The World’s Most Accurate AFM

Low Noise Z Detector-based True Sample Topography™

The quality of your data is critical to your work and success. In today's world of where many existing technologies are reaching the limits of their potential, the key to relevant quality results is accuracy at the nanoscale. Park Systems’ innovative NX Atomic Force Microscope (AFM) technology provides the most accurate nanoscale results at far lower total cost of ownership than traditional AFMs.

All AFM technology relies on precise piezo controlled movement. As such, AFMs often suffer from edge overshoots and piezo creep errors. While these errors can be small, when accuracy and consistency are important, they can cause large problems. To solve this problem, Park Systems has implemented the industry's leading low noise Z detector. Unlike other AFMs in the market using applied voltage signals, the low noise Z detector enables the recording of accurate sample surface height even during high-speed scanning.

The Park Systems NX technology builds on the company’s leadership in AFM data accuracy and is available for both research and industrial enthusiasts. The Park NX10 provides researchers with a premium research-grade small sample AFM. For users needing larger sample capacity, the Park NX20 provides a high end large sample AFM, often required in hard disk and semiconductor industries for failure analysis.

Please visit us at www.parkAFM.com/nx for more information.
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For more program information visit www.mrs.org/s13-itinerary-planner
Welcome to the Meeting

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The increasingly cross-disciplinary activity in materials research is highlighted each year with the MRS Spring Meeting. Symposium organizers from around the globe have created a program of 56 technical symposia, making it the largest Spring Meeting yet! An exciting mix of well-established, popular topics and leading-edge research captures the extraordinary progress in materials science and technology: energy; nanomaterials; electronics/photonics; biomaterials; and general materials science.

To complement the technical program, 10 tutorial sessions, all running on Monday, will provide detailed introductions to stirring areas of research. Evening poster sessions, also an integral part of the Meeting, will be held Tuesday through Thursday.

The exhibit is another fundamental part of the Spring Meeting. Don’t miss your chance to talk directly with more than 125 international exhibitors showcasing products and services of interest to the materials community. And while you’re in the exhibit hall, be sure to check out the activities happening in materials®, including LEGO® hands-on science activities, caricature sketches and the ever-popular Science as Art competition.

Special events start Monday with the Student-Organized Energy Materials Forum, which includes discussions on the current energy market and potential technologies on the horizon, and a networking poster session with presentations by almost 50 graduate students engaged in the field of alternative energy.

Monday closes with the Fred Kavli Distinguished Lectureship in Nanoscience presentation, Colloidal Metal Nanocrystals—Shape Control, Symmetry Breaking and Niche Application, by Younan Xia, Georgia Institute of Technology.

Symposium X, the lunchtime lecture series for the non-expert, will feature many of the MRS award recipients. Alexandra Boltasseva, Purdue University, recipient of the Outstanding Young Investigator Award, will present her talk, Empowering Plasmonics and Metamaterials Technology with New Material Platforms, on Tuesday. On Wednesday, John A. Rogers, University of Illinois at Urbana-Champaign, will present the Mid-Career Researcher Award Talk, Materials for Electronics That Can Stretch, Twist, Fold and Flex, Innovation in Materials Characterization Award recipients D. Bruce Chase and John F. Rabolt, University of Delaware, will present their award talks on Thursday: FT-Raman Spectroscopy—A Catalyst for Raman Scattering, and Innovations in Spectroscopic Instrumentation—Evolution, Revolution or Back to the Future? respectively.

The Awards Ceremony & Plenary Session convenes Wednesday at 6:30 pm, when the Outstanding Young Investigator Award, Mid-Career Researcher Award, Innovation in Materials Characterization Awards, and Graduate Student Gold and Silver Awards will be presented. The ceremony will be followed by the Plenary Session, A New Industrial Revolution for a Sustainable Energy Future, given by Arun Majumdar, Google, Inc.

MRS continues to expand its professional development portfolio this Spring Meeting. The MRS Career Center includes access to current job postings, a resume file for prospective employers and on-site interview opportunities. Tim Miller of Spoken Science will offer his popular presentations: Making the Most of Broadcast Media; Mastering Science Presentations; and Technical Poster Design. And a panel discussion, Diversity in STEM—Climbing the Ladder in Academia, Government and Private Industry, will be held on Wednesday morning at the Women in Materials Science & Engineering Breakfast.

On Wednesday, attendees can also participate in two special forums. Learn about funding opportunities from various government agencies at the Government Agency Forum. The Energy Materials Forum, Material, Economic and Manufacturing Strategies for Scalable Deployment, will bring together students, academicians, corporate leaders, nonprofit interest groups, government scientists, engineers and policymakers to address the issues facing alternative energy.

The 5th Technology Innovation Forum, Innovation and Entrepreneurial Excellence, held Thursday, offers perspectives from successful innovators, industry leaders and investors on the process of taking a technology from conception to market impact.

And just when you think the Meeting is over, think again! All award talks, several special events, and 16 technical symposia will be recorded and made available with presentation materials OnDemand® shortly after the Meeting. What’s more, the Student-Organized Energy Materials Forum and Symposium E—Materials and Integration Challenges for Energy Generation and Storage in Mobile Electronic Devices, will be streamed live on the interactive, web-based platform. Visit pages 8–9 for details.

We hope that you enjoy all this Meeting week has to offer and look forward to sharing this time with you in San Francisco!

2013 MRS Spring Meeting Chairs
Mark L. Brongersma, Vladimir Matias, Rachel Segalman, Lonnie D. Shea, and Heiji Watanabe
Meeting Symposia

ENERGY
A Film Silicon Science and Technology
B Organic and Hybrid Photovoltaic Materials and Devices
C Thin-Film Compound Semiconductor Photovoltaics
D From Molecules to Materials—Pathways to Artificial Photosynthesis
E Materials and Integration Challenges for Energy Generation and Storage in Mobile Electronic Devices
F Materials for Vehicular and Grid Energy Storage
G Electrochemical Interfaces for Energy Storage and Conversion—Fundamental Insights from Experiments and Computations
H Nanoscale Thermoelectrics—Materials and Transport Phenomena II
I Materials for Solid-State Refrigeration
J In-Situ Characterization Methods in Energy Materials Research
K Materials for Sustainable Development

NANOMATERIALS
L Nanoparticle Manufacturing, Functionalization, Assembly and Integration
M Solution Synthesis of Inorganic Functional Materials—Films, Nanoparticles and Nanocomposites
N Nanomaterials in the Subnanometer-Size Range
O Beyond Graphene—2D Atomic Layers from Layered Materials
P Graphene and Related Carbon Nanomaterials
Q Surfaces of Nanoscale Semiconductors
R Nanostructured Semiconductors and Nanotechnology
S Nanostructured Metal Oxides for Advanced Applications
T Electrical Contacts to Nanomaterials and Nanodevices
U Measurements of Atomic Arrangements and Local Vibrations in Nanostructured Materials
V Nanoscale Heat Transport—From Fundamentals to Devices
W Piezoelectric Nanogenerators and Piezotronics
Y Advances in Scanning Probe Microscopy for Imaging Functionality on the Nanoscale
Z Nanotechnology and Sustainability

ELECTRONICS/PHOTONICS
AA Advanced Interconnects for Micro- and Nanoelectronics—Materials, Processes and Reliability
BB Evolutions in Planarization—Equipment, Materials, Techniques and Applications
CC Gate Stack Technology for End-of-Roadmap Devices in Logic, Power and Memory
DD Emerging Materials and Devices for Future Nonvolatile Memories
EE Phase-Change Materials for Memory, Reconfigurable Electronics and Cognitive Applications
FF Compound Semiconductors for Generating, Emitting, and Manipulating Energy II
GG Single-Dopant Semiconductor Optoelectronics
HH Materials for High-Performance Photonics II
II Resonant Optics in Metallic and Dielectric Structures—Fundamentals and Applications
JJ Fundamental Processes in Organic Electronics
KK Charge and Spin Transport in Organic Semiconductor Materials

BIOMATERIALS
LL Hybrid Inorganic-Biological Materials
MM New Tools for Cancer Using Nanomaterials, Nanostructures and Nanodevices
NN Multifunctional Biomaterials
OO Design of Cell-Instructive Materials
PP Adaptive Soft Matter through Molecular Networks
QQ Conjugated Polymers in Sensing and Biomedical Applications
RR Lanthanide Nanomaterials for Imaging, Sensing and Optoelectronics
SS Bioelectronics—Materials, Interfaces and Applications
TT Materials and Processes for Electronic Skins

GENERAL
UU Plasma and Low-Energy Ion-Beam-Assisted Processing and Synthesis of Energy-Related Materials
VV Materials Applications of Ionic Liquids
WW Nuclear Radiation Detection Materials
XX Oxide Thin Films and Heterostructures for Advanced Information and Energy Technologies
YY Titanium Dioxide—Fundamentals and Applications
ZZ Carbon Functional Interfaces II
AAA Superconducting Materials—From Basic Science to Deployment
BBB Size-Dependent and Coupled Properties of Materials
CCC Novel Functionality by Reversible Phase Transformation
DDD Extreme Environments—A Route to Novel Materials
EEE Materials Education—Toward a Lab-to-Classroom Initiative
Manuscripts are being solicited for MRS Communications—a full-color, high-impact journal focused on groundbreaking work across the broad spectrum of materials research.

Published jointly by the Materials Research Society (MRS) and Cambridge University Press, MRS Communications offers a rapid but rigorous peer-review process and time to publication. An aggressive production schedule will bring your article to online publication and a global audience within a target 14-day process from acceptance.

Hosted on the cutting-edge Cambridge Journals Online (CJO) platform, the journal features a robust suite of author and reader services, including new open access options, as well as an immediate reader/subscriber base including over 16,000 MRS members and over 2,500 academic, industrial and government libraries worldwide.

Major article types for MRS Communications include:

- **RESEARCH LETTERS**
- **PROSPECTIVES ARTICLES**
- **EDITORIALS**
- **COMMENTARIES**
- **CORRESPONDENCE**

**Prospectives** are a unique feature of this journal, offering succinct and forward-looking reviews of topics of interest to a broad materials research readership.

Manuscripts are solicited in the following topical areas, although submissions that succinctly describe groundbreaking work across the broad field of materials research are encouraged:

- Biomaterials and biomimetic materials
- Carbon-based materials
- Complex oxides and their interfaces
- Materials for energy storage, conversion and environmental remediation
- Materials for nanophotonics and plasmonic devices
- Theory and simulation of materials
- Mechanical behavior at the nanoscale
- Nanocrystal growth, structures and properties, including nanowires and nanotubes
- Nanoscale semiconductors for new electronic and photonic applications
- New materials synthesis, templating and assembly methods
- New topics in metals, alloys and transformations
- Novel and in-situ characterization methods
- Novel catalysts and sensor materials
- Organic and hybrid functional materials
- Quantum matter
- Surface, interface and length-scale effects on materials properties

For more information about the journal visit [www.mrs.org/mrc](http://www.mrs.org/mrc) or email mrc@mrs.org.

For manuscript submission instructions, please visit [www.mrs.org/mrc-instructions](http://www.mrs.org/mrc-instructions).

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MRS Communications
The Letters and Prospectives Journal

A UNIQUE PUBLISHING OPPORTUNITY
Message from the President

Welcome to San Francisco and the 2013 MRS Spring Meeting! MRS once again proudly presents a sensational Meeting with high-quality technical sessions and event-filled evenings, thanks to the hard work of the Meeting Chairs—Mark L. Brongersma, Vladimir Matias, Rachel Segalman, Lonnie D. Shea, and Heiji Watanabe! Planning and executing meetings of this magnitude requires an extraordinary amount of time and effort by the Meeting Chairs, and also the symposium organizers, numerous volunteers and the MRS staff.

I think that you’ll be pleased with and impressed by the virtual activities that will be taking place during the Meeting. Several symposium sessions will be captured, as well as the plenary and award talks; exhibitors, speakers and attendees will be interviewed; and there will be a Virtual Poster Hall for winning and nominated posters. We welcome and value your feedback and your ideas for future activities. Contact Eileen Novak, Director of Communications (enovak@mrs.org) or Bob Braughler, Virtual Engagement Manager (braughler@mrs.org) with your comments.

The Materials Research Society Foundation (www.mrs.org/foundation) continues the MRS tradition of funding projects and partnerships conceived, developed, produced and implemented by MRS members, for MRS members and for the materials community. The first of these exciting grants will be announced at this Meeting.

The MRS Board of Directors is launching an initiative aimed at promoting materials innovations, bridging the gap between basic research and the marketplace, and further engaging today’s materials industry. We believe that creating forums for meaningful interactions between academia and national labs and the industrial sector will be beneficial to all parties. The Board’s Planning Committee will be delving into the issue and making recommendations to the Board. If you have ideas or suggestions, please contact Todd Osman, Executive Director (osman@mrs.org).

I encourage you to attend the fifth annual Technology Innovation Forum—Innovation and Entrepreneurial Excellence. Invited speakers from Industry, Academia and National Labs will discuss innovation, partnerships and best approaches for “technology push” and “innovation pull.”

And finally, I strongly encourage all members with a US mailing address to visit the Materials Voice kiosk on the second floor of Moscone West to easily and quickly send prepared letters to Congress expressing your support for science and technology funding. If cuts take place, they will negatively impact research, development, education and training of the next generation of scientists. In the end, the effects of these cuts will translate to a negative impact on the economy of the United States. These important letters may also be sent at any time from the Materials Voice website at http://www.mrs.org/materials-voice.

I hope that your week here will be productive and educational. Please take advantage of the many offerings—a tremendous array of informative technical symposia, professional development and career opportunities, special talks, government agency sessions, exhibits, poster sessions and education outreach activities. All of this is designed to serve your professional needs. Please check the Daily Schedule of Events to learn of the wide variety of activities, and don’t forget one of the best aspects of MRS meetings—the numerous opportunities to network with your colleagues!

Congratulations and thanks to the S13 Meeting Chairs, Symposium Organizers, Volunteers and MRS Staff on a very successful Meeting! We are looking forward to meeting all of you for a productive exchange of ideas at the 2013 MRS Spring Meeting.

Orlando Auciello, MRS President
Thanks to MRS Volunteers!

On behalf of our great Society, I’d like to express my deep appreciation to YOU — our committee chairs and members, meeting chairs, symposium organizers, MRS Bulletin, JMR, MRS Communications editors, special editors, news contributors, editorial boards, volume organizers and authors, outreach volunteers, Board members, and all the dedicated people who make great contributions when needed—all our volunteers, past and present! The dedication and commitment of all MRS volunteers is outstanding! Thank you for investing your valuable time and energy to advance our vibrant, progressive and innovative MRS organization to ever new highs for the good of the materials research community and society!

Orlando Auciello, 2013 MRS President

> ACADEMIC AFFAIRS COMMITTEE assesses existing educational curricula in materials science and engineering and evaluates the need for materials specialists in current and emerging technical areas. The Committee serves in an advisory capacity to University Chapters and maintains a current record of University Chapter officers and advisors.

Academic Affairs Committee
- M. Stanley Whittingham, Binghamton University, State University of New York
- Accreditation Subcommittee
  - William F. Hammeter, Sandia National Laboratories
- Curriculum Subcommittee
  - Steven M. Yalisove, University of Michigan
- International Student Affairs Subcommittee
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- University Chapters and Special Projects Subcommittee
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> AWARDS COMMITTEE oversees all Society awards according to policies approved by the Board of Directors, arranges for the preparation and presentation of awards, recommends new awards and changes to existing awards and oversees publicity for all awards.

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- External Awards Subcommittee
  - Jeffrey A. Eastman, Argonne National Laboratory
- Graduate Student Awards Subcommittee
  - Suveen N. Mathaudhu, U.S. Army Research Office
- Innovation in Materials Characterization Award Subcommittee
  - Karen L. Winey, The Pennsylvania State University
- MRS Fellow Subcommittee
  - William J. Weber, University of Tennessee
- MRS Medal Award Subcommittee
  - J. Charles Barbour, Sandia National Laboratories
- Materials Theory Award Subcommittee
  - Peter M. Anderson, Ohio State University
- Mid-Career Researcher Award Subcommittee
  - Debra R. Rolison, U.S. Naval Research Laboratory
- Outstanding Young Investigator Award Subcommittee
  - Susanne Stemmer, University of California, Santa Barbara
- David Turnbull Lectureship Award Subcommittee
  - Kevin J. Hemker, Johns Hopkins University
- Von Hippel Award Subcommittee
  - James J. De Yoreo, Pacific Northwest National Laboratory

> GOVERNMENT AFFAIRS COMMITTEE responds to and initiates opportunities to interact with government officials and public and private organizations on matters of science and technology policy, and participates in or plans events related to those policies. The Committee also identifies policy issues relevant to the Society’s interests and prepares proposed responses, with supporting background material, for Board of Directors’ consideration and disposition.

Government Affairs Committee
- Nabil D. Bassim, U.S. Naval Research Laboratory
- Congressional Fellow Subcommittee
  - Kevin Whittlesey, California Institute for Regenerative Medicine
- Congressional Visits Day Subcommittee
  - Linda Olafsen, Baylor University
- Government Agency Selection Subcommittee
  - Joshua D. Caldwell, U.S. Naval Research Laboratory
- Grassroots Subcommittee
  - Tabbetha A. Dobbins, Rowan University

> MEETINGS COMMITTEE is responsible for planning, executing and evaluating program content of all Meetings in which the Society participates. This will include technical and non-technical content, tutorials, workshops, electronic content delivery, experiments in new meetings, and co-sponsored, co-located or other partnered programming. The Committee evaluates proposed MRS endorsements for external technical meetings, seeks opportunities to coordinate efforts across the Society and communicates with the MRS Publications Committee to coordinate topical content between mediums when possible.

Meetings Committee
- David S. Ginley, National Renewable Energy Laboratory
- Program Development Subcommittee
  - Harry A. Atwater, California Institute of Technology
- Electronic Media Subcommittee
  - Martha Symko-Davies, National Renewable Energy Laboratory
- Meetings Assessment Subcommittee
  - Neville R. Moody, Sandia National Laboratories
- New Meetings Subcommittee
  - Terrence L. Aselage, Sandia National Laboratories
- Non-Technical Program Development Subcommittee
  - Shashi G. Jasty, Sigma-Aldrich
MEMBER ENGAGEMENT COMMITTEE promotes member engagement in the Society and assesses volunteer needs. The Committee serves in an advisory capacity to MRS committees and communities and the Board regarding member engagement and volunteerism. The Committee assesses programs and practices that can best serve the needs of MRS volunteers, including professional development and networking. It also facilitates awareness of volunteer opportunities within MRS.

Member Engagement Committee
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Winny Dong, California Polytechnic State University, Pomona

Communities Subcommittee
Tao Dang, Shanghai Jiao Tong University, China
Seth Miller, i2C Solutions LLC

Diversity Subcommittee
Magaly Spector, University of Texas at Dallas

Women in Materials Science and Engineering Subcommittee
Dawnielle Farrar, Johns Hopkins University

PUBLIC OUTREACH COMMITTEE develops activities and programs on both national and local levels to educate the general public on materials research and its importance. Activities and programs may include, but are not limited to, pre-university science education, press communications and public service information. The Committee evaluates, interprets and communicates impact of the Society's public awareness programs to the Board of Directors, publicizes existing Society programs and engages the membership in outreach activities.

Public Outreach Committee
Aditi Risbud, University of Utah

Strange Matter Green Earth Subcommittee
Jerrold A. Floro, University of Virginia

Impact of Materials on Society Subcommittee
Kevin S. Jones, University of Florida

Education Symposium Planning Subcommittee
Elizabeth Kupp, The Pennsylvania State University

PUBLICATIONS COMMITTEE is responsible for the quality of MRS publications and provides direction to and review of the Society’s print and electronic publications, including journals, books, news, educational and all other publications. It oversees general editorial policy, engages in strategic planning and development of the Society’s current and future publications, recommends and works with partner entities where appropriate and initiates publication-focused task forces and subcommittees as deemed necessary by the Committee.

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Are you passionate about materials science? Are you looking for ways to: Expand your professional network? Enhance your leadership skills? Share your experience and knowledge to shape the future of materials research? If so, consider becoming an MRS volunteer!

Active participation in the Society is one of the best ways to derive value from your membership! Whether you are a student or Kavli Prize winner, MRS welcomes your contributions and is committed to supporting its volunteers through a dedicated HQ staff, professional development and networking opportunities.

MRS encourages you to get involved in the Society, as well as the larger scientific community, and is always looking for energetic members to drive initiatives that further the MRS mission. Volunteer positions exist on a variety of operating committees and subcommittees as well as ad hoc opportunities for members to participate (short-term commitments).

To learn more about volunteer opportunities, contact the respective Committee/Subcommittee Chair or Michele Feder, Manager of Volunteer Affairs, feder@mrs.org. To apply for a volunteer position, visit the MRS website at www.mrs.org/MyMRS/ to complete a Volunteer Profile form today.
This is our biggest Spring Meeting yet, and we know you can’t be everywhere at once. But now, you can view selected talks and lectures, complete with slides, from the comfort of your home or office, or on the go!

MRS OnDemand® is the always-on, online community for the Materials Research Society. It features rich materials science content from the annual MRS Meetings and other relevant sources through an interactive experience, complete with video, audio and presentation materials.

With MRS OnDemand® you can:
- access sessions you missed from the MRS Spring and Fall Meetings
- review presentation content from sessions you attended
- gain insights from interviews with experts
- comment and connect with peers across the materials sciences
- follow materials science research topics in your specific area of interest

Whether you missed it the first time, or just want to see an amazing presentation again, experience the collaborative, interdisciplinary Materials Research Society community online, at your convenience—Your MRS, Your Way!

A select number of sessions are available via live streaming, so even if you’re unable to attend while in San Francisco, you can tune in and capture all the exciting content delivered.

AWARDS OF THE MATERIALS RESEARCH SOCIETY

Outstanding Young Investigator Award
Alexandra Boltasseva, Purdue University
Empowering Plasmonics and Metamaterials Technology with New Material Platforms

Mid-Career Researcher Award
John Rogers, University of Illinois at Urbana-Champaign
Materials for Electronics That Can Stretch, Twist, Fold and Flex

Innovation in Materials Characterization Award
D. Bruce Chase
University of Delaware and Pair Technologies LLC
FT-Raman Spectroscopy: A Catalyst for Raman Scattering

John F. Rabolt
University of Delaware
Innovations in Spectroscopic Instrumentation—Evolution, Revolution or Back to the Future?
After a successful premiere at the 2012 MRS Fall Meeting, MRS TV is back to cover the 2013 MRS Spring Meeting & Exhibit in San Francisco.

