago, there has not been a conclusive experiment. Following the previous extensive work on the pseudogap and its



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Annual Reviews

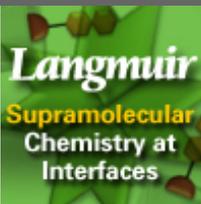


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CFEG S/TEM--
Unrivalled Raw Data

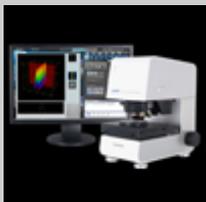
VAT, Inc.

New S11 HV Gate Valve



ACS Publications

Special Issue from the
Most-Cited Journal in Materials
Science



Olympus

Bring Answers to
the Surface



Desk-top Programmable

Spin & Dip coater

MTI Corporation

Total Solution for
Materials R&D



Nanofactory
Instruments

In situ TEM/SPM;
AFM-TEM Systems;
TEM Nanoindentation



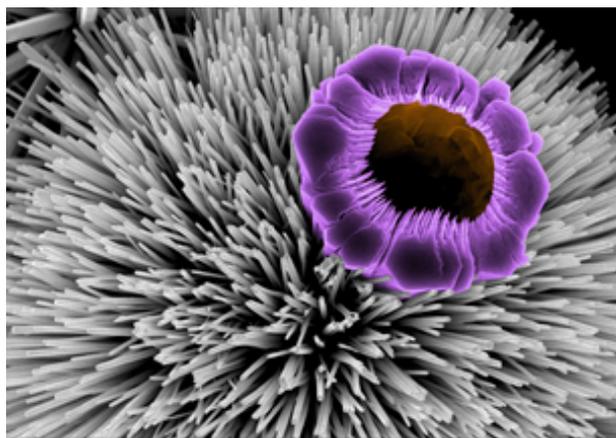
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relationship with superconductivity from Prof. Zhi-Xun Shen's group, a study recently published in Science has found the strongest evidence yet that the mysterious pseudogap in electronic structures could indicate a new phase of matter in high- T_c cuprates, which has a complicated interplay with superconductivity. ...The uniqueness of this study lies in applying three different experimental techniques to the same sample (optimally doped Pb-Bi2201): high-resolution angle-resolved photoemission spectroscopy (ARPES) measurements performed at SSRL Beam Line 5-4; high precision measurements of polar Kerr effect (PKE), which has proven to be a sensitive probe of the onset of a broken-symmetry state; and time-resolved reflectivity (TRR) measurements. With these three techniques, which had never before been combined, electronic behavior at the sample's surface covering the entire Fermi surface over wide temperature range, thermodynamic behavior in the sample's interior, and complementary information on the near-equilibrium dynamics of the system have been examined. ([read complete blog entry](#))

Add your comments, or e-mail materialsforenergy@mrs.org to suggest future topics and contributors.

Image in Focus



Nano Flower

Scanning electron microscope image of zinc oxide nanowire arrays with flower-like form.
Credit: Hyun Wook Kang, Korean Advanced Institute of Science and Technology

(One of three Science as Art competition first place winners at the 2011 MRS Spring Meeting)

[We invite you to [submit your images](#) to the Editor for possible inclusion in this feature]

HAPPENINGS AT MRS

MRS News

Aldrich Materials Science Endows a Mid-Career Researcher Award through the Materials Research Society



The Materials Research Society announces a new addition to its Awards Portfolio—the **Mid-Career Researcher Award**. Established through a permanent endowment by [Aldrich® Materials Science](#), a strategic growth initiative of [Sigma-Aldrich](#) (NASDAQ:SIAL), this award will honor individuals that have made outstanding mid-career advances in the scientific materials industry.

Nominations for the inaugural award are open through October 1, 2011, with the inaugural presentation to take place at the 2012 MRS Spring Meeting and Exhibit in San Francisco, April 9-13.



[American Elements](#)

Now Invent.™



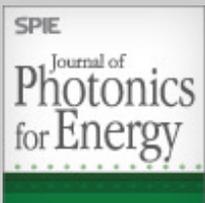
[CRAIC Technologies](#)

Spectroscopy and Imaging
of Microscopic Samples



[Elsevier](#)

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Free Access during 2011



Open to researchers, scientists and engineers in all areas of materials research between the ages of 40 and 52 at the time of nomination, the award is fully funded by Aldrich® Materials Science and managed by the Materials Research Society. In addition to the prestige of being recognized by their peers within the materials research community, the winner will receive a \$5,000 cash award.