MRS TV will screen a new episode each day of the Meeting, featuring a mix of well-established, popular topics and leading-edge research, reports from the exhibit hall, talks with experts in the field and interviews with Meeting attendees. The program will also feature exclusive reports, produced especially for the Meeting from universities and research institutes.

Watch MRS TV around the Meeting venues and on dedicated channels in the following hotels:

- San Francisco Marriott Marquis
- The Westin San Francisco Market Street
- InterContinental San Francisco

The MRS TV playlist can be found online at www.mrs.org/on-demand.
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<td>Moscone West, Level 3, Alcove 3024</td>
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<td>Moscone West, Level 2, Lobby</td>
<td>8:00 am - 4:00 pm</td>
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**BADGES**

All persons wishing to present their research and/or attend MRS conference sessions or evening events are required to register and must wear their meeting badges at all times while within the meeting venues. Security will be in place to ensure that all participants are wearing badges. Anyone not wearing a badge will be asked to leave the MRS functions immediately. Lost badges can be verified and replaced by reporting to the Registration area during posted registration hours.
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**High Resolution RBS**

National Electrostatics Corporation has added Ångstrom level, High Resolution RBS to the RC43 Analysis System for nanotechnology applications. A single Pelletron instrument can now provide RBS, channeling RBS, microRBS, PIXE, ERDA, NRA, and HR-RBS capability, collecting up to four spectra simultaneously. Pelletron accelerators are available with ion beam energies from below 1 MeV in to the 100 MeV region.

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**National Electrostatics Corp.**
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Moscone West

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# Oral Presentations

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**Authors check in and post papers** ................................................ 9:00 am – 5:00 pm*

**Papers judged for Best Poster Awards** ........................................ 5:00 pm – 8:00 pm*

(only judges are permitted in the poster hall during judging)

**Poster session general viewing** .................................................. 8:00 pm – 11:00 pm

(authors must be with their posters during general viewing to be eligible for a Best Poster Award)

*Access to poster boards will be limited to poster authors from 9:00 am to 5:00 pm. Only judges will have access to the poster boards from 5:00 pm to 8:00 pm.

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Winning posters will be displayed outside Salons 7, 8 and 9 for the remainder of the Meeting and can be removed by the authors at their convenience. Unless you are the winner of a “Best Poster Award,” it is extremely important that you remove your poster at the end of your poster session. (It is almost impossible to locate posters if they are left on the boards after 11:00 pm.)
Presentation Guidelines

ORAL PRESENTATIONS

- Most contributed presentations are scheduled for 15 minutes; most invited speakers are scheduled for 30 minutes.
- Standard audiovisual equipment available includes an LCD projector, a screen, pointer, and a wireless lapel microphone.
  A Speaker Ready Room will be available Monday through Friday.

POSTER PRESENTATIONS

IMPORTANT–NEW PROCEDURE:
All Poster Presenters MUST STOP at the poster check-in desk BEFORE putting up their poster. The presenter MUST be an author of the poster and a registered attendee, and must show a meeting badge at check-in. You will need to check in on the day of your presentation and not before. The check-in desk will be located on the Yerba Buena Level of the San Francisco Marriott Marquis Hotel.

REMEMBER:
- Pick up your meeting badge at MRS Registration located in Moscone West. NOTE: Your 2013 MRS Spring Meeting badge is required for poster check-in.
- Check in at the POSTER DESK (located on the Yerba Buena Level of the Marriott Marquis).
- Any posters that were not verified at the check-in desk prior to posting will be removed from the session.

Poster boards are aligned in a vertical format of 4’ wide by 8’ high. Pins for posting will be available at numerous stations throughout the poster hall. Please return the pins to these stations following your poster session for the convenience of authors who will be participating in other sessions later in the week.

The following information may assist you in preparing an informative and professional poster display.
- Print TITLE and AUTHORS in extra-large characters across the top of your display.
- Display your material in large print so it may be read from a distance. It is important to use text and graphics larger and bolder than those of your manuscript! Be clear and succinct.
- Each board will be 8’ high by 4’ wide. Usable space is 91” by 45”, although for best viewing by poster attendees—and convenient posting by authors—the Society recommends confining the displays to the 5’ high by 3.5’ wide area in the center of the poster board, as depicted. Boards will accept pushpins or Velcro. A (finite) supply of pushpins will be available.
- Each presentation will be assigned a board and will be labeled with the number of the paper (e.g., M5.18) and the presenting author’s name.
- Light refreshments will be provided from 8:00 pm to 9:30 pm.

BEST POSTER AWARDS
Poster sessions are an important and integral part of MRS meetings, allowing many more authors the opportunity to share their research and ideas with others.
Because the quality of the poster sessions is a major priority of the Society, the 2013 Spring Meeting Chairs will recognize the best presentations at each of the sessions.
A prize of up to $500 will be awarded by the Chairs to the presenting author(s) of the winning poster(s). One or more awards will be made each evening. The Meeting Chairs will select the winners on the basis of the poster’s technical content, appearance, graphic excellence, and presentation quality (not necessarily equally weighted). Poster award winners must be present at the viewing session in order to receive their award.
MRS does not endorse or sponsor any of the listings. Information is provided as a courtesy to our attendees.

**TRANSPORTATION** Visit www.bart.gov for up-to-date information and route maps.

**PARKING** Parking garages are located near the Moscone West Convention Center. Refer to: www.moscone.com/attendees/directions/parking.shtml. Parking is also available at the San Francisco Marriott Marquis Hotel.

For traveler information including weather, traffic conditions, and parking, visit 511: The Bay Area Travel Guide.

**LOST AND FOUND** Moscone Center offers a Lost and Found service. Lost items are kept throughout the duration of the conference and for sixty days after the conference. To check whether a lost item has been turned in, contact the Moscone Security on any white house courtesy phone by dialing “4021”.

**CHILD CARE SERVICES** Check with the Concierge Desk at the individual hotels for a comprehensive roster of licensed and bonded sitters.

**BUSINESS CENTER** A full-service business center is available at the Marriott Marquis Hotel. Relevant fees apply.

**ATM** Available at Moscone West, Level 1, and in the Marriott Marquis Hotel Lobby.

**FIRST AID** Moscone West provides a First Aid office, located at the south entrance to the First Floor Exhibit Hall.
AWARDS OF THE MATERIALS RESEARCH SOCIETY

Join us for a special evening of awards and celebration. Prior to the Plenary Session on Wednesday evening, the Outstanding Young Investigator, Innovation in Materials Characterization, Mid-Career Researcher and Graduate Student Awards will be presented, and the newly elected MRS Fellows will be recognized. Don’t miss the award talks throughout the week.

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Outstanding Young Investigator Award Talk Symposium X Presentation

Tuesday, April 2, 12:15 pm – 1:00 pm
Marriott Marquis, Golden Gate Level, Salon B

Alexandra Boltasseva
Purdue University

Empowering Plasmonics and Metamaterials Technology with New Material Platforms

In recent years, plasmonics and metamaterials have seen an explosion of novel ideas and device designs. However, transforming these concepts into practical devices requires a significant amount of effort. The constituent materials in these devices play a crucial role in realizing useful and efficient devices. Similar to the way silicon shaped the nanoelectronics field, efforts toward finding the best set of materials for plasmonic and metamaterial devices could revolutionize the field of nanophotonics. As a potential solution, alternative plasmonic materials have recently gained significant attention. Metals, despite being essential components of plasmonic and metamaterial devices, pose many technological challenges toward the realization of practical devices—primarily due to their high optical loss, integration and fabrication limitations. Hence, searching for an alternative to metals is vital to the success of future nanophotonic devices. In this talk, I will provide a brief survey of recent developments in the pursuit of better plasmonic materials, and discuss several classes of materials including doped semiconductor oxides and ceramics as potential alternatives to metals that provide low intrinsic loss, tunability and compatibility with standard semiconductor fabrication processes.

ALEXANDRA BOLTASSEVA is an Assistant Professor at the School of Electrical and Computer Engineering and Birck Nanotechnology Center, Purdue University, and an adjunct Associate Professor at Technical University of Denmark (DTU). She received her PhD degree in Electrical Engineering at DTU in 2004. Boltasseva specializes in nanophotonics, nanofabrication, plasmonics and metamaterials. She received the IEEE Photonics Society Young Investigator Award, the MIT Technology Review Top Young Innovator (TR35) Award that “honors 35 innovators under 35 each year whose work promises to change the world,” the Purdue College of Engineering Early Career Research Award, the Young Researcher Award in Advanced Optical Technologies from the University of Erlangen-Nuremberg, Germany, and the Young Elite-Researcher Award from the Danish Council for Independent Research. She is topical editor for Optics Letters and the Journal of Optics and guest editor for Advances in OptoElectronics, a senior member of the OSA, member of the IEEE, SPIE and MRS. Boltasseva has co-authored three invited book chapters and 65 research papers in refereed journals. She has an h-index of 22 (ISI Web of Science)/26 (Google Scholar) with a total number of citations above 1600. Boltasseva has been featured as an invited speaker at 59 international conferences and leading research centers.

Graduate Student Award Finalists’ Special Talk Sessions

Tuesday, April 2, 12:00 pm – 2:45 pm
Marriott Marquis, 4th Floor, Pacific B, C

The Graduate Student Award Finalists’ Special Talk Sessions are open to all meeting attendees; students, especially, are encouraged to attend. The Gold and Silver Graduate Student Awards will be presented during the Awards Ceremony on Wednesday evening.

SESSION 1 - Pacific B

TIME SPEAKER ........................................... PAPER OR POSTER
12:00 Matthew McDowell, Stanford University ....................... G3.01
12:15 Guang Zhu, Georgia Institute of Technology ................. W2.06
12:30 Xiaofeng Feng, University of California, Berkeley ....... P5.62
12:45 Aaron Rathmell, Duke University ............................. T4.01
1:00 Runzhe Tao, University of Illinois at Chicago ............ AAA8.05
1:15 BREAK
1:30 William Woodford, Massachusetts Institute of Technology ............................................. G1.05
1:45 You Zhou, Harvard University .................................. XX4.02
2:00 Sriharsha Aradhy, Columbia University ..................... Y3.05
2:15 Wei Bao, University of California, Berkeley ............... Y3.05
2:30 Ryan Comes, University of Virginia .......................... X8.14

SESSION 2 - Pacific C

TIME SPEAKER ........................................... PAPER OR POSTER
12:00 Woon Teck Yap, Northwestern University .................. OO3.02
12:15 Kedar Hippalgaonkar, University of California, Berkeley ............................................. V3.05
12:30 Benjamin Chee Keong Tee, Stanford University .......... TT1.02
12:45 Lito de la Rama, University of Illinois ....................... BBB4.03
at Urbana-Champaign
1:00 Juanjuan Du, University of California, Los Angeles ........ OO3.09
1:15 BREAK
1:30 Jongwoo Lim, University of California, Berkeley .......... H1.05
1:45 Le He, University of California, Riverside .................... L8.07
2:00 Wei Gao, University of California, San Diego ............... LL4.10
2:15 Ziliang Ye, University of California, Berkeley ............. I7.09
2:30 Jingqiang Zhang, Massachusetts Institute of Technology ............................................. P12.03
Materials for Electronics That Can Stretch, Twist, Fold and Flex

Biology is soft and curvilinear; silicon technology is rigid and planar. Electronic systems that eliminate this profound mismatch in physical properties will create new opportunities for devices that can integrate intimately with biological tissues and/or exploit biologically inspired designs. Recent work establishes a set of materials, mechanics concepts and manufacturing approaches for such a technology. This talk describes the key ideas through various examples, ranging from thin, elastic monitoring devices that wrap the heart, brain and skin, to digital cameras that adopt layouts inspired by ocular systems found in mammals and arthropods.

JOHN A. ROGERS obtained BA and BS degrees in Chemistry and in Physics from the University of Texas at Austin, in 1989. From MIT, he received SM degrees in Physics and in Chemistry in 1992 and a PhD degree in Physical Chemistry in 1995. From 1995 to 1997, Rogers was a Junior Fellow in the Harvard University Society of Fellows. He joined Bell Laboratories as a member of the technical staff in the Condensed Matter Physics Research Department in 1997, and served as Director of this department from the end of 2000 to 2002. Rogers is currently Swanlund Chair Professor at the University of Illinois at Urbana-Champaign, with a primary appointment in the Department of Materials Science and Engineering. He serves as Director of the Seitz Materials Research Laboratory.

Rogers’ research includes fundamental and applied aspects of materials and patterning techniques for unusual electronic and photonic devices, with an emphasis on bio-integrated and bio-inspired systems. He has published nearly 400 papers and is inventor on over 80 patents, more than 50 of which are licensed or in active use. Rogers is a Fellow of the MRS, IEEE, APS, and AAAS, and he is a member of the National Academy of Engineering. His research has been recognized with many awards, including a MacArthur Fellowship in 2009 and the Lemelson-MIT Prize in 2011.
Congratulations to the 2013 MRS Fellows

Honoring MRS Members who are notable for their distinguished research accomplishments and outstanding contributions to the advancement of materials research worldwide.

John E. E. Baglin
IBM Almaden Research Center
For outstanding achievement in advancing the mission of the materials community through service, pioneering ion-beam materials research of industrial importance; championing materials education globally.

Leonard J. Brillson
The Ohio State University
For seminal contributions to the understanding and control of semiconductor interfaces, metallurgical reactions, native point defects and electronic properties.

David Cahen
Weizmann Institute, Israel
For fundamental contributions to thin-film photovoltaics, photoelectrochemical energy conversion and biomaterial/inorganic interfaces; scientific leadership and service to the Materials Research Society.

Long-Qing Chen
The Pennsylvania State University
For contributions to development of the phase-field method and its innovative application to predicting mesoscale microstructural evolution and properties of metallic alloys, oxides and ferroelectrics.

Yang-Tse Cheng
University of Kentucky
For enduring research contributions to ion-solid interactions, shape-memory surfaces, superhydrophobicity, tribology, instrumented indentation and high capacity durable lithium ion batteries; distinguished leadership and service in the materials community.

Paul K. Chu
City University of Hong Kong
For outstanding contributions to the development of plasma immersion ion implantation for modifying materials surfaces to improve functional properties and obtain novel structures for industrial and biomedical applications.

Antonio Facchetti
Polyera Corporation and Northwestern University
For seminal contributions to materials research, from the design, synthesis and characterization of novel organic and hybrid materials to development of unconventional fabrication strategies and commercially viable electronic devices.

Joseph E. Greene
University of Illinois at Urbana-Champaign
For foundational contributions to the understanding of thin film and nanostructure synthesis, particularly for pioneering work in thin-film nitrides; distinguished leadership in the materials community.

Naomi J. Halas
Rice University
For fostering plasmonics within materials research; pioneering the study of nanoparticles with tunable optical properties and their applications in sensing, biotechnology and biomedicine.

Richard G. Hoagland
Los Alamos National Laboratory
For outstanding contributions in fracture mechanics and atomistic modeling of dislocation mechanisms of deformation and fracture of metals, ceramics and nanolayered composites.

Andrew B. Holmes
University of Melbourne, Australia, and Commonwealth Scientific Industrial Research Organization (CSIRO)
For distinguished contributions to materials science in the design and applications of conjugated organic materials for electronics; leadership and outreach in polymer materials.

Taeghwan Hyeon
Seoul National University, Republic of Korea
For outstanding contributions in scalable synthesis of nanomaterials with precisely controlled compositions and dimensions; pioneering research in the design of metal oxide nanocrystals for biomedical applications.

Ram S. Katiyar
University of Puerto Rico
For pioneering contributions in bulk and thin-film oxide ceramics for energy efficient electronics and energy-storage applications.

Enrique J. Lavernia
University of California, Davis
For outstanding contributions to the development of novel metal processing techniques; service and leadership in education.

Chad A. Mirkin
Northwestern University
For pioneering contributions to nanochemistry that have led to materials and devices which have dramatically increased our scientific understanding and capabilities.

Patricia M. Mooney
Simon Fraser University, Canada
For leadership in the understanding and control of point and extended defect structures in both compound and elemental semiconductors enabling new device technologies.

Daniel E. Morse
University of California, Santa Barbara
For seminal contributions to understanding the molecular mechanisms of biomineralization; development of novel bioinspired routes to kinetically controlled, low-temperature synthesis of nanostructured inorganic materials.

John H. Perepezko
University of Wisconsin–Madison
For seminal scholarly contributions to the fundamental understanding of structural synthesis, kinetics and alloy phase stability during materials processing, especially during the nucleation stage of reaction.

Pradeep K. Rohatgi
University of Wisconsin–Milwaukee
For sustained leadership in research on solidification synthesis and characterization of metal-matrix composites; pioneering initiatives in technology and product development, education, materials policy and institution building.

Rodney S. Ruoff
University of Texas at Austin
For fundamental and pioneering studies of novel carbon nanostructures, including graphene, chemically modified graphenes, nanotubes, nanofibers and fullerenes.

M. Stanley Whittingham
Binghamton University
For fundamental contributions to materials research leading to the discovery that provided the foundation for the Li-ion battery; leadership in materials education at all levels.

Karen I. Winey
University of Pennsylvania
For outstanding contributions to the understanding of polymer nanocomposites and ion-containing polymers through rigorous and insightful experiments; distinguished leadership in the materials community.

Jackie Y. Ying
Institute of Bioengineering and Nanotechnology, Singapore
For distinguished contributions to the synthesis of advanced nanostructured materials with unique functionalities for catalytic and biomedical applications; distinguished service to the materials community.

Steven J. Zinkle
Oak Ridge National Laboratory
For pioneering contributions to the understanding of radiation effects in materials; advancing the scientific basis of performance limits for structural materials in advanced nuclear energy systems.
Historically science drives technology, but occasionally the reciprocal happens where technology drives science as was the case with the development of the cw Nd YAG laser that led to the dawn of FT-Raman spectroscopy. This important spectroscopic technique has been deployed in thousands of laboratories worldwide and forms the basis of a number of commercially available instruments. A cursory review of the literature over the last 25 years reveals that the FT-Raman technique has had pervasive impact in application areas ranging from materials, to forensics, art and archaeology, biology, disease diagnosis (Alzheimer’s, cancer, etc.) and pharmaceuticals with thousands of peer-reviewed papers appearing in the literature.

A decade ago, the declassification of focal plane arrays (FPA) by the military ushered in a new spectroscopic technique: Planar Array IR (PA-IR) spectroscopy. Ultrafast (<10 msec), portable and capable of dual-beam operation, PA-IR promises to revolutionize the characterization of dynamics in materials and is another example of technology driving science well into the 21st century.
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FEATURED EVENTS

An exciting mix of special events will complement the technical sessions, highlighting a wide range of important topics in today’s materials landscape.

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Student-Organized Energy Materials Forum

Monday, April 1, 9:00 am – 5:30 pm
Moscone West, Level 2, Room 2007
www.mrs.org/on-demand

Energy issues are at the forefront due to increasing energy needs, concerns over climate change and the decline of fossil-fuel resources. A combination of new strategies and materials will be required to meet the growing need for sustainable energy production. Because energy-related research stretches across diverse fields and institutions, this forum will help bring together researchers in energy-related fields. It will be co-organized by students participating in the NSF-funded Integrative Graduate Education and Research Traineeship (IGERT) Programs at the University of South Dakota and the University of California, Santa Barbara.

This forum will:
- highlight challenges with current materials and devices in energy applications and the design of novel materials for future energy harvesting and storage
- address careers in alternative energy, policies and markets
- provide both an academic and industrial perspective of the current state of energy needs
- offer insights into various energy fields including solar, water, biomass conversion, geothermal and wind energy
- facilitate networking between students and researchers to help generate new collaborations
- build awareness of career advancement and professional development opportunities

Experts in energy issues from academia, industry and national laboratories will give presentations and engage in discussions regarding the current energy market and potential technologies on the horizon. A networking poster session with presentations by approximately 50 graduate students engaged in the field of alternative energy is included. This will be an excellent way for the participants to exchange ideas, interact with peers and seek potential collaboration opportunities.

STUDENT ORGANIZERS
Ying Bao, University of South Dakota
Luther Mahoney, University of South Dakota
Lauren Misch, University of California, Santa Barbara
Kate Barteau, University of California, Santa Barbara
Daren Davoux, South Dakota State University
Jon Fisher, South Dakota School of Mines and Technology

FACULTY ADVISORS
Mary Berry, University of South Dakota
Ram Seshadri, University of California, Santa Barbara
Chao Yang, University of South Dakota
Ranjit Kodali, University of South Dakota

SESSION ONE
9:00 am – 9:05 am: Opening Remarks
9:05 am – 9:45 am: Victor I. Klimov, Los Alamos National Laboratory
Semiconductor Nanostructures and Solar Energy Conversion
49:45 am – 10:10 am: Elena Hillenburg, NSF, East Asia and Pacific Summer Institutes Program
East Asia and Pacific Summer Institutes (EAPS) Program for U.S. Graduate Students in Science and Engineering
10:10 am – 10:30 am: Break

SESSION TWO
10:30 am – 11:10 am: Yury Gogotsi, Drexel University
Carbon Materials for Electrochemical Capacitors—Challenges and Opportunities
11:10 am – 11:40 am: Bin Chen, NASA
Nanomaterials for Energy Storage Devices
11:40 am – 12:10 pm: Marie Mapes, U.S. Department of Energy
The Status of Solar Energy Worldwide and DOE’s Response
12:10 pm – 1:30 pm: Break

SESSION THREE
1:30 pm – 2:10 pm: Richard R. King, Spectrolab Inc.
Research Opportunities in High-Efficiency Multijunction III–V Solar Cells for Concentrator Photovoltaics (CPV)
2:10 pm – 2:40 pm: Ram Seshadri, University of California, Santa Barbara
New Directions in Phosphor and Thermoelectric Materials for Energy Conservation
2:40 pm – 3:10 pm: Craig Arnold, Princeton University
Mechanical Effects on Lifetime in Electrochemical Energy Storage
3:10 pm – 3:20 pm: Ying Bao—Closing Remarks
3:15 pm – 3:30 pm: Break

SESSION FOUR
3:30 pm – 5:30 pm: Poster Session

IGERT ORGANIZATIONS
South Dakota IGERT ConvEnre IGERT
Fred Kavli Distinguished Lectureship in Nanoscience

Monday, April 1, 7:00 pm – 8:00 pm
Marriott Marquis, Golden Gate Level, Salon AB

The Kavli Foundation is dedicated to advancing science for the benefit of humanity, promoting public understanding of scientific research and supporting scientists and their work.

The Foundation’s mission is implemented through an international program of research institutes, professorships, symposia and other initiatives in the fields of astrophysics, nanoscience, neuroscience and theoretical physics. The Foundation is also a founding partner of the Kavli Prizes, which recognize scientists for their seminal advances in astrophysics, nanoscience and neuroscience. For more information about the Foundation, visit their website at www.kavlifoundation.org.

Colloidal Metal Nanocrystals—Shape Control, Symmetry Breaking and Niche Applications

Controlling the shape of colloidal nanocrystals may initially seem like a scientific curiosity, but its implication goes far beyond aesthetic appeal. For nanocrystals made of noble metals, shape not only determines their chemical, plasmonic, and catalytic properties but also their relevance for electronic and photonic applications. Although the first synthesis of colloidal nanocrystals can be traced back to the groundbreaking work on gold colloids by Michael Faraday in 1856, only within the last decade have methods become available for producing colloidal nanocrystals in the quality, quantity, and reproducibility needed for a systematic study of their properties as a function of size, shape and structure, and for exploration of their remarkable applications. This talk will briefly discuss some of these developments, with a focus on shape-controlled synthesis of metal nanocrystals via seed-mediated growth and symmetry breaking induced by kinetic control.

We have been working diligently to understand the nucleation and growth mechanisms leading to the formation of nanocrystals with specific shapes and structures. For example, we have discovered that the shape of metal nanocrystals is dictated by the crystallinity and structure of the seeds, which are, in turn, controlled by factors such as reduction kinetics, oxidative etching and surface capping. The success of these syntheses has enabled us to tailor the properties of noble-metal nanocrystals for a range of applications in photonics, sensing, imaging, biomedicine, catalysis and fuel cell technology.

YOUNAN XIA is the Brock Family Chair and Georgia Research Alliance Eminent Scholar in Nanomedicine at Georgia Institute of Technology. His research interests include the development of new methodologies for controlling the synthesis of nanostructured materials and exploration of their applications in biomedical research and catalysis. He received his BS degree in Chemical Physics from the University of Science and Technology of China in 1987, and a PhD degree in Physical Chemistry from Harvard University (with Professor George M. Whitesides) in 1996. Xia has received a number of awards, including the ACS National Award in the Chemistry of Materials (2013); MRS Fellow (2009); NIH Director’s Pioneer Award (2006); ACS Leo Hendrik Baekeland Award (2005); Camille Dreyfus Teacher Scholar (2002); David and Lucile Packard Fellow in Science and Engineering (2000); NSF CAREER Award (2000); Alfred P. Sloan Research Fellow (2000); ACS Victor K. La Mer Award (1999); and Camille and Henry Dreyfus New Faculty Award (1997). He has co-authored more than 500 publications in peer-reviewed journals, together with an h-index of 128. He has been named a Top 10 Chemist and Materials Scientist based on the number of citations per paper. He has served as an associate editor of Nano Letters since 2002.
Visualization methods provide an important tool in materials science for the analysis and presentation of scientific work. Images can often convey information in a way that tables of data or equations cannot match. Occasionally, scientific images transcend their role as a medium for transmitting information, and contain the aesthetic qualities that transform them into objects of beauty and art.

As a special feature of the 2013 MRS Spring Meeting in San Francisco, we are continuing the popular Science as Art competition. The competition is open to all registered Meeting attendees, with entries to be on display in Moscone West. Multiple first-place and second-place awards of $400 and $200, respectively, will be presented to the winning entries at the Meeting.

- **VOTING**
  - Tuesday: 9:30 am – 6:00 pm
  - Wednesday: 9:30 am – 12:00 pm
  - Moscone West, Level 1, Exhibit Hall, materials²

- **WINNERS ANNOUNCED**
  - Wednesday: 3:00 pm – 3:15 pm
  - Moscone West, Level 1, Exhibit Hall, materials²

- **ARTWORK DISPLAYED**
  - Tuesday through Wednesday: Moscone West, Level 1, Exhibit Hall, materials²
  - Thursday through Friday morning: Moscone West, Level 2

Symposium X—Frontiers of Materials Research

Tuesday through Thursday
Marriott Marquis, Golden Gate Level, Salon B

Symposium X—Frontiers of Materials Research will feature lunchtime lectures aimed at a broad audience to provide meeting attendees with an overview of leading-edge topics.

### Tuesday, April 2, 2013, 12:15 pm

**Alexandra Boltasseva**
Purdue University

**Empowering Plasmonics and Metamaterials Technology with New Material Platforms**
Outstanding Young Investigator Award Talk

### Wednesday, April 3, 2013, 12:15 pm

**John A. Rogers**
University of Illinois at Urbana-Champaign

**Materials for Electronics That Can Stretch, Twist, Fold and Flex**
Mid-Career Researcher Award Talk

### Thursday, April 4, 12:05 pm

**D. Bruce Chase**
University of Delaware

**FT-Raman Spectroscopy—A Catalyst for Raman Scattering**
Innovation in Materials Characterization Award Talk

### Thursday, April 4, 12:45 pm

**John F. Rabolt**
University of Delaware

**Innovations in Spectroscopic Instrumentation—Evolution, Revolution or Back to the Future?**
Innovation in Materials Characterization Award Talk

Sponsored in part by MMR Technologies, Inc. Booth 407
www.mmr-tech.com
Wine & Cheese Reception
Wrap up your day by joining friends and colleagues for a Wine & Cheese Reception.
TUESDAY
5:00 pm to 6:00 pm

Ice Cream Social
Take a break and enjoy a tasty ice cream or frozen fruit treat.
WEDNESDAY
2:30 pm to 3:30 pm

Visit your Materials Science “town square” in the Exhibit Hall

Science as Art Exhibition
Vote for your favorite image at the ever-popular science as art competition.
Voting
TUESDAY .................9:30 am to 6:00 pm
WEDNESDAY .............9:30 am to 12:00 pm
Winners Announced
WEDNESDAY ................3:00 pm

Functionalyzed Bricks with Embedded Intelligence Presentations

TUESDAY
10:00 am to 10:30 am
Mind/Muscle Controlled Games, Robots and Prosthetic Limbs
Electrical signals from the brain and muscles can be detected using a single sensor. FBEI modules are being modified to include EEG and EMG sensors. This demonstration will explain the technologies behind the mind and muscle controlled games, robots and prosthetic limbs. Followed by FBEI hands-on demonstrations until 1:00 pm.

2:30 pm to 3:00 pm
Monitoring Happiness for Improved Workplace Performance
Engineers, psychologists and scientists collaborate to monitor and analyze an individual’s sleep patterns, exercise, diet and body parameters to predict workplace performance. This demonstration will explain the technologies behind the happiness monitoring devices. Followed by FBEI hands-on demonstrations until 5:30 pm.

WEDNESDAY
10:00 am to 10:30 am
Piano and Bugs Controlled by Static Charges
Computer switches embedded in FBEI modules lead to a number of systems that can be used to spark the interest of learners in education, research and entrepreneurship. This demonstration will explain how static charges are used to control a piano and bugs. Followed by FBEI hands-on demonstrations until 1:00 pm.

2:30 pm to 3:00 pm
LEDs Used as Solar Cells
Typically, a p-n junction (a diode made of n- and p-type semiconductors) is used as a rectifier, solar cell, LED, LASER, Zener diode and a switch. This demonstration will explain how an LED array is used to produce solar energy. Followed by FBEI hands-on demonstrations until 5:30 pm.
Energy Materials Forum

Wednesday, April 3, 9:00 am – 5:00 pm
Marriott Marquis, Golden Gate Level, Salon B

Material, Economic and Manufacturing Strategies for Scalable Deployment
This forum will explore the physical, economic and strategic material requirements needed for solar photovoltaics, thermoelectrics, wind and other advancing technologies, along with the role of the market and government. The discussions will help define the material challenges of the future and what advancements must occur to make materials for alternative energy attractive, adoptable and scalable for industry.

This forum brings together students, academicians, corporate leaders, nonprofit interest groups, government scientists, engineers and policymakers to address the issues facing alternative energy. This will help prepare the next generation of students and energy researchers by providing them with insight into what research is necessary to advance these technologies and ultimately have them adopted by industry.

FORUM CHAIRS
Sudip Mukhopadhyay, Honeywell
Shannon Yee, University of California, Berkeley
Farshid Arman, Siemens AG
Yudhisthira Sahoo, Merck Chemicals

AGENDA

9:00 am – 9:15 am
Welcome
Sudip Mukhopadhyay
Honeywell

9:15 am – 9:50 am
Wind
Mark Johnson
Advanced Research Projects Agency—Energy

9:50 am – 10:25 am
Solar
John Benner
Bay Area Photovoltaic Consortium, Stanford University

10:25 am – 11:00 am
Thermoelectrics
Shannon Yee
University of California, Berkeley

11:00 am – 1:00 pm
Break

1:00 pm – 1:35 pm
Natural Photosynthesis
Junko Yano
Lawrence Berkeley National Laboratory

1:35 pm – 2:10 pm
Artificial Photosynthesis
Heinz Frei
Joint Center for Artificial Photosynthesis (JCAP)

2:10 pm – 2:45 pm
Clean Technologies
Rob McHenry
PARC

2:45 pm – 3:00 pm
Break

3:00 pm – 3:35 pm
Role of Government
Michael Shellenberger
The Breakthrough Institute

3:35 pm – 5:00 pm
Panel Discussion: The Future of Alternative Energy
Frank Ling
Ibaraki University, Japan
Farshid Arman
Siemens AG
Scott Elrod
PARC
Michael Shellenberger
The Breakthrough Institute
Moderator: Ilan Gur
Advanced Research Projects Agency—Energy

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A New Industrial Revolution for a Sustainable Energy Future

Access to affordable and reliable energy has been a cornerstone of the world’s increasing prosperity and economic growth since the beginning of the industrial revolution. Our use of energy in the twenty-first century must also be sustainable. This talk will provide a techno-economic snapshot of the current energy landscape and identify several research and development opportunities and challenges, especially related to materials science and engineering, to create the foundation for this new industrial revolution.

Arun Majumdar is currently a Vice President for Energy at Google, where he is driving Google.org’s energy initiatives and advising the company on its broader energy strategy. In October 2009, Majumdar was nominated by President Obama and confirmed by the Senate to become the Founding Director of the Advanced Research Projects Agency—Energy (ARPA—E), where he served until June 2012. Between March 2011 and June 2012, Majumdar also served as the Acting Under Secretary of Energy, and a Senior Advisor to the Secretary of Energy.

As part of his legacy, Majumdar helped create a vision for ARPA—E to innovate the future of energy technologies, recruit top talent, create new programs to translate science into a broad spectrum of potentially game-changing energy technologies, while setting up an organization with a culture of speed, efficiency, transparency and integrity. As the Acting Under Secretary of Energy, Majumdar was responsible for integrating technologies and policies across all of DOE along techno-economic sectors to maximize leveraging of federal funding and to accelerate technology transition from research to markets.

Prior to joining the Department of Energy, Majumdar was the Almy and Agnes Maynard Chair Professor of Mechanical Engineering and Materials Science and Engineering at the University of California, Berkeley and the Associate Laboratory Director for Energy and Environment at Lawrence Berkeley National Laboratory. His research career includes the science and engineering of nanoscale materials and devices as well as large engineered systems. In 2005, Majumdar was elected a member of the National Academy of Engineering. He received his bachelor’s degree in Mechanical Engineering at the Indian Institute of Technology, Bombay, in 1985 and his PhD degree from the University of California, Berkeley, in 1989.
The Fifth Technology Innovation Forum will focus on Innovation and Entrepreneurial Excellence. Designed to provide a stage for innovators, industry leaders and venture capitalists, this year’s forum will include a keynote talk and two sessions with invited speakers to discuss technology needs, market philosophies and funding processes.

After each session, representatives from participating organizations will be available for pre-scheduled meetings to discuss specific technologies of interest or partnering opportunities that may develop. Participation in these one-on-one discussions will be available on a first-come, first-served basis.

ORGANIZERS

Narayan Ramesh, Chair, The Dow Chemical Company
Niccolo V. Aieta, National Renewable Energy Laboratory
John P. Benner, Bay Area PV Consortium
Eugene (Gene) A. Fitzgerald, Massachusetts Institute of Technology

www.mrs.org/spring-2013-technology-innovation-forum-v

Keynote Address

Carlos A. Paz de Araujo
Professor, Associate Dean for Research and Development, Electrical & Computer Engineering, University of Colorado
Chairman, Symetrix Corporation

The Future of Materials Science in the Semiconductor Industry

Innovation is best described when discovery and invention take a measure of value in society. Thus, innovation is seldom shallow and without much knowledge and experience in the sciences and technologies that advance knowledge. Materials science is at the core of far-reaching innovation because it is after all dealing with the integration of scientific knowledge with engineering and technology to achieve real “material” products. In the semiconductor industry, the nanoscale devices are now a present reality and production at 22 nm is already here. But, the next seven years is really murky, and the 10-nm node by 2020 presents challenges that cannot be solved by the somewhat simple “Silicon Technology” manipulations of the last few generations (45 and 32 nm). It is almost a certainty that in the logic world, the FinFET with compound semiconductor channels will be the norm. At the same time, complex Si(Ge)Ni metallization for source and drain are to be expected to meet sheet resistance requirements. Most interesting is that any chip at the embedded, FPGA and SoC levels are becoming mostly memory circuits—and nonvolatile memories (NVRAM) beyond FLASH are desperately needed. No candidate NVRAM uses silicon as the storage medium—in fact, they are all some kind of smart oxide. This lecture reviews these opportunities and relies on past experience of entrepreneurial activities that translated research to real products. It also alerts the materials science community to this return to the era that materials will again drive semiconductor devices, as standard old methods are becoming almost irrelevant in future innovation.

A View from the Lab, Licensing and Legal Offices—Scaling Laboratory Developments in a Corporate Environment

This session focuses on the processes a product goes through from development in a lab to scaleup and key licensing and legal aspects associated with innovation.

David Ginley
Research Fellow, National Center of Photovoltaics
National Renewable Energy Laboratory

Has Si Won?—Crossing the Valleys of Death for Thin-Film PV

The U.S. DOE SunShot Initiative was predicated on the view that Si could not reach the key goals of 50-cents-per-watt module price and CdTe and CuInGaSe2 were the best hope. Subsequently, prices for Si have fallen dramatically and it appears that wafer-based technologies can meet the SunShot goals. What does this imply for thin-film-based technologies, or for the industry? What will be necessary at the technology and commercialization levels to enable thin-film technologies?

James C. Stevens
Dow Distinguished Fellow
The Dow Chemical Company

Perspectives on Guiding Innovations from the Lab to Commercialization

The path from idea to the marketplace is unique for every innovation. This talk will explore issues, commonalities and learnings from personal examples in two very different fields—taking novel ideas from the lab to commercial product launch in polyolefin thermoplastics and in residential rooftop solar energy.
University-Industry Partnerships Foster Technology Transfer

University inventions are often very early stage and require significant investment of people and resources to commercialize. How can universities and industry work together to move these inventions to the marketplace? What are the challenges in working together and how can we work most effectively together? We each have our roles in the transfer of technology and good partnering is the key.

Panel Discussion and Q&A—Scaling Laboratory Developments in a Corporate Environment

John P. Benner
Bay Area PV Consortium
Session Chair and Panel Moderator

Innovation in Established Industries and Government’s Role in Driving Innovation

The government plays a critical role in supporting innovation. Join members from government labs and academia to learn about the variety of programs that are designed to foster innovation at all stages. And learn best approaches for “technology push” and “innovation pull” that resulted in products and solutions developed to tackle a specific need.

Public-Private Partnerships to Stimulate U.S. Manufacturing

The U.S. Department of Energy SunShot Initiative’s mission is to develop solar energy technologies through a collaborative national push to make it cost-competitive with fossil-fuel-based energy. Achieving this goal will require significant cost reductions and technological innovations. A key element of this program is to revitalize U.S. manufacturing in solar technologies, through innovative public-private partnerships. SunShot is a cooperative program across DOE, involving the Office of Science, the Office of Energy Efficiency and Renewable Energy and ARPA-E.

Role of National Laboratory User Facilities in Aiding Innovation

The DOE National Laboratory User Facilities (synchrotron x-ray and neutron sources) provide a valuable method of aiding technological innovation through detailed characterization of advanced materials and processing. This presentation will explain how technology innovators can best gain access to and utilize these resources.

From Research to Economic Impact—A Perspective on Accelerating the Commercial Impact of Research-Based Innovations

MIT’s RLE investigators have pioneered disruptive technologies derived from basic research: acoustic noise cancellation, optical coherence tomography, HDTV, precision surgical scalpels and more. The question I will attempt to answer is whether one can accelerate the pace of transfer of innovative research ideas into products. I will share my perspective as a materials scientist, laboratory director and entrepreneur, and apply case studies in the commercialization of research innovation. RLE’s approach and initiatives aimed at addressing this opportunity will be presented.

Panel Discussion and Q&A—Innovation in Established Industries and Government’s Role in Driving Innovation

Niccolo V. Aieta
National Renewable Energy Laboratory
Session Chair and Panel Moderator

For more information on innovation, commercialization and new product development using advances in materials, visit the MRS Innovation Source at www.mrs.org/innovation.
at MRS Publications Sales
Monday 7:00 am – 6:00 pm
Tuesday–Thursday 7:30 am – 5:00 pm
Moscone West, Level 1, Lobby

Fundamentals of Materials for Energy and Environmental Sustainability
Editors
David S. Ginley and David Cahen
$79.00 MRS Member/Meeting Price
A unique, interdisciplinary TEXTBOOK with contributions from more than 100 experts in energy and the environment from around the world.

Handbook of Modern Ion Beam Materials Analysis, 2nd Edition
Editors
Yongqiang Wang and Michael Nastasi
MRS Member/Meeting Price
$125.00 Print Chapters, DVD of Appendices
$200.00 Print Chapters/Appendices, DVD of Appendices
The most comprehensive database on ion beam analysis ever published—revised and updated from the popular handbook released in 1995!

2013 MRS Spring Meeting Symposium Proceedings
Order during the meeting week and enjoy discounted pricing.
Prices increase after publication date. See page 98 for more information.

Abstracts of the 2013 MRS Spring Meeting
Searchable DVD Format
$35 each, while supplies last

Tutorial Notes
10 Spring Meeting Tutorials
$40 each, while supplies last
See pages 96-97 for tutorial information.
$10.00 Per Assortment
Each assortment includes 10 note cards, 5 designs
Proceeds from the sales of Note Cards benefit MRS student programs and activities.

NOTE CARDS

Four-part series DVD set
Step behind the headlines as MAKING STUFF—Stronger, Smarter, Smaller, and Cleaner dramatizes the human stories woven into the current wave of hi-tech breakthroughs. Hosted by the New York Times’ lively technology correspondent David Pogue.
Produced by NOVA and made in collaboration with the Materials Research Society.

SPECIAL PRICE! Limited quantities

BOOK SALE
Select books on SALE for $15 Buy 3, Get 1 FREE!
Applies only to $15 books.

Buy 2 or more MRS Books at regular member price and Save $10!
Optimize Your Time at the Meeting with MyItinerary

MyItinerary allows you to customize your Meeting agenda on a unique, web-based platform, then manage important Meeting details right from your smart phone!

- view abstracts for all technical talks
- learn about special meeting events
- search, create, display and organize your daily schedule

www.mrs.org/spring-2013-itinerary-planner

INTERNET ACCESS

Attendees of the 2013 MRS Spring Meeting will have both wired and wireless Internet access available at Moscone West and Marriott Marquis.

CYBER CAFÉ

Offers wired, high-speed Internet access and black and white printing.

Moscone West, Level 2, Lobby
Monday 7:30 am – 6:00 pm
Tuesday – Thursday 7:30 am – 5:30 pm
Friday 7:30 am – 1:30 pm

Marriott Marquis, Golden Gate Level, C3
Tuesday – Wednesday 7:30 am – 5:30 pm

WIRELESS ACCESS

Moscone West, Levels 2 and 3, Lobby
Marriott Marquis, Lobby

GET SOCIAL

Connect with other Meeting attendees via MRS Social Media. Discuss talks and events, get the scoop on local dining and entertainment options, see and post pictures and more.

www.mrs.org/socialmedia #s13mrs

MRS MEETINGS BLOG

The MRS Meetings Blog is a glimpse of activities at MRS Meetings as seen by our attendees. Get important information like talk summaries, event details, opinions and more, plus personal first-hand accounts of a day in the life of a Meeting attendee. Join the conversation by commenting on posts and pictures that spark your interest.

www.mrs.org/meetings-blog

MEETING SCENE

This year’s Spring Meeting has more talks, presentations and events than ever before! Don’t miss a moment with Meeting Scene. Get daily news and highlights of technical presentations and events by on-the-spot reporters at the Meeting.

www.mrs.org/meeting-scene

THE MEETING DOESN’T END ON FRIDAY

After the Meeting, view recorded talks and lectures, complete with slides, from the comfort of your home or office, or on the go!

Visit pages 8-9 for more details and to see a list of recorded events.

www.mrs.org/on-demand
GOVERNMENT AGENCY FORUM

Wednesday, April 3, 8:00 am – 1:00 pm
Marriott Marquis, Golden Gate Level, Salon A

The Government Affairs Committee is pleased to announce that MRS has moved the Government Agency Presentations into a half-day forum. Invited and contributed talks by agency leaders and program managers will focus on the funding opportunities in the materials science and technology research areas. A tentative list of speakers includes the following:

- 8:00 am – 8:45 am Office of Science and Technology Policy (OSTP)
- 8:45 am – 9:30 am National Science Foundation-Division of Materials Research
- 10:15 am – 10:45 am Break
- 10:45 am – 11:15 am U.S. Department of Energy-Solar Energy Technologies Office
- 11:15 am –12:00 pm U.S. Department of Energy-Energy Frontier Research Centers
- 12:00 pm –12:30 pm NIST-Materials Genomics, Material Measurement Laboratory
- 12:30 pm – 1:00 pm Meet with Agency Program Managers

For the most up-to-date information and the Government Agency Forum schedule check [www.mrs.org](http://www.mrs.org)
Do you have an idea for a new book or journal on a materials-related topic? Is there a materials topic that is underrepresented, or shows exceptional potential for growth within the MRS publications portfolio? If so, then submit a proposal to the Materials Research Society—where we don’t just serve the materials community, we ARE the materials community.

FACTS & FEATURES

- The Materials Research Society is built on a culture of collaboration across disciplines, around the world, and from science to applications. MRS publications embrace such diverse thought and reflect a dynamic community.