More information on the award, eligibility and the nomination process will be available soon. Look for details in future issues of *MRS Bulletin* and *Materials 360*, or on the MRS Web site at www.mrs.org/awards.

[The MRS Apprentice Science Reporter Program](#)

This joint program between the Materials Research Society (MRS) and the NSF International Center for Materials Research (ICMR) at the University of California, Santa Barbara funds graduate students/post-docs in materials-related areas at US universities to accompany MRS staff to conferences outside the US and compile daily technical reports for inclusion in the MRS Meeting Scene e-newsletter. For 2011, we are looking for two graduate students or post-docs for covering the XX International Materials Research Congress 2011 in Cancun, Mexico, from August 14-18. The candidates will need to have an interest in science writing, be able to attend talks in materials research areas outside their specific areas of expertise and be able to write up short summaries quickly. They will need to be a graduate student or post-doctoral researcher at a US-based university at the time of the conference. The application by e-mail should include a Resume, writing samples related to materials science/engineering, and a brief letter of intent sent to Tim Palucka(palucka@mrs.org).

MEETINGS UPDATE

[Critical Meeting Deadlines](#)

<p>7th International Dendrimer Symposium June 26-July 1, 2011, Gaithersburg, Maryland</p>	<p>Final Registration Deadline— June 12, 2011</p> <p>No registrations will be accepted AFTER 5PM (EST), June 12, 2011, and for security reasons, no registrations will be accepted on-site.</p>
<p>Organic Microelectronics & Optoelectronics Workshop VII July 18-20, 2011, San Francisco, California</p>	<p>Early Registration is now Open</p>
<p>International Materials Research Congress XX August 14-19, 2011, Cancun, Mexico</p>	<p>Preregistration Deadline— July 15, 2011</p>
<p>2011 MRS FALL MEETING & EXHIBIT November 28 - December 2, 2011, Boston, MA</p>	<p>Call for Papers—Submission site is now Open. Abstract deadline-- June 21, 2011</p>
<p>6th International Conference of the African Materials Research Society December 11-16, 2011, Victoria Falls, Zimbabwe</p>	<p>Abstract Deadline— June 30, 2011</p>

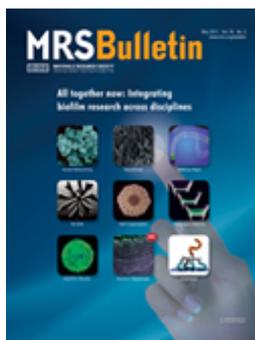
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MRS Bulletin

[All Together Now: Integrating Biofilm Research Across Disciplines](#)

May 2011 Issue

Guest Editors: Gerard C.L. Wong and George A. O'Toole

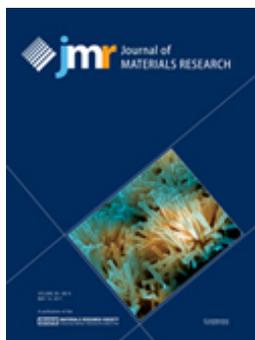


Bacterial biofilms are integrated, multi-species communities of cells that adhere to almost any surface and are fundamental to the ecology and biology of bacteria. Not only do biofilms contribute to human health and disease, they also play important roles in the context of energy and the environment. The formation of biofilms requires interactions between bacteria and the surfaces they colonize, and both microbe and surface can impact the structure, function, and composition of these communities. Bacteria in biofilms exhibit surprisingly sophisticated social behavior, both cooperative and competitive, made possible by their cell biology. However, they are also hierarchically organized systems governed by complex physical and chemical interactions. Because of this, the study of bacterial biofilms has recently attracted the attention of materials scientists, physicists, chemists, and nanotechnology experts

who import not only new tools, but also new concepts and perspectives. This issue reviews recent progress in multidisciplinary studies of biofilms.