- As not-for-profit organizations, MRS and our publishing partner, Cambridge University Press, share values in service to advancing materials science and education. Fair compensation for authors is balanced with product pricing accessible to the community.

- We are selective and looking for pioneering print and electronic products for a global community of students, researchers and practitioners. A team of materials science leaders guides and assesses new grassroots product ideas versus MRS values, strategic objectives and the competitive environment.

- MRS has materials science expertise and access to high-quality scientific editorial talent. We are interdisciplinary and connected to the relevant leading-edge materials communities.

- In partnership with Cambridge University Press, we offer international excellence in scholarly publishing, with editorial, production, marketing and sales teams all held to the highest standards.

- The MRS/Cambridge collaboration brings with it an immediate reader/subscriber base of 16,000+ MRS members and over 2,500 academic, industrial and government libraries worldwide—providing unparalleled and targeted scope, reach and impact.

For more information, or to discuss your publishing ideas, contact:

Betsy Fleischer, MRS Principal Development Editor  
fleischer@mrs.org • 724.779.2746
Looking for a job? Start the search at the 2013 MRS Spring Meeting Career Center. Talk with companies from around the globe interested in hiring applicants from a wide array of backgrounds. Then continue to expand your professional development with these specialized seminars, workshops and presentations.

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Professional Development

Two opportunities for you to schedule each of these popular professional development sessions!

Admission is included with your 2013 MRS Spring Meeting registration.

**Making the Most of Broadcast Media Workshop**

- Monday, April 1, 3:00 pm – 5:00 pm
  Moscone West, Level 3, Room 3000
- Tuesday, April 2, 5:00 pm – 7:00 pm
  Marriott Marquis, 4th Floor, Pacific A

Tim Miller
Spoken Science

Learn how to craft a brief, but impacting, news story about your work

There is no better way for your research to reach a broader audience than through broadcast media. Films, television, radio and the Internet provide a huge pipeline through which society can discover scientific research. Yet news departments worldwide continue to devote less reporting to topics in science, and the onus now falls on scientists to craft and deliver messages about their work that is suited for dissemination through these media channels.

In this session, communications expert Tim Miller discusses some of the principles of creating newsworthy stories from research discoveries. Participants will gain hands-on experience at turning a research paper into a newspaper article or television story, with the opportunity to practice giving a live media interview. The session also includes a segment on using modern media creation and distribution pathways to create content that connects researchers directly to public audiences.

**Technical Poster Design Seminar**

- Tuesday, April 2, 7:30 am – 8:30 am
  Marriott Marquis, 4th Floor, Pacific A
- Wednesday, April 3, 5:00 pm – 6:00 pm
  Marriott Marquis, 4th Floor, Pacific A

Tim Miller
Spoken Science

Learn how to make your next poster a standout

One of the mainstays of technical communication, the scientific poster offers a compact and powerful format for sharing your work with your peers. Yet, sometimes, even the most brilliant results can be obscured by poor layout or design.

Communications expert Tim Miller will share the basic rules of good poster design and show you some of the most effective tools and techniques for creating technical posters with quality and clarity. Numerous examples of good and bad poster design will be critically reviewed. You will leave this session armed with the skills to guarantee that your next scientific poster will stand out in a crowd.

**Mastering Science Presentations Seminar**

- Monday, April 1, 5:30 pm – 7:00 pm
  Marriott Marquis, Yerba Buena Level, Nob Hill AB
- Wednesday, April 3, 7:30 am – 8:30 am
  Marriott Marquis, 4th Floor, Pacific A

Tim Miller
Spoken Science

Learn the fundamentals of sharing science

The scientific process is not just about generating ideas; it is about freely sharing those ideas with the broader world. Now, more than ever, the ability to recruit students, attract colleagues, garner attention and secure funding is tied to your ability to successfully communicate the results of your work, both to peers and to the general public.

Communications expert Tim Miller has spent his career helping scientists and students bring their work out of the laboratory and share it with a wider audience. For a variety of reasons, communicating your research with nonexperts is an important skill. In this session, you will learn the fundamentals of sharing science as Miller explains how to choose the very best tools to do the job of communication, and reveals some of the tips and tricks that can help you take your scientific presentations to the next level.

Tim Miller is a freelance developer in the Informal Science Education industry, specializing in live public interactions. He has worked with museums, science centers and research laboratories across the country, helping to bring the products and the process of science to a broad public audience. His recent projects include the development of a graduate student training program for the Harvard School of Engineering and Applied Sciences, and the construction of a temporary installation at the Exploratorium in San Francisco. His background includes formal training in theater and public speaking, and he holds degrees in physics and engineering.

Session sponsored by
NISE Network and the
National Science Foundation
Career Center — a premiere tool for connecting job seekers and employers!

Moscone West, Level 1, Exhibit Hall

Do the research to advance your career... visit the MRS Career Center

JOB SEEKERS

Whether you’re looking for a new job or planning the next step in your career path, the MRS Career Center is a rich resource for exciting career opportunities. We’ll show off your talents to high-tech firms, universities and laboratories. At the Career Center, you can access job postings, visit recruitment booths and interview with prospective employers. Don’t forget to bring extra copies of your resume!

EMPLOYERS

Looking to fill a position? The MRS Career Center is a great way to recruit qualified candidates from a wide range of materials-related fields at various career stages. Stop by and learn how to post your job announcements, interview candidates on-site and purchase the electronic resume book.

On-Site Registration Hours
Monday ...............................................1:00 pm – 4:00 pm

Career Center Hours
Tuesday and Wednesday .................10:00 am – 5:00 pm

Job seekers may also register/submit resumes online. For details, visit www.mrs.org/spring-2013-career-center/.

The Career Center is FREE of charge to all MRS members and those registered to attend the meeting.

Recruiters that will be on-site:
- Applied Materials
- Exponent
- Korea Institute of Science and Technology
- Sandia National Laboratories
- SuperPower Inc.
- Oak Ridge National Laboratory
- and more ...

ABET Retraining Session

Tuesday, April 2, 7:15 pm – 9:30 pm
Marriott Marquis, 2nd Floor, Foothill E

A retraining session for evaluators for the Accreditation Board for Engineering and Technology, Inc. (ABET) will be available at the 2013 MRS Spring Meeting. This session is open to anyone who wants to learn more about the process, is preparing for an upcoming accreditation visit, or wants to ask questions about how to prepare your materials department for an accreditation visit. This session can be attended without registering for the MRS Spring Meeting.

While advanced sign-up is not required, it is helpful to the trainers. Please use this link to add your name: http://webrsvp.mrs.org/rsvp.aspx?meeting_id=78.

ABET—the recognized accreditor for college and university programs in applied science, computing, engineering and technology—is a federation of 30 professional and technical societies representing these fields. Among the most respected accreditation organizations in the United States, ABET has provided leadership and quality assurance in higher education for nearly 80 years.

ABET is recognized by the Council for Higher Education Accreditation. More information can be found at http://www.abet.org/.

Open Access Option for Authors

For more information on this exciting new JMR and MRS Communications publishing option, visit www.mrs.org/jmr and www.mrs.org/mrc.

Now Available
Women in Materials Science & Engineering Breakfast

Wednesday, April 3, 7:00 am – 8:30 am
Marriott Marquis, 2nd Floor, Club Room

Diversity in STEM—
Climbing the Corporate Ladder in Academia, Government and Private Industry

PANEL DISCUSSION AND Q&A

Panel Members
Magaly Spector, Dawnielle Farrar, and Naida Lačević

Moderator
C. Barry Carter, University of Connecticut

The Women in Materials Science and Engineering Subcommittee would like to invite you to the Diversity in STEM Panel highlighting the career paths of individuals from diverse backgrounds through the fields of science and engineering. Come learn about the differences in navigating your way through Academia, Government/National Labs, and Private Industry. The panelists will provide perspectives on their personal journey, share challenges encountered and offer feedback on steps to success. In addition, this moderated session will provide attendees with an open forum for their questions.

Magaly Spector received her PhD degree in Physics from Lehigh University. She is Vice President for Diversity and Community Engagement at the University of Texas at Dallas. Prior to her appointment at UT Dallas, Spector held increasingly responsible research and development positions at Bell Labs, AT&T/Lucent Technologies, including Global Manager for Product Quality and Reliability. She was responsible for pioneering many new technologies that enabled high-speed Internet, and optical and wireless networking communications, and she holds several patents on her work. Spector was selected to become a Bell Labs Fellow in 2004, one of the highest distinctions worldwide for a scientist. She is currently Chair of the MRS Diversity Subcommittee.

Dawnielle Farrar received her PhD degree in Materials Science and Engineering from Johns Hopkins University. She is a Senior Electrical and Materials Engineer at the Johns Hopkins University Applied Physics Laboratory. Farrar is Principal Investigator for a Noise Reduction Platform Grant involving smart materials, for an Electron Beam Lithography Initiative for nano-patterning applications, and for a Middle-Ear Implant Sensor IR&D benefitting a number of military and medical applications. Her research interests include micro/nano materials and devices, piezoelectric polymer film and fibers, sensors, microelectronic design and packaging. Farrar has authored/co-authored more than 30 papers, produced a book chapter and is the recipient of one US Patent, with four pending. She is currently Chair of the MRS Women in Materials Science and Engineering Subcommittee.

Naida Lačević
NextGen Aeronautics, Inc.

Naida Lačević received her PhD degree in Physics from Johns Hopkins University with an emphasis on computational materials science. She is currently a Lead Engineer and Technical Area Lead of the Materials Modeling and Characterization Group at NextGen, and a Project Manager for the Phase II Advanced High Energy Density Propellants SBIR sponsored by ARDEC. During her postdoctoral research at Lawrence Livermore National Laboratory and the University of California, Berkeley, and graduate research at Johns Hopkins University, NIST, and University of Michigan, Lačević extensively used large-scale molecular dynamics simulations in multi-scale frameworks alongside advanced analysis techniques to address structure/dynamics-property relationships in complex systems exposed to external and internal perturbations.

Men and women are invited to attend this discussion and complimentary breakfast.

Advance sign-up required; tickets for the event will be distributed at MRS Information at Moscone West by 12:00 noon on Tuesday, April 2. Space is limited.

Sponsored by:
www.sigmaaldrich.com/matsci
Booth 425
Let LEGO®-compatible bricks containing electronic circuits spark your interest in a special **Nano Coffee Break, Functionalized Bricks with Embedded Intelligence**. Then, let your voice be heard! Stop by the **Materials Voice Booth** and send a letter to your congressional representatives. Make time to visit the **Public Outreach Booths** and learn about science education, public outreach and volunteer opportunities available through MRS.
**PUBLIC ADVOCACY**

Tell your legislators why support of the physical sciences and science education is necessary—for national security, quality of life and a strong economy. It is essential that your voice be heard. All U.S. residents are invited to stop by and send letters to their legislators on matters of importance to the materials research community. It takes only five minutes to send the draft letters currently available through our Materials Voice website.

**Strange Matter—North American Tour**

A TRAVELING INTERACTIVE MUSEUM EXHIBITION

Link up with our award-winning Strange Matter Web site and experience interactive materials science experiments to discover why the Washington Times called the site, “An awesome immersion in the science of materials...”

Discover where Strange Matter, the hands-on exhibition about materials science, has toured and see if it is coming to a North American location near you. Find out how you can volunteer and be a part of this dynamic highly interactive exhibition.

**NOVA MAKING STUFF**

MRS and NOVA, the flagship PBS science documentary series, teamed to produce a four-part PBS primetime series on materials science entitled MAKING STUFF. The four-part series, which premiered in early 2011, was rebroadcast in September 2012, and focused on the themes of Stronger, Smarter, Smaller, and Cleaner. It introduced the fundamental concepts of materials science in a fun and exciting way while teaching the public how scientists can tailor materials to meet new challenges. Stop by the NOVA MAKING STUFF Information Booth and see video clips of the series.

For more information about MAKING STUFF, visit: www.pbs.org/wgbh/nova/tech/making-stuff.html

**SPECIAL MEETING PRICE**

$15.00 per set

Quantities limited! Pick up your copy at Publications Sales, Moscone West, Level 1, Lobby.
NISE NETWORK SCIENCE COLLABORATOR

Register at the MRS/NISE Network Booth to participate in the NISE Network as a science collaborator. Learn how you can apply your much-needed expertise to help foster public awareness, engagement and understanding of nanotechnology.

HANDS-ON NANO COFFEE HOURS

Join us throughout the week during the coffee breaks as national science centers, science museums and researchers in partnership with the NISE Network and MRS present “stimulating” educational outreach through hands-on activities in materials science and nanotechnology.

Monday through Thursday  9:30 am – 10:30 am
2:30 pm – 3:30 pm
Moscone West, Level 2, Lobby

NanoDays

NANODAYS 2014 AND NISE NETWORK

Learn How You Can Celebrate NanoDays 2014. A Nationwide Festival of Nanopublic Outreach Events!

The NISE Network selected March 30–April 6 for NanoDays 2014, a week of community-based educational outreach events to raise public awareness of nanoscale science and engineering in local communities across the U.S.

- Learn about NanoDays 2014.
- Find out if your community is planning to participate in NanoDays 2014 and how you can get in on the action.
- Find out how your institution can become a partner in the NISE Network.

For more information about NanoDays 2014 and the NISE Network, visit www.nisenet.org.

INSIDE SCIENCE TV

Do you have an idea for a 90-second TV spot on Materials Science? Something of interest to the general public?

Visit the Inside Science TV Booth this week at the Public Outreach Center and learn how you can submit your story to the ISTV staff. The goal of the ISTV program is to provide TV stations with short, accurate science clips that will increase the public’s awareness and appreciation of the role science and technology plays in today’s society. So get involved . . . and help us spread the news about Materials Science!

For more information about ISTV, visit www.insidescience.org/television
Strange Matter Green Earth is a new pioneering educational venture brought to you by the Materials Research Society—an international traveling science exhibition that will enable millions of people across the globe to discover ways in which advances in materials can lead to a more sustainable future.

A network of science educators, science center professionals and materials researchers from three continents—North America, South America and Europe—will collaborate to create interactive exhibit experiences and dynamic community programs that will emphasize materials, from the mundane to the mysterious, and how they profoundly influence the quality of our lives and the planet.

Building on the incredible success of the MRS traveling exhibition Strange Matter, now in its tenth year, Strange Matter Green Earth aims to empower the world’s citizens to make sustainable choices in their own lives and communities.

Sponsorship Opportunities Now Available

Learn More at the Strange Matter Green Earth Booth
Public Outreach Center | Moscone West, Level 2, Lobby
Here’s an event just for our student attendees—the Student Mixer! Meet and mingle with fellow students from around the world. For our MRS University Chapter Representatives, don’t miss our lunch meeting. Chapter officers and faculty advisors discuss ways to promote student interest in materials science, compare notes on recent activities and brainstorm on new projects and issues of common concern. In this section you will also learn about future student opportunities with MRS.
THANKS!

Student Activities & Opportunities

to our MRS University Chapters
for their continued enthusiasm
and efforts to promote student interest
in materials science.

ALABAMA
Alabama A&M University
Tuskegee University

ARKANSAS
University of Arkansas–Fayetteville

CALIFORNIA
California Institute of Technology
California Polytechnic State University
Stanford University
University of California, Berkeley
University of California, Davis
University of California, Irvine
University of California, Los Angeles
University of California, Merced
University of California, Riverside
University of California, San Diego
University of Southern California

COLORADO
University of Colorado at Boulder
Colorado School of Mines

CONNECTICUT
Southern Connecticut State University
University of Connecticut

DELaware
University of Delaware

FLORIDA
University of Central Florida
University of Florida

GEORGIA
Georgia Institute of Technology

IDAHO
Boise State University

ILLINOIS
Northwestern University
University of Illinois
at Urbana-Champaign

INDIANA
Purdue University

IOWA
Iowa State University

KENTUCKY
University of Kentucky

MARYLAND
Johns Hopkins University
University of Maryland

MASSACHUSETTS
Boston University
Franklin W. Olin College of Engineering
Massachusetts Institute of Technology
Northeastern University
University of Massachusetts Lowell

MICHIGAN
University of Michigan

MINNESOTA
University of Minnesota

NEVADA
University of Nevada, Reno

NEW JERSEY
Princeton University
Rutgers University
Stevens Institute of Technology

NEW YORK
Binghamton University
Columbia University
Cornell University
Rochester Institute of Technology
University at Buffalo
University of Rochester

NORTH CAROLINA
Duke University
North Carolina State University
University of North Carolina
at Chapel Hill

NORTH DAKOTA
North Dakota State University

OHIO
University of Toledo/Bowling Green University

PENNSYLVANIA
Carnegie Mellon University
Drexel University
The Pennsylvania State University
University of Pittsburgh

SOUTH CAROLINA
Clemson University

SOUTH DAKOTA
South Dakota State University

TENNESSEE
University of Tennessee, Knoxville
Vanderbilt/Fisk Universities

TEXAS
University of North Texas
University of Texas at Austin
University of Texas at El Paso

VIRGINIA
Norfolk State University
University of Virginia
Virginia Polytechnic Institute and State University

WASHINGTON
Washington State University

WISCONSIN
University of Wisconsin–Eau Claire
University of Wisconsin–Stout

INTERNATIONAL CHAPTERS

MEXICO
Centro de Investigación y de Estudios Avanzados del Instituto Politécnico Nacional (Cinvestav-IPN)

SAUDI ARABIA
King Abdullah Univ of Science and Technology (KAUST)

List compiled as of March 1, 2013
Student Mixer

Monday, April 1, 7:00 pm – 8:00 pm
Marriott Marquis, Yerba Buena Level, Yerba Buena Foyer

Mingle with colleagues, enjoy good food and drink and have fun exploring science!

Are you ready to be amused while challenging your science expertise? Do you want an opportunity to relax with your old friends and make some new ones? Join us at the Student Mixer for good food and drink while exploring interactive science activities.

Professional public educators are teaming up to provide a collection of hands-on activities and demos in materials science and nanotechnology.

- Lawrence Hall of Science
- Michigan State University
- University of Utah

Sponsored by NISE network

Symposium Assistant Positions

Graduate students who are interested in assisting in the symposium sessions during the Materials Research Society’s 2013 MRS Fall Meeting are encouraged to apply for a Symposium Assistant position. Symposium Assistants deliver essential meeting materials to the technical session rooms, operate audiovisual equipment and room lighting, track and record attendance and perform other tasks requested by the Session Chairs. By assisting in a minimum of four half-day sessions, students will earn a complimentary student registration, a one-year MRS student membership commencing January 1, 2014, and a stipend to help defray expenses. Positions are assigned on a first-come, first-served basis.

The Symposium Assistant Application will be available on the MRS website by October 1, 2013.
www.mrs.org/fall-2013-symposium-assistants

Student Opportunities

Graduate Student Awards

MRS Graduate Student Awards are intended to honor and encourage graduate students whose academic achievements and current materials research display a high level of excellence and distinction. MRS seeks to recognize students of exceptional ability who show promise for significant future achievement in materials research.

In addition to current MRS Graduate Student Gold and Silver Awards, MRS is proud to announce a newly endowed Fall Meeting student award, the Arthur Nowick Graduate Student Award. This award honors the late Dr. Arthur Nowick and his lifelong commitment to teaching and mentoring students in materials science, and will be presented to a Fall Meeting GSA finalist who shows particular promise as a future teacher and mentor. The deadline to submit an application for the 2013 MRS Fall Meeting Graduate Student Awards is August 15, 2013. For more information, please visit www.mrs.org/gsa.

International MRS Student Chapters

The MRS University Chapters Program works to generate interest in materials science by offering many benefits: travel support to attend MRS Spring and Fall Meetings, Chapter rebates, distinguished speaker support and special project grants, to name a few. Above all, these Chapters provide a network to compare notes on recent activities and to brainstrom with other students on new projects and issues of common concern.

And now, MRS is proud to expand its University Chapter Program internationally! Members can connect with different regions from around the globe to maximize positive impact for materials research worldwide.

To find out more about forming a University Chapter, visit www.mrs.org/international-university-chapters/.

Want to forge a new path?
Start an MRS University Chapter!
MRS Corporate Affiliates

to our Corporate Affiliates for their financial support.

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Dr. Eberl MBE-Komponenten GmbH
Ecole Polytechnique Fédér Vale de Lausanne
EMD Chemicals Inc.
EMD Millipore Corporation
FCT Systeme GmbH
FEI Company
Fischione Instruments, Inc.
Fisher Scientific
Forschungszentrum Jülich GmbH
Fuji Elec etronic Industrial Co., Ltd.
Fujitsu Corporation
GE Global Research
Gelcast, Inc.
Glycosan Biosystems, Inc., a Division of Orthocyte Corp.
Graphenea Nanomaterials
Helmholtz-Zentrum Berlin
Hitachi High Technologies America, Inc.
Hystron, Inc.
IBM Almaden Research Center
IBM T.J. Watson Research Center
Intel Corporation
iPen Inc.
ITAC Ltd.
iTRIX Corporation
Janis Research Company, LLC
Japan Society of Applied Physics
JEOL USA, Inc.
Karlruhe Institute for Technology
Lawrence Berkeley National Laboratory
Lawrence Livermore National Laboratory
Los Alamos National Laboratory
M. Braun, Inc.
Magnolia Solar, Inc.
MANTIS Deposition Ltd.
Max Planck Institute of Colloids and Interfaces
Micron Technology Foundation Inc.
Mikrouna Beijing Mechatronics Technology Company, Ltd.
NanoCarbon Research Institute Co., Ltd.
NanoDiamond Products Limited
NanoMagnetics Instruments Ltd.
Nanomechanics, Inc.
NanoScan AG
NanoWorld AG
National Institute of Standards and Technology
National Renewable Energy Laboratory
NION
Nissan Arc Research Ltd.
Novelus Systems, Inc.
Oak Ridge National Laboratory
Omicron NanoTechnology USA, LLC
Pacific Northwest National Laboratory
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Sandia National Laboratories
SBA Materials, Inc.
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Seki Diamond Systems
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Zurich Instruments Ltd.

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Materials Research Society
tel. 724-779-2755
cell 724-996-5683
kaufold@mrs.org
UPCOMING MEETINGS AND EVENTS

Mark your calendar! Don’t miss these upcoming meetings and events of interest to the materials community.

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CALL FOR PAPERS
Abstract Deadline — April 28, 2013

A joint meeting of the Sociedad Mexicana de Materiales and the Materials Research Society

A core mission of the Materials Research Society is to promote leading-edge research on materials around the world. The Materials Research Society (MRS) and the Sociedad Mexicana de Materiales (SMM) are excited to be working together on this global effort by growing the International Materials Research Congress (IMRC) held annually in Cancun, Mexico.

SYMPOSIA

NANOSCIENCE AND NANOTECHNOLOGY
1A Theoretical Aspects of Metal Clusters and Nanoalloys
1B Nanostructured Carbon Materials—Fundamentals to Applications
1C Emergent Properties of Polar Interfaces and Nanostructures
1D Nanotechnology-Enhanced Coatings
1E Nanostructured Materials and Nanotechnology

BIOMATERIALS
2A Biomaterials for Medical Applications
2B Bioinspired Hybrid Materials Synthesis
2C Biominerals—From Biological Mechanisms to Applications

MATERIALS FOR ENERGY
3A Photovoltaics, Solar Energy Materials and Technologies
3B Renewable Energy and Sustainable Development
3C Advanced Materials and Technologies for Energy-Storage Devices

FUNDAMENTAL MATERIALS SCIENCE
4A Advanced Structural Materials
4B Concrete and Durability of Concrete Structures
4C Functional Solid-State Materials—Synthesis, Characterization, Theory and Structure-Property Relationships
4D New Trends in Polymer Chemistry and Characterization
4E Advances in Computational Materials Science
4F Advances in Thin-Film Processing

MATERIALS CHARACTERIZATION
5A Electron Microscopy of Materials
5B Advancing Materials Characterization with Neutrons
5C Structural and Chemical Characterization of Metals, Alloys and Compounds

MATERIALS FOR ENVIRONMENTAL APPLICATIONS
6A Catalysis—Solids, Molecules, Nanoparticles and Interfaces
6B NACE—Corrosion and Metallurgy
6C Materials for Environmental Remediation and Sensing

MAGNETIC AND ELECTRONIC MATERIALS
7A Magnetic Shape Memory Alloys—From Fundamentals to Applications
7B Current Trends in Magnetic Refrigeration
7C Magneto-Optical Materials for Nonreciprocal Photonics, Imaging and Spatial Light Modulators
7D Advances in Semiconducting Materials
7E Low-Dimensional Semiconductor Structures

GENERAL
8A Cultural Heritage and Archaeological Issues in Materials Science (CHARIMSc)
8B Strategies for Academy-Industry Relationship

MEETING CHAIRS

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www.mrs.org/IMRC2013
Upcoming Meetings and Events

CALL FOR PAPERS

Abstract Deadline—June 19, 2013
Abstract Submission Site Opens May 19, 2013

SYMPOSIA

BIOLOGICAL MATERIALS AND SOFT MATTER
A Modeling and Theory-Driven Design of Soft Materials
B Point-and-Click Synthesis—Implementations of Click Chemistry in Polymers
C Advances in Mechanics of Biological and Bioinspired Materials
D Engineering and Application of Bioinspired Structured Materials
E Fundamentals of Gels and Self-Assembled Polymer Systems
F Synthetic Tools for Understanding Biological Phenomena
G Integration of Biomaterials with Organic Electronics
H Advanced Composites and Structures for Tissue Engineering
I Multiscale Materials in the Study and Treatment of Cancer
J Materials for Neural Interfaces
K Micro- and Nanoscale Processing of Materials for Biomedical Devices

ELECTRONICS AND PHOTONICS
L Photonic and Plasmonic Materials for Enhanced Optoelectronic Performance
M Large-Area Processing and Patterning for Active Optical and Electronic Devices
N Functional Aspects of Luminescent and Photoactive Organic and Soft Materials
O Solution Processing of Inorganic and Hybrid Materials for Electronics and Photonics
P Emergent Electron Transport Properties at Complex Oxide Interfaces
Q Organic Microlasers—from Fundamentals to Device Application
R Oxide Semiconductors
S Diamond Electronics and Biotechnology—Fundamentals to Applications VII
T Compound Semiconductor Materials and Devices
U Magnetic Nanostructures and Spin-Electron-Lattice Phenomena in Functional Materials
V Enabling Metamaterials—from Science to Innovation

ENERGY AND SUSTAINABILITY
W Next-Generation Inorganic Thin-Film Photovoltaics
X Physics of Organic and Hybrid Organic-Inorganic Solar Cells
Y Sustainable Solar-Energy Conversion Using Earth-Abundant Materials
 AA Catalytic Nanomaterials for Energy and Environment
 BB Thermoelectric Materials—from Basic Science to Applications
 CC Advanced Materials for Rechargeable Batteries
 DD Materials and Technologies for Grid-Scale Energy Storage
 EE Advanced Materials for Nuclear Energy Technologies
 FF Characterization of Energy Materials In-Situ and Operando
 GG Surface/Interface Characterization and Renewable Energy

GENERAL MATERIALS AND METHODS
HH Functional Surfaces/Interfaces for Controlling Wetting and Adhesion
II Bulk Metallic Glasses
JJ Materials Fundamentals of Fatigue and Fracture
KK Dislocation Plasticity
LL Advances in Scanning Probe Microscopy
MM Neutron Scattering Studies of Advanced Materials
NN Strategies and Techniques to Accelerate Inorganic Materials Innovation
OO Solid-State Chemistry of Inorganic Materials

MATERIALS AND SOCIETY
PP Materials Issues in Art and Archaeology X
QQ Advances in Materials Science and Engineering Education and Outreach

NANOMATERIALS
RR Large-Area Graphene and Other 2D-Layered Materials—Synthesis, Properties and Applications
SS Nanowires and Nanotubes—Novel Materials, Advanced Heterostructures, Doping and Devices
TT Transport Properties in Nanocomposites
UU Phonon-Interaction-Based Materials Design—Theory, Experiments and Applications
VV Designed Cellular Materials—Synthesis, Modeling, Analysis and Applications
WW Self-Organization and Nanoscale Pattern Formation
XX Microelectromechanical Systems—Materials and Devices
YY Elastic Strain Engineering for Unprecedented Materials Properties
ZZ Nanostructured Materials in Extreme Environments

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www.mrs.org/fall2013
Upcoming Meetings and Events

2014 MRS Spring Meeting & Exhibit
April 21–25, 2014 • San Francisco, California

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SYMPOSIA (Tentative)

- Oxide Thin Films and Heterostructures—Fundamental Science and Materials Synthesis
- Materials for Dye-Sensitized Solar Cells
- Materials for Carbon Capture
- Nanostructures, Thin Films and Bulk Oxides—Synthesis, Characterization and Applications
- Materials Challenges and Integration Strategies for Flexible Energy Devices and Systems
- Actinides—Basic Science, Applications and Technology
- Film Silicon Science and Technology
- Recent Advances in Superconductors, Novel Compounds and High-Tc Materials
- Electro- and Chemomechanics of Energy Materials and Systems
- Synthesis and Processing of Organic and Polymeric Materials for Displays, Lighting and Photovoltaics
- Materials for Photoelectrochemical and Photocatalytic Solar Energy Harvesting and Storage
- Earth-Abundant Inorganic Thin-Film Solar Energy Conversion Technologies
- Controlling the Interaction between Light and Semiconductor Nanostructures for Energy Applications
- Materials, Technologies and Sensor Concepts for Advanced Battery Management Systems
- Photoactivated Chemical and Biochemical Processes on Semiconductor Surfaces
- Electrochemical Energy-Storage Materials
- Energy-Storage Technologies beyond Lithium-Ion Batteries
- Advanced Multifunctional Biomaterials for Neuroprosthetic Interfaces
- Micro- and Nanofluidic Systems for Materials Synthesis, Device Assembly and Bioanalysis
- Bioelectronics—Materials, Processes and Applications
- Biomaterials for Biomolecule Delivery and Understanding Cell-Niche Interactions
- Functional Biomaterials for Tissue Engineering
- Emerging Topics in Plasmonics and Optical Metamaterials
- The Grand Challenges in Organic Electronics
- Materials for End-of-Roadmap Devices in Logic, Power and Memory
- Silicon Carbide—Materials, Processing and Devices
- Materials and Processes for Nonlinear Optics
- Single-Dopant Semiconductor Optoelectronics
- Resonant Optics in Metallic and Dielectric Structures—Fundamentals and Applications
- Phase-Change Materials for Memory, Reconfigurable Electronics and Cognitive Applications
- From Interconnect Challenges to Advanced Patterning and Novel Display Technologies
- Transparent Electrodes
- Advances in Inorganic Semiconductor Nanoparticles and Their Applications
- 2D Materials and Devices beyond Graphene
- De Novo Graphene
- Nanodiamonds
- Soft Nanomaterials
- Computationally Enabled Discoveries in Synthesis, Structure and Properties of Nanoscale Materials
- Solution Synthesis of Inorganic Functional/Multifunctional Materials
- Nanotubes and Related Nanostructures
- Semiconductor Nanowires—Synthesis, Properties and Applications
- Magnetic Nanomaterials and Nanostructures
- Nanocrystal Growth via Oriented Attachment and Mesocrystal Formation
- Mesoscale Self-Assembly of Nanoparticles—Manufacturing, Functionalization, Assembly and Integration
- Predictive Simulations of Materials by Design
- Materials Behavior under Extreme Irradiation, Stress or Temperature
- Shape Programmable Materials
- Advances in Scanning Probe Microscopy (SPM) for Materials Research
- Applications of In Situ Synchrotron Radiation Techniques in Nanomaterials Research
- Meeting the Challenges of Understanding and Visualizing Mesoscale Characterization of Ion-Beam-Induced Effects in Materials
- In Situ Characterization of Material Synthesis and Properties at the Nanoscale with EM
- Atomic-Resolution Analytical Electron Microscopy of Disruptive and Energy-Related Materials

2014 MRS Fall Meeting & Exhibit
November 30—December 5, 2014 • Boston, Massachusetts

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Upcoming Meetings and Events

2013 Meetings and Workshops Organized, Co-sponsored and/or Managed by the Materials Research Society

June 26–28
55th Electronic Materials Conference
University of Notre Dame
South Bend, Indiana

July 28–August 1
International Symposium on Integrated Functionalities
Hilton DFW Lakes Executive Conference Center
Grapevine, Texas

August 11–15
XXII International Materials Research Congress (IMRC) 2013
Co-organized by the Sociedad Mexicana de Materiales and the Materials Research Society
JW Marriott Cancun Resort & Spa | CasaMagna, Marriott Cancun Resort
Cancun, Mexico

August 25–30
10th International Conference on Nitride Semiconductors
Gaylord National Hotel and Convention Center
Washington, DC

September 16–20
2013 JSAP-MRS Joint Symposia
Co-located with The 74th Japan Society of Applied Physics (JSAP) Autumn Meeting
Kyotanabe Campus, Doshisha University
Kyoto, Japan

September 10–13
Photovoltaic Materials and Manufacturing Issues III
Denver Marriott West
Golden, Colorado

December 1–6
2013 MRS Fall Meeting & Exhibit
Hynes Convention Center | Sheraton Boston Hotel
Boston, Massachusetts

2013 JSAP-MRS JOINT SYMPOSIA

September 16-20, 2013
Doshisha University | Kyoto, Japan

The Japan Society of Applied Physics (JSAP) and the Materials Research Society (MRS) are excited to jointly sponsor 23 symposia as part of the 74th Japan Society of Applied Physics Autumn Meeting, held September 16-20 in Kyoto, Japan. The 2013 JSAP-MRS Joint Symposia continues the collaboration between the two societies initiated at the 2012 MRS Spring Meeting in San Francisco, and will offer a wide range of scientific topics of interest to the materials community—both basic and applied.

IMPORTANT DATES

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<td>Preregistration Ends</td>
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For more information about the 2013 JSAP-MRS Joint Symposia, including a complete list of symposia topics, visit www.mrs.org/jsap-2013.

For the most current information on these and future events, visit www.mrs.org/meetings
Upcoming Meetings and Events

2013 MRS Endorsed Meetings

January 26–28
5th International Conference and Satellite School on Si Photonics 2013
Tokyo, Japan

April 7–11
18th International Conference on Microscopy of Semiconducting Materials (MSM 18)
Oxford, United Kingdom

May 12–16
2nd International Conference on Materials for Energy (EnMat II)
Karlsruhe, Germany

May 12–16
17th International Symposium on Intercalation Compounds (ISIC17)
Sendai, Japan

June 24–27
2013 TAPPI International Conference on Nanotechnology for Renewable Materials
Stockholm, Sweden

July 23–25
Adventures in the Physical Metallurgy of Steels (APMS)
Cambridge, United Kingdom

September 2–6
YUCOMAT 2013
Herceg Novi, Montenegro

September 15–20
18th International Conference on Surface Modification of Materials by Ion Beams (SMIBM 2013)
Kuşadası, İzmir, Turkey

The following events have been funded, in part, by the generous contributions of these organizations.

THANKS!

QUICK REFERENCE POCKET GUIDE

www.ma-ték.com  •  Booth 132

WOMEN IN MATERIALS SCIENCE BREAKFAST

www.sigma-aldrich.com/matsci  •  Booth 425

SCIENCE AS ART

www.mmr-tech.com  •  Booth 407

BADGE LANYARDS

www.americanelements.com
Visit the MRS Spring Exhibit and talk directly to 130 international manufacturers, suppliers and developers about the latest techniques and advances in the swiftly evolving world of materials research.

INNOVATIVE LEARNING MODULES—FUNCTIONALIZED BRICKS WITH EMBEDDED INTELLIGENCE
Let FBEI learning modules, developed at Michigan State University, spark your interest in engineering education and research during hands-on activities on Tuesday and Wednesday. FBEI presentations will include Mind/Muscle Controlled Games, Monitoring Happiness for Improved Workplace Performance, Piano and Bugs Controlled by Static Charges, and LEDs Used as Solar Cells. See page 39 for times.

WINE & CHEESE HAPPY HOUR RECEPTION
Wrap up your day on Tuesday by joining friends and colleagues for a Wine & Cheese Happy Hour Reception from 5:00 to 6:00 pm.

SCIENCE AS ART EXHIBITION
Vote for your favorite image at the ever-popular science as art competition, highlighting the interplay between art and science. Winners will be announced on Wednesday afternoon at 3:00 pm.

ICE CREAM SOCIAL
Enjoy a tasty treat at the Wednesday afternoon refreshment break.

CARICATURE SKETCHES
Stop by materials2 Tuesday and Wednesday and have your caricature drawn by Doug Shannon, the Bay Area’s premier caricature artist.

CAREER CENTER
The Career Center provides employers a chance to meet their next employee, and job seekers a chance to meet their next employer.
Alphabetical Check List

Take a moment to read through the exhibitor profiles and check the companies you wish to visit.

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☐ 220 Sonoplot, Inc.
☐ 203 SPECS Surface Nano Analysis
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☐ 601 Springer
☐ 512 STAIB Instruments, Inc.
☐ 329 SunaTech Inc.
☐ 529 Sunpower Inc.
☐ 505 SURFACE Systems & Technology GmbH & Co. KG
☐ 426 SurfX Technologies
☐ 224 SVT Associates, Inc.
☐ 413 Ted Pella, Inc.
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☐ 632 Toshiba Manufacturing Co., Ltd.
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☐ 213 VG Sciencia, Inc.
☐ 225 Vigor Gas Purification Technologies Inc.
☐ 100 WiTe Technologies Corp.
☐ 524 XEI Scientific, Inc.
☐ 105 Xradia, Inc.
1-Material Inc.
info@1-material.com
www.1-material.com

**Key Products:** OPV Materials; Conducting Polymers; Polymer Solar Cell

1-Material is providing Organic Nano Electronic (ONE=1) materials to support your research in OPV, OLED, OTFT and printing electronics in general. Reproducibility matters, without a reproducible material, the reported data lose their significance for comparison and the industry loses its momentum for commercialization. We are developing the technology to make ONE materials (for example, PCDTBT, PCPDTBT, PTB7) reproducible, consistently delivering world-record performance (PCE of a polymer solar cell) scientifically in Advanced Materials, Nature and Science.

2-DTech Ltd.
info@2-dtech.com
www.2-dtech.com

**Key Products:** Graphene; 2-D Materials; Graphene Oxide

A company owned by The University of Manchester and spun-out from the Condensed Matter Research Group led by Professor Sir Andre Geim and Professor Sir Kostya Novoselov, 2-DTech is based in the University’s Incubator Centre and benefits from being closely aligned with Manchester’s world-leading graphene group. 2-DTech supplies fully characterized research and application grade graphene and other two dimensional materials.

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**Key Products:** Cryostats; Helium Liquefiers; Probe Stations

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AIXTRON SE  
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www.aixtron.com

**Key Products:** MOCVD/CVD/PECVD Equipment; OVPD and PVPD Equipment; ALD Equipment

AIXTRON is a leading provider of deposition equipment to the semiconductor industry. The Company’s technology solutions are used by a diverse range of customers worldwide to build advanced components for electronic and opto-electronic applications based on compound, silicon, or organic semiconductor materials, as well as polymers, carbon nanotubes (CNT), graphene and other nano materials. Such components are used in fiber optic communication systems, wireless and mobile telephony applications, optical and electronic storage devices, computing, signaling and lighting, as well as a range of other leading-edge technologies.

AIA International, Inc.  
topgun@ajaint.com  
www.ajaint.com

**Key Products:** Sputtering Systems; Sputter Sources; Sputter Targets

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Aladdin Industrial Corporation  
www.aladdin-e.com

**Key Products:** Aladdin Reagents

Aladdin, a leading manufacturer and supplier of research chemicals, biochemical products and materials, offers a comprehensive range of chemistry, analytical chemistry, life science and materials science products. Today we offer over 20,000 products in stock, in sizes from gram-scale catalog items to semi-bulk and bulk production quantities. Quality is the most critical component of all products and services. Our established quality process ensures a high level of service and a promise of continually striving for perfection.

Aldrich Materials Science  
matsci@sial.com  
www.sigma-aldrich.com/matsci

**Key Products:** Biopolymers; Materials for Energy Efficiency; Electronics; Organic Electronics; Nanomaterials

Aldrich Materials Science, a strategic technology initiative of Sigma-Aldrich, offers a range of performance materials for the Alternative Energy, Electronics and Biomedical markets. Through our materials chemistry Centers of Excellence in Hard Materials and Polymers, we seek to enable innovation through new product additions to our materials portfolio, collaborations, technology licensing, custom research, process development and scale-up. More information is available at www.sigma-aldrich.com/matsci.

Alfa Aesar, a Johnson Matthey Company  
info@alfa.com  
www.alfa.com

**Key Products:** High-Purity Metals; Evaporation Materials; Ceramics

Alfa Aesar is a leading manufacturer and supplier of research chemicals, metals and materials. Our product line includes fabricated metals from aluminum to zirconium, provided in a comprehensive range of forms. The NEW 2013-15 Alfa Aesar Catalog, featuring over 8,000 new products including inorganic and organic research chemicals, pure elements, alloys, precious metal compounds and catalysts, rare earths, precious metal labware, analytical products and more. Visit booth #504 for your copy of the High Purity Metals and Materials catalog and more.

Angstrom Thin Film Technologies LLC  
info@angstrom-dep.com  
www.angstrom-dep.com

**Key Products:** Atomic Layer Deposition System

Located in Albuquerque, NM and founded by scientists from nearby national laboratories, Angstrom Thin Film Technologies LLC specializes in ALD equipment and related thin film technologies. Our products include the economic Thermron ALD system and the versatile Angstrom-dep™ series ALD/plasma-ALD systems. There are three reasons for choosing our ALD system: 1) allows corrosive chlorine chemistry; 2) professional vacuum design; 3) available models for ALD of powder samples.
Exhibitor Profiles

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www.annealsys.com

**Key Products:** RTP; RTCVD; Annealing; MOCVD; Spray-CVD; LPCVD

Annealsys manufactures Rapid Thermal Processing and Chemical Vapor Deposition systems. RTP systems with cold wall chamber, high temperature lamp furnace (1500°C) and high vacuum capability from 3-inch to 200 mm for RTP and RTCVD processes. Graphene CVD capability. MOCVD systems with direct liquid injection vaporizers for deposition of metals, oxides, nitrides, carbon nanotubes, III-V and II-VI materials. 2-inch system with in-situ annealing capability for MOCVD and spray pyrolysis. LPCVD batch furnace for 4-inch wafers.

Anton Paar USA
info.us@anton-paar.com
www.anton-paar.com

**Key Products:** Small Angle X-Ray Scattering; SAXS; X-Ray Diffraction

Anton Paar’s novel X-ray Scattering Instrument, SAXSess, combines Small-Angle and Wide Angle X-ray Scattering, powerful in studying particles or two-phase systems in the 0.5 to 50 nm size range (SAXS) and phase state analysis (WAXS). Investigated systems include liquid crystals, emulsions, dispersions, polymers, proteins, and surfactants. Information obtained includes: size distribution, particle shape, internal structure, surface-to-volume ratio, and crystallinity/phase state. Anton Paar USA is the exclusive distributor of SAXSess in the United States and Canada.

Asahi Spectra Co., Ltd.
info@asahi-spectra.com
www.asahi-spectra.com

**Key Products:** Xenon Light Source; Monochromator; Optical Filters

Asahi Spectra provides the 300W xenon light source, MAX-303, to universities and laboratories for material research and photochemistry such as photocatalyst or photochromism. Especially as a UV reactor, MAX-303 will be able to play an important role in your experiment. Furthermore, the monochromator, CMS-100 which can combine with MAX-303, is also presented. The system is useful for a sensor evaluation. Visit our booth #528 and find out the unprecedented “cool” xenon light source!

Asylum Research, an Oxford Instruments Company
sales@AsylumResearch.com
www.AsylumResearch.com

**Key Products:** Atomic Force/Scanning Probe Microscopes; AFM/SPM Probes

The AFM/SPM technology leader will feature the Cypher™ and the MFP-3D™ families of Atomic Force Microscopes. Our AFMs have raised the technical innovation bar for the highest resolution, fast scanning and environmental control. Asylum AFMs go beyond topography and offer unmatched performance with numerous advanced characterization modes/tools for applications at the nanoscale. Examples include biology, materials science, chemistry, graphene, electrochemistry, batteries, photovoltaics, energy storage, devices, piezoelectrics, and glovebox measurements.
Balazs NanoAnalysis, a Division of Air Liquide Electronics U.S. LP
info@balazs.com
www.balazs.com

Key Products: Analytical Testing; Materials Characterization; AMC-SMC

Balazs NanoAnalysis, a division of Air Liquide Electronics U.S. LP, operates ISO 17025 accredited laboratories that identify, analyze, and resolve contamination issues for semiconductor and other high-tech industries. Balazs analyzes water, air, chemicals, process gases, components, and wafers with industry experts available to identify and track contamination to their source using: High Resolution ICP-MS, ICP-OES, GD-OES, XRF, IC, SEM-EDS, LA-ICP-MS, VPD, GC, GC-MS, FTIR, Raman, wafer outgassing, air and gas sampling, and thin film analysis.