Journal of Materials Research

[May 2011, Volume 26, Issue 9 - A selection of papers](#)



[Self-heating of silicon microwires: Crystallization and thermoelectric effects](#)

Gokhan Bakan, Niaz Khan, Adam Cywar, Kadir Cil, Mustafa Akbulut, Ali Gokirmak and Helena Silva, DOI: 10.1557/jmr.2011.32

[Low-temperature fabrication of nanocrystalline silicon thin films on mechanically flexible substrates by vacuum arc discharge](#)

Jeff T.H. Tsai, Tsung-Ying Lin and Daniel H.C. Chua, DOI:10.1557/jmr.2011.48

[High lithium conductivity in \$\text{Li}_{1-2x}\text{Ca}_x\text{Si}_2\text{N}_3\$](#)

Eiichirou Narimatsu, Yoshinobu Yamamoto, Takashi Takeda, Toshiyuki Nishimura and Naoto Hirosaki, DOI:10.1557/jmr.2011.50

Upcoming JMR Focus Issues - Calls for Papers

[February 2012 – One-Dimensional Micro/Nano Materials](#)

Manuscript Submission Deadline: June 28, 2011

[March 2012 – Plasma and Ion-Beam Assisted Materials Processing](#)

Manuscript Submission Deadline: July 15, 2011

DIVERSIONS

Did You Know?

The recent E-MRS meeting in Nice, France, included an MRS/E-MRS Bilateral Energy Conference consisting of 11 symposia?

Quiz

What will be the theme of the April 2012 Special Issue of the MRS Bulletin? The first special issue, published in 2008, had the theme of "Harnessing Materials for Energy."

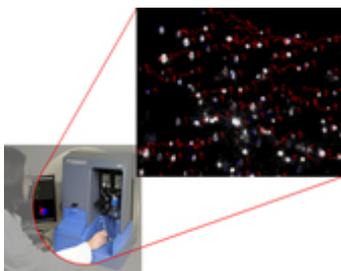
(Answer will be published in the next Materials360®)

Answer to the Quiz in the previous Materials360®:

Thirty MRS Fellows were inducted into the latest class. The deadline for submission of candidates for the next class is October 1, 2011.

NEW PRODUCTS FOCUS

Nanoparticle Characterization



NanoSight, manufacturers of nanoparticle characterization technology, recently announced the release of Zeta Potential Analysis applying Z-NTA, particle by particle characterization of surface charge. Zeta Potential Nanoparticle Tracking Analysis (Z-NTA) adds measurement of surface charge to simultaneous reporting of size, composition (light scattering intensity), fluorescence and count. As with NTA, the core of NanoSight's nanoparticle measurement systems, it collects data on a particle-by-particle basis. No other methodology comes close to providing such simultaneous, multiparameter nanoparticle characterization.

[Contact: 44-1980-676060 or info@nanosight.com]

Automatic Two-Channel Temperature Controller



Warner Instruments, a designer and manufacturer of biomedical devices for the electrophysiological, cellular and neurological sciences, recently introduced the new CL-200 Dual Channel Bipolar Temperature Controller for automatic control of two Peltier devices. Accurately maintaining temperatures between -6° and 65°C with a single control, this model features a feedback thermistor switch that allows the user to select which thermistor is used for feedback control. Built-in

protection for Peltier devices prevents overheating or freezing, while a low-noise power source makes the CL-200 ideal for sensitive electrophysiology applications.

[Contact: 203-776-0664 or pr@warneronline.com]

Electrochemistry Cell for Atomic Force Microscopes

Asylum Research, a leader in Scanning Probe and Atomic Force Microscopy (SPM/AFM), has announced the new Electrochemistry Cell (EC Cell) for its MFP-3D™ AFMs. The EC Cell is a versatile platform for electrochemical experiments combined with AFM imaging. The EC Cell accommodates samples (working



electrodes) of various sizes, including metal cylinders, flat conducting samples, and even conducting thin films on insulating substrates, and enables studies of deposition, oxidation, corrosion, and mass transfer of metals and other materials. Nanoscale topographical changes can be precisely monitored in situ as induced by electrochemical reactions. The cell provides for heating from ambient to 60°C (optional) and can be operated in a fully sealed configuration. [Contact: 805-696-6466 or info@asylumresearch.com]

[To suggest items for inclusion in Industry News and New Products Focus, please contact [Mary Kaufold](#) at 724-779-2755]

ABOUT MATERIALS360®

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