Barnett Technical Services LLC
info@barnett-technical.com
www.barnett-technical.com

Key Products: Scanning Probe Microscopes; Cathodoluminescence Systems; AFM-Raman

Representative of Attolight Cathodoluminescence (CL) systems and Nanonics Imaging Scanning Probe Microscopes (SPM). Attolight’s CL systems offer easy-to-use and powerful CL measurement capabilities in both continuous and ps time-resolved modes with major application areas that include compound semiconductors and other photonic materials for LEDs and photovoltaics. Nanonics Imaging’s SPMs offer multiprobe functionality for near-field measurements using AFM, NSOM, or advanced measurement capabilities through the use of our unique range of probe tips composed of tapered glass fibers.

BaySpec, Inc.
info@bayspec.com
www.bayspec.com

Key Products: Raman Microscope; Raman Moving Lab; Raman Benchtop 1064, 785, 532

BaySpec, Inc., founded in 1999 with 100% manufacturing in the USA (San Jose, California), is a vertically integrated spectral sensing company. The company designs, manufactures and markets advanced spectral instruments, from UV-VIS spectrometers to handheld and portable NIR and Raman analyzers, for the biomedical, pharmaceuticals, chemical, food, semiconductor, homeland security, and the optical telecommunications industries.
### Exhibitor Profiles

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<thead>
<tr>
<th>Company</th>
<th>Corporate/Affiliate</th>
<th>Booth</th>
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<tbody>
<tr>
<td>Beijing Mikrouna Mechatronics Technology Co., Ltd.</td>
<td>CORPORATE</td>
<td>125</td>
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<tr>
<td>Mikrouna offers vacuum deposition systems, etc. With a mission of providing glove boxes and gas purification systems with a high ratio of performance and price by applying state-of-the-art technology, assembling components from well-known suppliers. The glove box can remove H2O and O2 rapidly and maintain less than 1 ppm of H2O and O2. In addition, Mikrouna offers vacuum deposition systems, etc. With a mission of “Achieving social goals through advancing technology,” Mikrouna will continue to innovate in product design, improve product quality and strengthen service.</td>
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<tr>
<td><a href="mailto:us@biolinscientific.com">us@biolinscientific.com</a></td>
<td>Affiliate</td>
<td>121</td>
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<tr>
<td>Key Products: Glove Box; Gas Purification System</td>
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<tr>
<td>BioInk Scientific, Inc.</td>
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<td>Biologic USA, LLC</td>
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<td>Bio-Lologic USA, LLC</td>
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<tr>
<td>Key Products: Substrate Wafer Heaters; Thin Film Deposition Systems; Thin Films and Coating Materials; R&amp;D Services</td>
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<tr>
<td>Blue Wave Semiconductors, Inc.</td>
<td>Affiliate</td>
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<tr>
<td>Key Products: Spin Coating; Dip Coating; Chemical Precursors</td>
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<tr>
<td>Chemat Technology, Inc.</td>
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<tr>
<td>Key Products: X-Ray Diffraction; Atomic Force Microscopy; Spectroscopy</td>
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<td>California Analytical Instruments, Inc.</td>
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<td>Key Products: FTIR</td>
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<td>Bio-Logic USA, LLC</td>
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<td>606</td>
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<tr>
<td>Key Products: Research Instruments; Battery Research; Electrochemical</td>
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<tr>
<td>BioInk Scientific, Inc.</td>
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<tr>
<td>Key Products: Quartz Crystal Microbalance with Dissipation Monitoring; Fairfield Dual Polarization Interferometer; Attension Theta Optical Tensiometer</td>
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COSMOTEC Corporation
www.feedthrough.net

Key Products: Coaxial Feedthrough; Multi-Pin Feedthrough; Thermocouple Feedthrough

COSMOTEC Corporation has designed and manufactured UHV feedthroughs since its establishment in 1992. It also is a specialized trading company that has an agency contract with the well-known company Kyocera. Kyocera is one of the finest ceramic companies in the world and it has a wide variety of ceramic to metal products. Coaxial, Multi-pin, Thermocouple and Isolators are always ready to ship from our huge inventory. Feel the best results ever with our high reliable products!

CRAIC Technologies, Inc.
sales@microspectra.com
www.microspectra.com

Key Products: Microspectrophotometers; Raman

CRAIC Technologies builds UV-visible-NIR microscopes, microspectrophotometers, Raman microspectrometers as well as tools as microspot thin film thickness, micro-colorimetry and standards traceable to NIST. CRAIC Technologies’ instruments can image and measure the spectra of even sub-micron samples by transmission, reflectance, Raman, luminescence and with polarized light from the deep UV to the NIR. Visit our booth to see how we can help you!

CRC Press-Taylor & Francis
orders@crcpress.com
www.crcpress.com

Key Products: Books; Journals; Netbase Products

Take your research skills to the next level with Taylor & Francis/CRC Press, a leading global publisher of scientific and technical textbooks, practical manuals, references, and journals. Visit our booth to browse and receive special discounts on new titles such as Fundamentals of Soft Matter Science, Dopants and Defects in Semiconductors, Renewable Energy: A First Course, and many others. Please inquire with the press editors if interested in developing a book project.

CrystalMaker Software Ltd.
info@crystamaker.com
www.crystamaker.com

Key Products: CrystalMaker; CrystalDiffract; SingleCrystal

Award-winning software for understanding crystalline materials and their diffraction properties: CrystalMaker® provides quick-and-easy visualization of crystal/molecular structures and their behavior, with interactive manipulation and animation, plus “crystal engineering” tools for surfaces, interfaces and defects. Featuring spectacular 3D graphics, high-resolution output and professional-quality video, CrystalMaker® works seamlessly with our two diffraction programs CrystalDiffract® (x-ray and neutron powder diffraction) and SingleCrystal™ (TEM etc.) to simulate diffraction properties and characterize real data.

CVD Equipment Corporation
info@cvdequipment.com
www.cvdequipment.com

Key Products: CVD Equipment; Gas/Liquid Delivery; Gas Abatement; Nano-enabled Materials

Our EasyTube® First Nano CVD process development platforms, EasyGas™ gas delivery and EasyExhaust™ process gas exhaust abatement systems are used by researchers worldwide. We have the largest installed base of research CVD systems and together with our Application Laboratory focus on accelerating the commercialization of tomorrow’s technologies in the Nano/Solar/Energy fields. Our CVD Materials division enables development worldwide by providing innovators with a growing range of research nanomaterials. www.cvdequipment.com, www.firstnano.com, www.cvdmaterialscorporation.com, www.stainlessdesign.com

cyberTECHNOLOGIES USA, LLC
www.cybertechnologies.com

Key Products: High-Resolution Surface Measurements; Roughness Measurement Systems; Optical Surface Profilometers

cyberTECHNOLOGIES is the leading provider of standalone, integrated and dual-sided high resolution 3D Optical Metrology Systems for non-destructive process control of film thickness, surface topography, total thickness variation and quality inspection of Wafers, MEMS, Solar Cells, Fuel Cells, Lenses, Printed Products, Chip Packages and many other applications. Our systems reliably measure on absorbent, highly reflective, soft or transparent materials (clear on glass) with high vertical and lateral resolution even over large areas of interest. Our customers cite the systems’ ease-of-use, automation capabilities, high speed, accuracy, flexibility and comprehensive parametric capabilities for R&D and production as deciding factors when selecting a metrology system from cyberTECHNOLOGIES.

Ecopia Corp.
sales@ecopia21.co.kr
www.ecopia21.co.kr

Key Products: Hall Effect Measurement Systems; RTP Systems

Ecopia is a leading supplier of Hall Effect Measurement Systems including the HMS5000 series with variable temperature from 80K to 350K, and ambient to 573K or 773K. Motor controlled magnets provide automated operation. Measures and plots temperature versus: resistivity, carrier density, mobility, hall coefficient, conductivity. Check contacts with I-V and I-R curves. HMS3000 measures at 300K and 77K with optional high temperature sample kit and new optional Variable Tesla Kit.

Electron Microscopy Sciences/
Diatome U.S.
www.emsdiasum.com

Key Products: Laboratory Supplies; Chemicals/Adhesives; Equipment

Electron Microscopy Sciences (EMS) will have on display their comprehensive line of chemicals (material embedding kits), supplies and equipment (polishers, grinders, manipulators, disc punches, tripods, and lapping machines) for microscopy and all of the related material research fields. As well, Diatome will be exhibiting their Diamond Knives for materials micrometry, including the unique UltraSonic Oscillating Diamond knife for compression free sections.
FlackTek, Inc.
speedmixer@flacktek.net
www.speedmixer.com

**Key Products:** Mixing Machines; Laboratory Mixers; High-speed Mixing

The FlackTek SpeedMixer is an advanced tool for mixing, grinding/milling and dispersing. This Non-Invasive Mixing™ technology removes air bubbles while homogenizing the sample in a matter of seconds, and there is ABSOLUTELY NO CLEANUP! The SpeedMixer can be used to process any combination of powders, pastes, putties, and liquids in batches ranging from 1g to 5Kg. Please visit our booth to learn how a SpeedMixer can benefit your R&D, quality control and specialty productions.

Fischer Technology, Inc.
info@fischer-technology.com
www.fischer-technology.com

**Key Products:** Picodentor HM500; Fischerscope Micro Hardness Testers; Fischerscope XRF Instruments

Fischer Technology manufactures instruments for micro-indentation hardness testing, non-destructive materials analysis and thin film coating thickness measurement. The principles of x-ray fluorescence, magnetic induction, eddy current and beta backscatter are incorporated into handheld and bench top instruments. Fischer instruments are used to characterize materials in applications ranging from tribological coatings to thin film solar materials and energy storage devices.

Fischione Instruments
info@fischione.com
www.fischione.com

**Key Products:** Electron Microscope Accessories; Sample Preparation

Fischione Instruments features TEM Specimen Preparation Instruments including the Electropolisher, Dimpling Grinder, Ultrasonic Disk Cutter, Ion Mill (TEM/SEM) and Plasma Cleaner. The NanoMills® TEM specimen preparation system results in artifact-free preparation. The ASaP enhances SEM specimen quality. Imaging Instruments include the HAADF detector and TVIPS cameras. TEM Tomography Specimen Holders for single-axis, dual-axis, on-axis and ultra-narrow gap applications.

Flow Sciences, Inc.
information@flowsciences.com
www.flowsciences.com

**Key Products:** VBSE Vented Balance Safety Enclosures; Hybrid Isolator; Contained Environments

Flow Sciences, Inc. (FSI) designs and manufactures containment solutions for research and development laboratories, pilot plants, laboratory automation suites, manufacturing and production sites. Our commitment to safety and performance in the engineering, design, testing, and installation of containment enclosures has proven performance throughout pharmaceutical, biotech, chemical, forensic, academic, government and other industrial facilities.

Frontier Semiconductor
fsm100@frontiersemi.com
www.frontiersemi.com

**Key Products:** Film Stress Hysteresis Measurement Tool with 3D Mapping Capability; Film Adhesion Test and Raman for Lattice Level Strain Measurement

Film Stress Hysteresis Measurement Tool with 3D Mapping capability during heat-up for up to 450mm wafers + TDS; Quantitative Adhesion Testers, 4 Point Bend and Modified Edge Lift Testers; High spectral and high spatial resolution, production ready UV/VIS Raman Spectroscopy for Strain in Si, SOI, SiGe, STI and MEMS applications.

FUJIFILM Dimatix, Inc.
info@dimatix.com
www.dimatix.com

**Key Products:** Dimatix Materials Printer; Dimatix Materials Cartridge; Dimatix Printheads & Systems

With the Dimatix Materials Printer (DMP), FUJIFILM Dimatix has advanced ink jetting to enable high-performance micro-precision deposition of a wide range of “inks” tailor fit to specific applications. It is the industry’s first low-cost, cartridge-based piezo inkjet printing system that enables direct deposition of fluids for proprietary research allowing faster and less expensive product development. The MEMS-based inkjet head coupled to a disposable cartridge allows researchers to deposit the materials they have manufactured.

Gamry Instruments
sales@gamry.com
www.gamry.com

**Key Products:** Potentiostats; Quartz Crystal Microbalance; Electrochemistry Accessories

Gamry Instruments, innovators in electrochemical instrumentation since 1989, offers a full line of high performance instruments, software and accessories. For research involving energy storage, corrosion, analytical electrochemistry, or sensors, we can help make the measurements you need. Visit the Gamry exhibit to see the latest in electrochemical instrumentation.
Gatan, Inc.
info@gatan.com
www.gatan.com

Key Products: Materials Characterization; Nanotechnology; Photovoltaics

Gatan, Inc. designs and manufactures instruments and products for applications in electron microscopy. Gatan specializes in materials research and development and its products are used in a broad range of advanced material science applications, including: nano-materials, semiconductors (micro- and nano-electronics), and photovoltaics. Scientists and engineers use Gatan’s products to acquire critical information and insight into the structural, electrical, mechanical, and chemical properties of materials.

Hadland Technologies, Inc.
xray.service@hadtek.com
www.hadtek.com

Key Products: X-ray Computed Tomography Services; Real-time Radiographic Imaging Services; X-ray System Sales

Hadland Technologies provides high-quality, cost-effective 3D imaging services using X-ray computed tomography (X-ray CT) for use in research and development, manufacturing, failure analysis, and academia. X-ray CT is a non-destructive technique that creates internal and external 3D representations of a sample, a 3D data volume. This volume can be used for material segmentation, porosity/inclusion analysis, geometric measurement, fiber composite analysis, and defect detection. Hadland Technologies has over 20 years of experience in microfocus X-ray and X-ray CT.

HeatWave Labs Inc.
technicalsales@cathode.com
www.cathode.com

Key Products: Substrate Heaters; Cathodes; Ion Sources

HeatWave Labs is an engineering, design and manufacturing company that specializes in components and assemblies for the vacuum tube and vacuum equipment industries. Our expertise lies in the areas of thermionic cathodes and ion emitters and guns, ion sources and ionizers, ion pumps and controllers, vacuum tube design, processing and rebuilding, specialized high purity and refractory materials, UHV sample heating and filament products, temperature controllers and power supplies, ceramics and vacuum envelope assemblies and other related products.

Heidelberg Instruments, Inc.
info@himt.de
www.himt.de

Key Products: Maskless Lithography Laser Writers

Maskless Direct Write Lithography Systems for photomask production, direct writing applications and gray scale exposures. Ideal for rapid prototyping of 2D and 3D microstructures. The µPG 501 is the latest, award winning addition to the series of lithographic systems by Heidelberg Instruments, a company with over 20 years of experience and over 400 direct write lithography installations worldwide, including prestigious universities and research institutes in the USA.

HORIBA Scientific
info-sci@horiba.com
www.horiba.com/scientific

Key Products: Raman; Spectroscopy; Ellipsometry

World-leading manufacturer of high-performance spectroscopic instrumentation for R&D and routine analyses. Products include Raman, steady-state and lifetime spectrophotometers with both TCSPC and phase capability, spectroscopic ellipsometers, XRF, imaging spectrometers, detectors, and high performance CCDs. Combination technologies include Cathodoluminescence for SEM, AFM/Raman and Raman/PL. Recent innovations include: NEW research-grade Raman LabRAM HR Evolution microscope, a fully-automated Uvise2 Ellipsometer with computer controlled sample alignment, autofocus, spot size selection and mapping functions, and a Syncerity CCD Detector.

Hysitron, Inc.
info@hysitron.com
www.hysitron.com

Key Products: TI 950 TriboIndenter; PI 95 FEI PicoIndenter; TI 750 Ubi

As world leader in nanomechanical test instruments, Hysitron® is dedicated to providing next-generation testing solutions for nanoscale mechanical characterization. Our instruments feature a full suite of advanced complementary techniques, including nanoDMA® III to continuously obtain elastic-plastic and viscoelastic properties of materials as a function of indentation depth, frequency, and time. Additional Hysitron in-situ techniques include SPM imaging, heating/cooling, Modulus Mapping™, and nanoECR®. Stop by our booth to learn about the latest Hysitron technologies and view the new PI 95, PI 85, and PI 87 Picolindenter® products, Hysitron’s quantitative depth-sensing indenters capable of direct-observation testing in a TEM or SEM.
Innovative Technology, Inc.
info@gloveboxes.com
www.gloveboxes.com

Key Products: Glove Box Systems

Innovative Technology, Inc. is a designer and manufacturer of Inert Glove Box, Gas Purification and Solvent Purification Systems. Our range of Pure Lab Glove Boxes are commonly integrated with deposition equipment to facilitate the oxygen and moisture free handling of materials produced during the deposition processes. Spin coaters are routinely integrated into the glove box environment allowing for complete inert handling and processing of substrates from start to finish. Please visit our booth to discuss your specific requirements.

Integrated Dynamics Engineering
info@ideworld.com
www.ideworld.com

Key Products: Vibration Isolation; EMI Cancellation; Acoustic Control

Integrated Dynamics Engineering (IDE) is internationally recognized for environmental controls in the Microscopy, Medical and Semiconductor Industries. With facilities in the United States, Europe, and Japan, IDE is one of the leading developers and manufacturers of Active Vibration Isolation, EMI Compensation and Acoustic Control Systems. With installations in academic, US government, military, and private research institutions, IDE has over 20 years of experience in solving some of the toughest environmental challenges facing the ever more demanding SEM and TEM markets.

IOP Publishing
info@ioppubusa.com
publishing.iop.org

Key Products: Applied, Semiconductor, Superconductor and Material Journals

IOP Publishing is an international, not-for-profit, learned society publisher. Our catalogue comprises of many leading journals including Journal of Physics D: Applied Physics, Semiconductor Science and Technology, Superconductor Science and Technology, Nanotechnology and published in partnership with NIMS, Science and Technology of Advanced Materials. Visit booth 612 with any questions, for a free sample copy of one of our publications, or for a demonstration of our award-winning electronic journals service and community websites such as nanotechweb.org.

iXRF Systems, Inc.
info@ixrfsystems.com
www.ixrfsystems.com

Key Products: EDS Microanalysis; X-ray Fluorescence (XRF); Detectors

iXRF Systems Iridium Ultra EDS system boasts unprecedented value, quality, and performance in a single premium EDS platform. Never pay for an upgrade or software option again. With iXRF, enjoy an all-inclusive premium software package loaded with high-end features such as full automation, particle analysis, spectral and phase mapping, and many many more. iXRF also offers the only adaptable XRF tool suitable for the SEM. Experience increased ppm sensitivity, improved quantitative accuracy, and better peak separation with the exclusive SEM-XRF technique from iXRF.

Janis Research Company, LLC
sales@janis.com
www.janis.com

Key Products: Micromanipulated Probe Stations; Cryostats; Cryocoolers

Janis combines over 50 years of manufacturing experience with extensive engineering capabilities to provide cryogenic systems for all research applications. We offer systems that cover the entire low temperature range you need, in a variety of environments. They include magnetic fields, optical access, fiber optic cables, shielded high frequency coaxial cables and a variety of other customized options as dictated by your experimental requirements.

Japan Society of Applied Physics
www.jsap.or.jp/english/index.html

Key Products: Journals

Japan Society of Applied Physics (JSAP) will promote our international journals, Applied Physics Express (APEX) and Japanese Journal of Applied Physics (JJAP). These journals cover various fields in applied physics related to materials research, including the fields in semiconductors, photonics, superconductors, spintronics, nanoscale science, and plasma processing.

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JEOL USA, Inc.
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Key Products: TEM; SEM; Auger/MicroProbe
JEOL is a global solutions provider of high performance electron microscopy, ion beam, e-beam lithography, and analytical instrumentation and technology for scientific and industrial R&D. Core markets include nanotechnology, materials science, biological science, and the semiconductor industry. Innovative, sub-angstrom developments enable customers to advance scientific research and manufacturing applications. Learn about Centurio, our new generation of SDD-EDS for ultrafast, ultrasensitive collection of X-rays through analysis with JEOL 200kV aberration-corrected S/TEMs including ARM-200F and new JEM-2800.

JASCO
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Key Products: Raman; Portable Raman; Near Field
JASCO specializes in analytical instrumentation for Spectroscopy and Chromatography and is experienced within the academic, pharmaceutical, biotechnology, and industrial markets including materials analysis and nanotechnology, worldwide. We offer a full line of reliable and robust instrumentation: specializing in Raman including the NRS-5000/7000 research-grade Raman instruments and the RMP-300 series of portable Raman instruments, Near-Field (NSOM) systems, FT-IR, FT-IR Microscopy, FT-Raman, Thin-Film Thickness measurements, UV-Vis/NIR, Fluorescence, Circular Dichroism, Polarimetry, Dissolution, SFC/SFE, HPLC, and X-LC (UHPLC). JASCO is the only company offering a single, cross platform software for our many different spectroscopic instruments.

Kurt J. Lesker Company
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Key Products: Pure Targets/Materials; Vacuum Components; Thin Film Deposition Systems; UHV Manipulation; ALD
KJLC® is a world leader in plasma and thin film deposition technology and vacuum coating for materials discovery and molecular engineering. We deliver complete solutions (turn-key systems, deposition materials, sample motion and heating stages from UHV Design Ltd., vacuum components, and process development) with expertise in pulsed cathodic arc, magnetron sputtering, Isolux Inverted Cylindrical Magnetrons, electron beam and thermal evaporation, organic electronics, and atomic layer deposition (ALD) for your materials research challenges.

Labtec Sales Partners LLC
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www.labtecsp.com

Key Products: Maskless Lithography Systems; ALD Systems; Deposition Systems
A global sales and distribution partner for companies who provide equipment for microlithography and thin film processing. We can provide complete processing solutions for our customers or simple process tools that the customers can integrate into their existing processing lines. Additionally, we work with leading providers of support equipment for all our products, so we can provide our customers with all that they need to get up and running.

Koei Chemical Company, Limited
www.koeichem.com

Key Products: Ionic Liquids; Chemical Products Containing Nitrogen Atom; Organometallics
Koei Chemical is an expert in manufacturing chemical products containing nitrogen atoms such as pyridines, pyrazines and amines. These are the key components for various products such as pharmaceutical intermediates. In addition, we are developing the technology to manufacture organometallics as well as ionic liquids. We started the research of ionic liquids several years ago and the product line-up has increased to over 500. The trademark of our ionic liquids is KOELIQ™.

Lake Shore Cryotronics, Inc.
sales@lakeshore.com
www.lakeshore.com

Key Products: Probe Stations; Hall Effect Systems; Cryogenic Instruments and Sensors
Supporting advanced research since 1968, Lake Shore is a leading innovator in measurement and control solutions under extreme temperature and magnetic conditions. Products include cryogenic temperature sensors and instrumentation, magnetic test and measurement systems, probe stations for electronic/magnetic material testing, and precision materials characterization systems exploring electronic and magnetic properties. Lake Shore serves as an international base of scientists at leading university, government, and commercial research institutions and is supported by a global sales network.

Labtec Sales Partners LLC
info@labtecsp.com
www.labtecsp.com

Key Products: Maskless Lithography Systems; ALD Systems; Deposition Systems
A global sales and distribution partner for companies who provide equipment for microlithography and thin film processing. We can provide complete processing solutions for our customers or simple process tools that the customers can integrate into their existing processing lines. Additionally, we work with leading providers of support equipment for all our products, so we can provide our customers with all that they need to get up and running.

Lake Shore Cryotronics, Inc.
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Lucas Scientific LLC
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Key Products: Portable Mechanical Testers
Together with Wagner Scientific, Lucas Scientific introduces the revolutionary FLS-1 USB Portable Mechanical Tester, capable of real-time force-displacement recordings synchronized to integrated microscopic video imaging. The tester features customized easily-changeable jigs and tailored software for a wide variety of materials testing. It requires no external power supply and is designed to be used with minimal training. Targeted at field workers such as ecologists, or for undergraduate or advanced school projects, it provides a low-cost solution for obtaining material properties rapidly and accurately. Stop by our booth and see it in use.

MANTIS Deposition Ltd.
sales@mantisdeposition.com
www.mantisdeposition.com

Key Products: Nanoparticle Sources; UHV Deposition; PVD
MANTIS Deposition is dedicated to the manufacture of high-quality deposition components and systems for cutting-edge applications such as nanotechnology, MBE, PVD and ion-beam assisted deposition. Our product offerings include: nanoparticle deposition sources and systems, RF atom and RF ion sources, mini e-beam evaporators, sputter cathodes and thermal gas crackers as well as modular R&D deposition systems.

Materials Analysis Technology Inc.
marketing@ma-tek.com
www.ma-tek.com

Key Products: Materials Analysis; Failure Analysis; Reliability Testing
MA-tek, a leading materials analysis company, provides prompt, value-added services and total solutions for customers. Main service items contain materials and surface analysis, physical and electrical failure analysis, electrostatic discharge, and reliability tests. We offer a 24-hour, worldwide on-call service with analysis turnaround time of one day for emergency cases. Our service labs are located in Taiwan and Shanghai. Now, our customers widely distribute in fields of silicon IC, LED, PV, MEMS, and LCD.

Metrohm USA, Inc.
info@metrohmusa.com
www.metrohmusa.com

Key Products: Electrochemical Systems; Impedance Characterizations; Sensors
See new Multichannel Autolab MAC system and modular PGSTAT 302N potentiostats/galvanostats for electrochemical testing and analysis of materials or systems, and impedance characterization of sensor and material components; both offer low-current, high-speed scanning options as well as integration with QCM, photometric, SPR and other measuring/monitoring systems. Also on display: Metrohm Computrace analysis systems for trace-level analysis of material components; DropSens screen-printed electrodes, cells and portable single- and multichannel electrochemistry systems.
Microtrac, a global pioneer of particle characterization technologies, strives to provide the world with innovative, reliable, high temperature box/tube furnaces, pressing machine, CIP, research labs, such as crystal substrates, cutter, polisher, and process development of semiconductors, high-brightness LEDs, data storage devices and solar photovoltaics. Nanometrics’ automated and integrated systems address numerous process control applications, including critical dimension and film thickness measurement, device topography, defect inspection, and analysis of various other film properties such as optical, electrical and material characteristics. Please visit http://www.nanometrics.com for more information.

Key Products: Single Crystal Substrates; High Temperature Furnaces; Battery Research Equipment

MTI Corporation
info@mtixtl.com
www.mtixtl.com

Key Products: Single Crystal Substrates; High Temperature Furnaces; Battery Research Equipment

Since 1995, MTI has been providing a total solution for materials research labs, such as crystal substrates, cutter, polisher, high temperature box/tube furnaces, pressing machine, CIP, film coaters, glove boxes, high vacuum system, RTP furnaces, multichannel gas mixing system as well as compact XRD and equipment for battery research.

Key Products: Ion Beam Etching; PECVD; Sputtering

NANO-MASTER, Inc. specializes in Single Wafer Thin Film Processing Systems in: Deposition: E-Beam, PECVD, PLD, DLC, DC and RF Sputtering, Ion Beam Sputtering, Thermal Evaporation; Etching: RIE, DRIE, ICP, Ion Beam, Plasma, Wet; Growth: ALD, PA-MOCVD, CNT, Graphene; Surface Treatment: Ion Beam, PIII, Plasma, RTP; Cleaning: Dry (Ion Beam, Plasma) and Wet (Megasonic, Brush, Piranha, O3DIW); and Other: Device Testing Systems, Heated Platens, Plasma Sources, Resist Stripping (Dry and Wet).

Key Products: Hall Effect; Seebeck Effect; Microprobe Systems; LN2 Generators; Closed Cycle Coolers; Variable Temperature

MMR Technologies manufactures temperature controlled systems—cryogenic cooling systems and wide temperature range thermal stages—which find application in materials research in chemistry, biology, electrical engineering, materials research, environmental studies, physics. These systems operate over the temperature range of 70 K to 730 K. They are used for electrical resistivity, Hall effect, Seebeck effect, DLTS, MEMS, magnetoresistivity, and luminescence studies. They are also used in medical applications and the cooling and characterization of computer chips, electronic devices, laser diodes and thermal imaging devices as a function of temperature.

Key Products: AFM and SPM Probes; Particle Size and Zeta Potential Analyzers; DIHM

Nanometrics Incorporated specializes in Single Wafer Thin Film Metrology System; Hall Measurement System; Electrochemical CV Profiler; Photoluminescence Mapping System

Nanometrics is a leading provider of advanced, high-performance process control metrology and inspection systems used in R&D and process development of semiconductors, high-brightness LEDs, data storage devices and solar photovoltaics. Nanometrics’ automated and integrated systems address numerous process control applications, including critical dimension and film thickness measurement, device topography, defect inspection, and analysis of various other film properties such as optical, electrical and material characteristics. Please visit http://www.nanometrics.com for more information.

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Nanovea  
info@nanovea.com  
www.nanovea.com  

**Key Products:** Nano/Micro/Macro Mechanical Tester; 3D Non-Contact Profilometers; Tribometers  
From the Irvine, CA office, Nanovea designs and manufactures Profilometers, Mechanical Testers and Tribometers to combine the most advanced testing capabilities in the industry: scratch adhesion, indentation hardness, wear friction and 3D non-contact metrology at the nano, micro and macro range. Unlike other manufacturers, Nanovea also provides laboratory services, offering clients availability to the latest technology and optimal results through improvements in material testing standards.

National Electrostatics Corp.  
nec@pelletron.com  
www.pelletron.com  

**Key Products:** Pelletron Accelerator; RBS/PIXE/ERD; Accelerator Mass Spectrometry  
National Electrostatics Corp. (NEC) is the manufacturer of MeV ion and electron beam systems including a new turnkey RBS system with Angstrom level resolution. This high-resolution RBS system is also capable of standard RBS, channeling, PIXE, ERD and NRA. In addition, NEC manufactures a wide variety of ion beam systems including complete Accelerator Mass Spectrometry (AMS) systems for a wide variety of radioisotope measurements including all necessary hardware and software for low background, high precision and high throughput measurement. Applications for these systems include semiconductor research, carbon dating, pharmaceutical research and many others. Accelerator subsystems and components including ion sources are also available from NEC.
National Nanotechnology Infrastructure Network
www.nnin.org

**Key Products:** Nanofabrication; Nanotechnology

The National Nanotechnology Infrastructure Network consists of user facilities at 13 major universities, funded by the National Science Foundation to provide nanotechnology research resources to the user community. Available technologies include fabrication, deposition and growth of nanomaterials, characterization, and computation of nanoscale materials and device properties. Applications include electronics, MEMS, optics, materials science, chemistry and biology. All facilities are available on an open basis for hands-on use. Training, instruction, and process support are provided.

National User Facility Organization
info@nufo.org
www.nufo.org

The National User Facility Organization (NUFO) represents scientists and engineers who work at 47 user facilities nationwide. NUFO’s goals are to educate scientists, the general public, and other stakeholders about the significance of the research conducted at these facilities, the role the facilities play in economic competitiveness, education of the next-generation scientific workforce, and basic knowledge of the universe around us. Building awareness of user facilities, their capabilities, and increasing their user base is the future of America.

Neocera, LLC
sales@neocera.com
www.neocera.com

**Key Products:** Pulsed Laser Deposition Systems; Pulsed Electron Deposition Systems

Neocera creates, develops and promotes advanced thin film materials and deposition technologies. Founded in 1989 to commercialize technical expertise in cutting-edge materials; Neocera is now a world leader in Pulsed Laser Deposition (PLD) and Pulsed Electron Deposition (PED) systems for research and production applications for wafer sizes up to 8-inches in diameter. Neocera’s nanotechnology products include UHV PLD systems, Laser MBE systems with RHEED diagnostics, Combinatorial PLD/PED Systems, Ion assisted-PLD/PED Systems, and PLD Systems with integrated RF and DC Sputter sources. Neocera also offers components such as Laser Heaters, Ion Energy Spectrometers and Optical Emission Spectrometers for PLD and PED applications.

Netzsch Instruments N.A. LLC
nib-sales@netzsch.com
www.netzsch-thermal-analysis.com

**Key Products:** Thermal Analysis; Thermal Conductivity; Thermal Expansion; Calorimetry

Thermal analysis, thermal properties, calorimetry, and contract testing services; DSC, DTA, TGA, STA (Simultaneous DSC/DTA-TGA) from cryogenic to +2400°F, evolved gas analysis by coupled FTIR and MS, and GC-MS, the new ‘Perseus’ fully-integrated TGA/STA-FTIR with no transfer line, specific heat measurement, Dilatometers for thermal expansion, thermal conductivity, thermal diffusivity by laser flash method, DMA, TMA, DEA for in-situ thermostet cure monitoring, and ARC calorimeters to measure thermal and pressure properties of chemical reactions.

NIST
www.nist.gov/srm

**Key Products:** Standard Reference Materials; Data and Calibration Services

NIST Standard Reference Materials supports accurate/compatible measurements by certifying and providing over 1200 SRMs with well-characterized composition or properties, or both. SRMs are used to perform instrument calibrations as part of quality assurance, accuracy of specific measurements and support new measurement methods. Standard Reference Data provides well-documented numeric data to scientists and engineers for use in technical problem-solving, research, and development. The Calibration Services are designed to help in achieving high levels of measurements.

NIST/CNST
www.cnst.nist.gov

**Key Products:** Nanoscale Research Program; Nanofabrication Facility; User Facility

The NIST Center for Nanoscale Science and Technology (CNST) supports the U.S. nanotechnology enterprise from discovery to production by providing industry, academia, NIST, and other government agencies with access to world-class nanoscale measurement and fabrication methods and technology. The CNST’s shared-use NanoFab gives researchers economical access to and training on a state-of-the-art tool set required for cutting-edge nanotechnology development. The simple application process is designed to get projects started in a few weeks. Looking beyond the current state of the art, CNST research is creating the next generation of nanoscale measurement instruments and methods, which are made available through collaboration.

Nor-Cal Products, Inc.
ncsales@n-c.com
www.n-c.com

**Key Products:** Vacuum Chambers; Flanges & Fittings; Valves

Since 1962, Nor-Cal Products, Inc. has manufactured high and ultra-high vacuum components for many applications. Nor-Cal has earned a reputation worldwide for quality components, competitive prices and excellent customer service and is now ISO 9001:2008 registered. Standard products include: flanges; fittings, viewports, feedthroughs and flexible hoses; crystal monitors, manual and pneumatic valves; pressure control valves and controllers; heater jackets; foreline traps; and manipulators. Custom chambers, manifolds, feedthrough collars and baseplates can be manufactured from customer specifications, sketches or drawings. Entire systems can be supplied. Our extensive 3D Model Library is available on-line. Visit our website at www.n-c.com for more information.
FTAM & View Fitting: Small Angle X-ray Scattering; X-ray Fluorescence

Dispersive XRF Analysis: X-ray Fluorescence (XRF) and Wavelength Dispersive XRF Analysis (WDXRF)

Announces new X-ray Diffraction System: PANalytical launches Empyrean X’Pert PRO, a breakthrough system for high throughput research

PANalytical is a leading research and development company focused on the X-ray field and developing new instrumentation for research, materials and semiconductor industries.

Park NX10: 45x (Full Resolution) – 1.30 x 1.00 µm

Park NX20: 90x (Full Resolution) – 0.65 x 0.50 µm

Optofluidics, Inc.
info@optofluid.com
www.optofluidicscorp.com

Key Products: Nanoparticle; Optical Tweezers; Photonics: Materials Analysis; Nanotechnology

Optofluidics is a venture-backed biotech startup that is commercializing nanophotonic and microfluidic nanomanipulation tools developed at Cornell University. Their flagship product is the Molecular NanoTweezer, which will give researchers the unprecedented ability to control and localize single proteins, DNA, quantum dots and viruses with the push of a button. Supported by the National Science Foundation, DARPA and the Ben Franklin Technology partners, Optofluidics was named Life Science Startup of the Year by the Philadelphia Chamber of Commerce, and will launch their first products in mid-2013. Optofluidics has offices and lab space at the Science Center in Philadelphia, which is ideally situated between the University of Pennsylvania and Drexel University.

Photonic Cleaning Technologies, LLC
sales@photoniccleaning.com
www.photoniccleaning.com

Key Products: First Contact Polymer Products

Protochips, Inc.
contact@protochips.com
www.protochips.com

Key Products: Microscopes, Electron Microscopy and Instrumentation; Nanotechnology; Biological, Biomedical, Bio-related Sciences

If you believe that electron microscopy can provide far more than imaging. If you want the proper in situ tools to generate high resolution, accurate and quantifiable data. Then Protochips has the heating, electrical, electrothermal, liquid, and electrochemical solutions for you. Develop tomorrow’s materials today. Protochips is Quantifiably Better.

PVD Products, Inc.
sales@pvdproducts.com
www.pvdproducts.com

Key Products: Pulsed Laser Deposition Systems; Sputtering Systems; Evaporation Systems

PVD Products sells a complete line of thin film deposition tools including magnetron sputtering, pulsed laser deposition, thermal and electron beam evaporation systems for both R&D and prototype production applications. We manufacture custom components such as magnetron sputter sources, substrate heaters, target manipulators, and optical trains and unique components for coated-conductor applications. PVD also provides thin film deposition, SEM, and EDS services.

Plasmaterials, Inc.
info@plasmaterials.com
www.plasmaterials.com

Key Products: Sputtering Targets; Backing Plates; Evaporation Materials

PLASMATERIALS, Inc., since 1987, has been supplying the Thin Film Industry with high quality planar and rotatable sputtering targets, backing plates, backing tubes, evaporation materials, crucible liners, e-beam starter sources and bonding services for use in PVD equipment and related applications. These materials are well suited for industrial applications, laboratory processing, research and development applications, pilot production applications as well as full scale production. For more information, please contact one of our sales engineers.

Quantum Design, Inc.
info@qdusa.com
www.qdusa.com

Key Products: Physical Property and Magnetic Property Measurement Systems; Cryogenic Systems

Quantum Design is the leading manufacturer of automated material characterization systems for the physics, chemistry, and materials science research communities. These systems provide temperatures from <0.4 to 1000 K and field strengths up to 16 Tesla. The SQUID-based Magnetic Property Measurement System (MPMS) is the industry standard for ultra-sensitive magnetic measurements. The Physical Property Measurement System (PPMS) is an innovative device designed to provide a wide range of fully automated measurements, including: magnetometry (AC, DC, Torque and VSM), electrical transport (AC, DC, Hall effect and critical current), thermal transport (thermal conductivity, Seebeck coefficient, thermopower), and heat capacity. Both systems can be supplied with an optional cryocooler.

R.D. Mathis Company
info@rdmathis.com
www.rdmathis.com

Key Products: Evaporation Sources; Power Supplies; Gas Purifier

Celebrating our 50th year, the R. D. Mathis Company specializes in the fabrication of high vacuum evaporation sources and materials for the thin film coating and metallizing industries. We offer a comprehensive selection of Tungsten, Molybdenum and Tantalum sources through our catalog as well as custom fabrication to meet your specific coating needs. High Purity evaporation materials are also available. We also offer our “LV Series” Low Voltage, High Current Power Supplies and our “GP 100” Inert Gas Purifier to compliment your evaporation process. ISO9001/AS9100 Certified

Radiant Technologies, Inc.
radiant@ferrodevices.com
www.ferrodevices.com

Key Products: Ferroelectric Testers; Multiferroic Test Systems; Piezoelectric Test Systems

Radiant’s Precision materials testers are designed unlike any other test instruments in the world. They can characterize the individual material properties of dielectric response, remanent polarization, piezoelectricity, pyroelectricity, and electrical leakage with no configuration change. Radiant has introduced a MultiFerroic Test system, Advanced Piezoelectric measuring Software, as well as new Magneto software to characterize the charge response of a piezoelectric or multiferroic sample in the presence of a magnetic field.
Renishaw Inc.
usa@renishaw.com
www.renishaw.com

Key Products: Raman Microscopes; Spectrometers

Renishaw Raman Microscopes provide chemical information at a spatial resolution of less than 1 micron. Renishaw’s spectrometers perform from 244 nm to 830 nm, analyze to within 10 cm⁻¹ of the laser line and include direct 2-D Raman and photoluminescence imaging. Process and Forensic Raman Spectrometers interface options include optical, AFM and SEM microscopes.

RHK Technology, Inc.
info@rhk-tech.com
www.rhk-tech.com

Key Products: SPM Universal Controls; UHV STM; UHV AFM/STM

Imaging the Future of Nanoscience: Choose RHK for fundamental science at the atomic scale. UHV LT-VT AFM-STM Beetle, PanScan, and QuadraProbe SPM extend your research across all surface science fields. RHK’s new R9, a revolutionary single-box AFM-STM ultra-performance Controller, is engineered for advanced applications yet easily operated by new users. Choose RHK for superb performance, value, 20 years of commitment to customer and quality, and a lifetime of experimental success.

Rigaku Americas Corporation
info@rigaku.com
www.rigaku.com

Key Products: X-ray Diffraction Systems; Small Angle X-ray Scattering Systems

Rigaku provides the world’s most complete line of X-ray diffraction and X-ray fluorescence instruments and components, including benchtop XRD and XRF systems, X-ray optics and detectors, the Saturn and SXmini CCD-based single crystal diffractometers for small molecule crystallography, the Ultima IV and SmartLab® multi-purpose diffractometers with SAXS and in-plane capabilities, and the ZSX Primus series of high-powered WDXRF spectrometers with mapping capabilities, in either tube-above or tube-below configurations.

RKI Instruments, Inc.
sales@rkiinstruments.com
www.rkiinstruments.com

Key Products: Photoelectron Spectrometer

RKI Instruments, Inc. is partners with Riken Keiki Co, Ltd. of Tokyo, an innovative instrument company and manufacturer of the Model AC-2. This revolutionary Photoelectron Spectrometer was originally developed by the Institute of Physical and Chemical Research in Japan. The AC-2 is the world’s only Photoelectron Spectrometer that measures Work Function and Ionization Potentials in air. Providing measurements in just 5 minutes, the AC-2 is a fantastic time saving tool for materials surface research.

Rocky Mountain Vacuum Tech, Inc.
contact@rmvac.com
www.rmvac.com

Key Products: Vacuum Equipment; Vacuum Components

Rocky Mountain Vacuum Tech manufactures Vacuum Systems and Components used in research and production environments. RMV supplies revolutionary vacuum systems to those customers that expect exceptional quality and reliability at an affordable price. Through the Mark IV™ line of vacuum products, RMV carries a broad selection of versatile vacuum solutions, ranging from Desktop options (such as the new Desktop R&D Deposition System) to Large Area Coaters capable of mass producing Solar Cell Components and Systems.

Royal Society Publishing
royalsocietypublishing.org/journals

Key Products: Journals

The Royal Society publishes four journals, which regularly publish content in the area of materials science. Journal of the Royal Society Interface and Proceedings A publish individual research articles and reviews, whilst Interface Focus and Philosophical Transactions A publish topical themed issues. For more information about the scope and editorial procedures of our journals, please come and have a chat with our representative Dr. Tim Holt at booth 615. Alternatively, visit our website at http://royalsocietypublishing.org.

Seki Diamond Systems
www.sekdiamond.com

Key Products: Microwave Plasma CVD Systems; Hot Filament CVD Systems; Plasma CVD Systems

Seki Diamond Systems is the leading manufacturer of Microwave Plasma CVD Systems and global distributor for sp3 Diamond Technologies’ Hot Filament CVD Systems and Blue Wave Semiconductor’s HF CVD systems for R&D and EDP single crystal diamond products for R&D and tool applications. Our Microwave Plasma CVD systems are designed for high growth rate, high quality diamond films, single-crystal diamond, carbon nanotubes and advanced material research. The sp3 HF CVD system provides highly uniform deposition of smooth ultra nano crystalline and faceted diamond films for electronics, tools, and wear part coating applications. The Blue Wave HF CVD provides a wide range of excellent diamond growth over a 2-in. area with load-lock.
Simpleware Ltd.
sales@simpleware.com
www.simpleware.com

Key Products: Imaging Processing Software; Mesh Generation Software

Simpleware provides and develops world-leading 3D visualization and mesh generation software which converts 3D scan data (e.g., CT, MicroCT, XMT, MRI, Microscopy) into high-quality computational models. Our Software is being used by researchers across the Material Engineering sectors, including material science, geosciences, oil and gas, aerospace, etc. Simpleware links directly across the Material Engineering sectors, including material science, geosciences, oil and gas, aerospace, etc.

Solartron Analytical (AMETEK)
solartron.info@ametek.com
www.solartronanalytical.com

Key Products: ModuLab MTS; 1260 Impedance Analyzer; Cryostats & Furnaces

Solartron Analytical provides a range of solutions that enable researchers to measure the electrical properties of materials. Testing at high and low temperature is simplified using integrated temperature control facilities, while our comprehensive data acquisition/materials analysis software helps to optimize your materials. The new ModuLab MTS materials test system is on show. This modular system offers unique capabilities with its integrated time domain (I-V), pulse, impedance, C-V, Mott-Schottky and temperature control techniques.

SonoPlot, Inc.
sales@sonoplot.com
www.sonoplot.com

Key Products: Microplotter; Printed Electronics; Materials Printer

SonoPlot designs and sells Microplotter® materials dispensing systems for depositing features as small as 10 microns, with true contiguous lines for superior conductive traces. Our patented dispensing technology enables the deposition of solutions containing graphene, carbon nanotubes, nanoparticles, and polymers, as well as inks with viscosities up to 450 cP. Integrated digital video and precise positioning allow for accurate alignment and dispensing onto a wide range of substrates, including flexible materials.

Semicore Equipment Inc.
sales@semicore.com
www.semicore.com

Key Products: Sputtering Systems; Evaporation Systems; Custom PVD Systems & Components

Semicore Equipment, Inc., a Silicon Valley based manufacturer, supplies, services and supports Sputtering, Evaporation, Thin Film PVD systems for the electronics, optical, solar energy, medical, military, academic and related high technology industries worldwide. Semicore’s products provide state-of-the-art repeatable and reliable quality coating capability on a variety of materials including plastic films, glass, ceramics, metals and hybrid substrates and range from entry-level/R&D to high-performance production level installations at a competitive price. Please call or visit www.semicore.com.

SPI Supplies/Structure Probe, Inc.
spi3spi@2spi.com
www.2spi.com

Key Products: Plasma Etching Systems; Graphene Coated Grids; Ion Milling Systems

Consumable and instrument supplier for sample preparation in the SEM, TEM, optical and AFM disciplines. Featuring the Plasma Prep III low-temperature etcher (optional adapter for TEM Specimen Stage), and the Technoorg Linda Gentle Mill 3 ion mill system for final preparation of TEM/SEM samples. Ask about the Vacu Prep II turbo pumped bench top evaporator. We offer a complete line of TEM grids including membrane windows, Smart grids, ceramic grids and our newly introduced graphene coated grids.

SPECS Surface Nano Analysis, Inc.
usa@specs.com
www.specs.com

Key Products: JT Scanning Tunneling Microscope; NAP PHOIBOS Energy Analyzer; Curlew SPM

SPECS manufactures cutting-edge systems and components for surface analysis in UHV, based on methods like XPS, UPS, AES, ISS, STM, LEEM/PEEM, LEED, SIMS, SNMS and HREELS. We offer a variety of sources for deposition, excitation and charge neutralization as well as analyzers, monochromators and research microscopes like LEEM and STM. A strong focus of our work is on customized systems combining thin film preparation (MBE) with spectroscopic and microscopic options.

STAIB Instruments, Inc.
staib-us@staibinstruments.com
www.staibinstruments.com

Key Products: RHEED; Auger; Surface Analysis

STAIB designs and manufactures high performance, reliable instruments for in-situ material analysis and Multi-Technique Surface Analysis Chambers: Electron Guns for analytical surface studies-flood, microfocus, general purpose, low energy, nano-focus; RHEED systems to study structure, film quality in UHV and high pressure; Auger Probe for in-situ chemical studies during growth; CMA energy spectrometers (Auger, SAM, XPS, and UPS) for analytical surface studies; SEM using our micro-focus guns; Photo-Electron Emission Microscopes-PEEM; ESCA; X-ray Sources.

Springer
exhibits-ny@springer.com
www.springer.com

Key Products: Books; Journals; E-Books

With around 300 new materials science books each year, Springer leads the world in materials science book publishing. And every book since 2005 is available electronically at SpringerLink.com. Come to booth 601 to learn more about using eBooks; and about how publishing your book with Springer will increase your work’s visibility. Also find out more about our core journals including the Journal of Materials Science and EPJ B and E. springer.com/materia...
SunaTech Inc.  supplies  chemicals  and  materials  for R&D in a number of advanced technological sectors, such as organic photovoltaics, organic light emitting diodes, OTFT, bioanalytics and medical diagnostics, etc. Examples of SunaTech’s products are luminescent metal complexes and newly developed monomers/intermediates for low bandgap OPV conducting polymers. The company also provides custom synthesis and contract research for both academic and industrial community under confidential agreement.

SunaTech Inc.  info@sunatech.com  www.sunatech.com

Key Products: OLED; OPV; Intermediates

Sunpower Inc.
www.sunpower.com

Key Products: Stirling Cryocoolers

Sunpower develops and manufactures Stirling cryocoolers. Cryocoolers can be used in place of liquid nitrogen to reach cryogenic temperatures. Why hassle with LN2 when all you have to do is flip a switch? Sunpower’s CryoTel® cryocoolers are the result of over thirty years of technical leadership, innovation and evolution in free-piston Stirling technology. Our cryocoolers are cost effective, exceptionally quiet, low in vibration, and extremely efficient. Since they require no maintenance, our customers can expect many years of high-performance, trouble-free cooling.

Sunpower Inc.  sales@sunpower.com  www.sunpower.com

Key Products: Stirling Cryocoolers

SURFACE Systems & Technology GmbH & Co. KG
info@surface-tec.com  www.surface-tec.com

Key Products: PLD Systems; UHV Cluster Tools; Nanomechanical Heating & Cooling Systems

SURFACE systems+technology is the leading European supplier of PLD technology and has been producing PLD workstations and laser MBE systems for 20 years. In-situ PLD systems for synchrotron beam line applications are the newest addition to the product family. SURFACE laser heating systems and SURFACE nanometrology combine more than 20 years of experience in the area of nanoindentation with the laser know-how of PLD system manufacturing. The result is the laser heating technology for nanoindentation, especially for the MTS/Agilent nanoindenter, for SEM and TEM. The SURFACE online shop distributes exclusive SURFACE LED-chamber lights, the most innovative way to illuminate UHV and HV chambers, and nanoindenter tips for any nanoindenter brand made by Synton.

SURFACE Systems & Technology GmbH & Co. KG  info@surface-tec.com  www.surface-tec.com

Key Products: PLD Systems; UHV Cluster Tools; Nanomechanical Heating & Cooling Systems

Surfx Technologies
info@surfxtechnologies.com  www.surfxtechnologies.com

Key Products: Atmospheric Plasma; Cold Plasma; Bonding

Surfx Technologies sells cold atmospheric plasma products for surface activation and cleaning prior to bonding and/or coating. Surfx Technologies has the technical experience and products necessary to solve virtually every adhesion issue. Surfx Technologies has been solving adhesion issues for the largest and most successful companies for over a decade. Come by their booth for a product demonstration.

Surfx Technologies  info@surfxtechnologies.com  www.surfxtechnologies.com

Key Products: Atmospheric Plasma; Cold Plasma; Bonding

SVT Associates, Inc.
sales@svta.com  www.svta.com

Key Products: Molecular Beam Epitaxy; Pulsed Laser Deposition; Atomic Layer Deposition

SVT Associates offers a full range of UHV thin-film deposition equipment and in-situ process monitoring for advanced materials. We design tailored solutions for emerging materials through MBE, ALD, PVD, PLD, and UHV thin film deposition equipment. With a unique combination of equipment design capability and an onsite film growth laboratory, we have the tools and the process knowledge to provide the best support for your application. Epitaxial and advanced device manufacturing services are available.

SVT Associates, Inc.  info@svta.com  www.svta.com

Key Products: Molecular Beam Epitaxy; Pulsed Laser Deposition; Atomic Layer Deposition

Thermo Scientific
analyze.us@thermofisher.com  www.thermoscientific.com/materialscience

Key Products: Raman Microscope; XPS Spectrometer; X-Ray Microanalysis System

Stop at the Thermo Scientific booth to learn about solutions using molecular spectroscopy, microanalysis and surface analysis products that can improve your results and increase the efficiency of analyses. We help our customers involved in materials research to advance their scientific knowledge, improve manufacturing processes, and protect people and the environment with instruments, scientific equipment and integrated software solutions. Products include Raman and XPS spectrometers as well as EDS and WDS X-ray analysis systems.

Thermo Scientific  info@thermofisher.com  www.thermoscientific.com/materialscience

Key Products: Raman Microscope; XPS Spectrometer; X-Ray Microanalysis System

Toshima Manufacturing Co., Ltd.
staff@material-sys.com  www.material-sys.com

Key Products: Sputtering Targets; MOCVD Precursor; Functional Ceramics

Toshima Manufacturing Co., Ltd., Materials System Division, supplies sputtering targets for several categories of electron fields, such as Battery and Energy, Optoelectronics, Ferro-electronics and Superconductors. Our products have a good reputation among Japanese official research institutions and overseas corporate laboratories. We always strive to provide our customers with new types of materials to meet your satisfaction.

Toshima Manufacturing Co., Ltd.  info@material-sys.com  www.material-sys.com

Key Products: Sputtering Targets; MOCVD Precursor; Functional Ceramics

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Key Products: Sputtering Targets; MOCVD Precursor; Functional Ceramics
United Mineral & Chemical Corporation
inquiry@umccorp.com
www.umccorp.com

Key Products: MBE Source Materials; MBE Equipment; Dopants

United Mineral and Chemical Corporation is a leading supplier of ultra high purity, MBE grade ingots and metal sources including Arsenic, Red Phosphorus, Indium, Gallium, Aluminum, Antimony, Magnesium, Selenium, Silicon and Tellurium. Compounds of III-V materials are also offered. UMC also represents Dr. Eberl MBE-Komponenten for MBE effusion cells, crackers, doping and sublimation sources as well as ancillary equipment and components.

VG Scienta, Inc.
usasales@vgscienta.com
www.vgscienta.com

Key Products: Surface Analysis and UHV Systems and Components; Valves; Sample Manipulators

VG Scienta is the world’s premier supplier of vacuum components, surface analysis instruments, and UHV systems to industry, R&D firms, and the scientific community. VG Scienta remains at the cutting edge of science with over 30 years' experience in HV and UHV technology.

Vigor Gas Purification Technologies Inc.
info@vigor-glovebox.com
www.vigor-glovebox.com

Key Products: Glove Box; Gas Purification System; Solvent Purification System

Vigor is a fast growing technology company. As scientists, engineers and glovebox users ourselves, we have developed innovative technologies and superior quality. Our patented seal technologies reduce glovebox leakage rate by over an order of magnitude vs. the industry standard. This ultra-low leak rate, the most important measure for glovebox performance, demonstrates Vigor’s unmatched quality. We have many years of R&D experience in gas separations/purification, and have developed efficient purifiers. Our customers include leading universities and industry giants around the world.

WiTec Instruments Corp.
info@witec-instruments.com
www.witec-instruments.com

Key Products: Confocal Raman Microscopy; Scanning Near-Field Microscopy; Atomic Force Microscopy

WiTec is a manufacturer of high-resolution optical and scanning probe microscopy solutions for scientific and industrial applications. A modular product line allows the combination of different microscopy techniques such as Raman, NSOM or AFM in one single instrument for flexible analyses of optical, chemical and structural properties of a sample. WiTec headquarters and production facilities are based in Ulm, Germany. WiTec’s US sales office, WiTec Instruments Corp., is located in Knoxville, TN.

XEI Scientific, Inc.
info@evactron.com
www.evactron.com

Key Products: Remote Plasma De-contaminators for SEM, TEM and FIB Chambers; Sample Precleaning

XEI Scientific invented remote plasma cleaning for electron microscopes and has supplied Evactron® De-contaminator systems since 1999 for fast carbon removal from vacuum systems. Clean instruments give optimum performance and the best possible images and data. Evactron® systems provide plasma activated oxidation of hydrocarbons using air as an oxygen source to remove contamination. The versatile Evactron De-Contaminator is supplied in a variety of configurations to solve your contamination problems.

Xradia
info@xradia.com
www.xradia.com

Key Products: UltraXRm; Versa XRm; UltraSPX/XRM for Synchrotron

Xradia designs and manufactures 3D X-ray microscopes for industrial and academic research applications. Xradia computed tomography solutions extend the reach of the core imaging lab with unparalleled high contrast and high resolution imaging capabilities for a large range of sample sizes and shapes, enabling in situ and 4D studies. Xradia’s laboratory product families, the UltraXRm-L and VersaXRm, deliver full volume 3D imaging with resolution down to 50 nm, with synchrotron systems down to 30 nm.
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- **Rhenishaw Inc.**
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### Cryogenic Systems

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### Deposition Equipment, Processes and Materials

- **AIXTRON SE**
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- **Angstrom Thin Film Technologies LLC**
- **Annealsys**

### Electronic and Electrical Properties Instruments

- **AdValue Technology, LLC**
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- **Blue Wave Semiconductors**
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- **Labtec Sales Partners LLC**
- **MANTIS Deposition Ltd.**
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- **Nano-Master, Inc.**
- **Neocera, LLC**
- **NIST**
- **NIST/CNST**
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- **Photonic Cleaning Technologies, LLC**
- **Plasmatronics, Inc.**
- **PVD Products, Inc.**
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### Energy

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Lucas Scientific LLC
MANTIS Deposition Ltd.
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MTI Corporation
NanoAndMore USA Inc.
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Nanovea
Neocera, LLC
NIST/CNST
Nor-Cal Products, Inc.
NT-MDT Co.
Omicron NanoTechnology USA, LLC
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<td>Asylum Research, an Oxford Instruments Company</td>
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Labtec Sales Partners LLC
MTI Corporation
Nano-Master, Inc.
NIST/CNST
Seki Diamond Systems
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VG Scienta, Inc.

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With over 5,700 presentations in 57 topical symposia, the 2013 MRS Spring Meeting will be our largest Spring Meeting yet. The program is an exciting mix of well-established popular topics and leading-edge research that captures the extraordinary progress in materials science and technology.

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The 2013 MRS Spring Meeting will feature 10 tutorials covering a variety of topics to complement the technical sessions. The tutorials are free of charge to all attendees. Tutorial notes are optional at $40—a limited supply is available for on-site purchase at Publications Sales. Pre-ordered tutorial notes will be available for pickup on Monday, April 1, 8:00 am – 3:00 pm, at Moscone West, Level 2, Pre-Paid Tutorial Notes Booth, and 3:00 pm – 6:00 pm at Moscone West, Level 1, Publications Sales; Tuesday through Thursday, 7:30 am – 5:00 pm, at Moscone West, Level 1, Publications Sales.

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**Monday, April 1, Moscone West, Level 2**

**A** Thin-Film Silicon and Related Materials for Solar Cells and Displays  
9:00 am – 10:00 am, Eric A. Schiff, Properties of Thin-Film Si and Related Materials  
10:00 am – 10:30 am, Break  
10:30 am – 11:15 am, Qi Wang, Growth Processes and Technologies for Thin-Film Solar Cells  
11:15 am – 12:00 pm, Eric A. Schiff, Basics of Thin-Film Solar Cells  
1:30 pm – 2:45 pm, Qi Wang, Tandem and Triple Multijunction and a-Si/c-Si Heterojunction Solar Cells  
2:45 pm – 3:15 pm, Break  
3:15 pm – 4:00 pm, Qi Wang, Basics of Thin-Film Transistors and Displays  
4:00 pm – 5:00 pm, Eric A. Schiff, Light Trapping in Thin-Film Solar Cells; Prospects for Efficiency Improvements.

Instructors: Eric A. Schiff, Syracuse University  
Qi Wang, National Renewable Energy Laboratory

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**C** Young Scientist Tutorial on Characterization Techniques for Thin-Film Solar Cells  
9:00 am – 5:00 pm, Room 2001

All presentations will be given by young, yet experienced researchers who are active in the characterization of Si-, III–V-, and chalcogenide-based thin-film solar cells. Although these materials will be discussed as model systems, the presentations will primarily focus on the characterization techniques and should be of interest to participants from other symposia as well. Scientific exchange and discussion between students will be encouraged.

Introduction: Daniel Abou-Ras  
- Fundamental Characterization of Thin-Film Solar Cells  
- Capacitance and Modulated Photocurrent Measurements of Thin-Film Solar Cells  
- Luminescence Techniques for Defect Spectroscopy  
- Atom-Probe Tomography of Thin-Film Solar Cells  
- 1D and 2D Device Simulations of Thin-Film Solar Cells

Instructors:  
Chris Thompson, University of Delaware  
Pete Erslev, National Renewable Energy Laboratory  
David Regesch, University of Luxembourg  
Oana Cojocaru-Mirédin, Max Planck Institute for Iron Research, Germany  
Ana Kanecne, National Renewable Energy Laboratory

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**D** Artificial Photosynthesis and Photovoltaics—Similarities, Differences, Knowledge Transfer  
1:30 pm – 5:00 pm, Room 2002

Maxim P. Nikiforov  
**Theoretical Aspects of Photovoltaics and Photosynthesis**  
Part I will emphasize the description of light as well as parallels in energy conversion mechanisms between artificial photosynthesis and photovoltaics.  
**Practical Aspects of Photovoltaics and Photosynthesis**  
Part II will cover the practical aspects of photovoltaics and photosynthesis, with an emphasis on optical measurements such as absorption, transmission, reflection and quantum efficiency.

Kristzina Gajda-Schrantz  
**Photovoltaic and Electrochemical (PEC) Cells for Solar Fuel Generation Based on Nano-Bio Assemblies**  
Part III will present the theoretical and practical aspects of semiconductor-based PEC cells for solar fuel generation using nano-bio assemblies. It will address the latest developments in the field, both from the oxygen- (anode) and hydrogen- (cathode) generating part of the PEC cell.

Instructors:  
Maxim P. Nikiforov, Argonne National Laboratory  
Kristzina Gajda-Schrantz, Swiss Federal Laboratories for Materials Science and Technology (EMPA), Switzerland

---

**E** Material Assembly and Testing for Batteries  
1:30 pm – 2:20 pm, Venkat Srinivasan, Electrochemical System Modeling  
3:00 pm – 4:00 pm, Vince Battaglia, Laboratory Cell Fabrication and Testing  
4:00 pm – 5:00 pm, Wanli Yang, Synchrotron-Based Soft X-Ray Spectroscopy of Battery Materials

Electrochemical energy-storage devices are hierarchical systems. New materials play a critical role in the improvement of the technology at the base level. Synchrotron-based soft x-ray diagnostic has emerged as a powerful tool to understand the redox process for new battery materials during electrochemical processes. Materials scientists who develop next-generation battery materials will greatly benefit.

Instructors:  
Venkat Srinivasan, Lawrence Berkeley National Laboratory  
Vince Battaglia, Lawrence Berkeley National Laboratory  
Wanli Yang, Lawrence Berkeley National Laboratory

---

**F** Growth and Characterization Techniques for Metal Oxide Nanoscale Structures  
1:30 pm – 5:00 pm, Room 2003

The first part will illustrate the main methods for producing functional metal oxide nanostructures. The presentation will elaborate on the potential of chemical and physical strategies to obtain functional structures by material combinations and discuss the growth—structure—property relations. Besides the conventional methodologies, the presentation will also include description and unique advantages and limitations of novel approaches such as vapor transport and condensation synthesis of one-dimensional single crystalline structures and hierarchical self-assembly using spray deposition.

The second segment introduces the main modern techniques used to characterize the structural, electronic and chemical properties of oxide nanomaterials and their surfaces/interfaces. The new functionalities of these materials, related to their hierarchical self-assembly, ordered structure and single-crystal assembly will be illustrated, and their role in applications such as catalysis, electronics, energy conversion, environmental analysis and health will also be discussed.

Instructors:  
Alberto Vomiero, CNR IDASC Sensor Laboratory, Italy  
Federico Rosei, Institut National de la Recherche Scientifique (INRS), Canada

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**G** Measuring and Predicting Thermal Transport Properties  
1:30 pm – 5:00 pm, Room 2005

The tutorial will describe the fundamentals that underlie cutting-edge experimental and modeling techniques for determining phonon properties and system-level thermal transport properties.

The first segment will describe molecular dynamics simulations and lattice dynamics calculations and how they can be applied to predict phonon properties thermal conductivity and interface thermal conductance. Particular attention will focus on how to model the atomic interactions, choice of simulation parameters and optimizing the speed of the calculation. The advantages and disadvantages of free software packages will be discussed.

The second segment will review experimental techniques to characterize microscale and nanoscale heat transfer in materials and devices. Thin-film thermal conductivity measurement based on the 3D and time-domain thermoreflectance (TDTR) techniques will be described. Picosecond acoustics as a means to study low-frequency phonon propagation in nanomaterials will be reviewed. The tutorial will then focus on nanowire thermal characterization using suspended microheater membranes. Various techniques for submicron temperature measurements such as thermoreflectance imaging, scanning thermal and thermoelectric microscopy and Raman spectroscopy will be presented. There will be a brief description of techniques to characterize the Peltier coefficient and thermoelectric figure of merit of thin films.

Instructors:  
Alan McGaughey, Carnegie Mellon University  
Ali Shakouri, Purdue University
Tutorials

W Nanogenerators and Piezotronics—From Fundamental Science to Technological Applications
9:00 am – 10:15 am
9:00 am – 10:15 am
Hyunsang Hwang, Pohang University of Science and Technology (POSTECH), Republic of Korea
Shinji Yuasa, Nippon Dental School, Japan
Hyunsang Hwang, Pohang University of Science and Technology (POSTECH), Republic of Korea
Shinji Yuasa, Nippon Dental School, Japan

EE Overview of Phase-Change Materials—Physics and Applications
9:00 am – 10:15 am
Simone Raoux
The first segment demonstrates how materials engineering can be used to optimize materials for different applications. It will focus on the materials optimization for various solid-state memory applications such as storage-class memory or DRAM replacement. An outlook will be given to new applications of phase-change materials such as neuromorphic computing.
10:45 am – 12:00 pm
Stephen R. Elliott
The second segment will provide in-depth coverage of theoretical simulations of phase-change materials. While emphasis will be placed on density functional theory combined with molecular dynamics simulations, the focus of the tutorial is not on theory alone, but particularly on explaining and predicting behavior and properties of phase-change materials as observed in experiments and applications. This segment will also touch on reconfigurable electronics and cognitive applications.
1:30 pm – 2:45 pm
Agostino Pirovano
The third part develops the interplay between material properties and modeling of physics and device behavior, while keeping the balance between scientific and technological concerns. This segment will address the physics of threshold switching and the mechanisms involved in the phase transitions, providing both a comprehensive picture of the current understanding of the underlying physical phenomena and details for their investigation with numerical models.
3:30 pm – 4:45 pm
Matthew J. BrightSky
The tutorial concludes with a state-of-the-art technology review on memory devices including design, fabrication, performance and applications.
Instructors: Simone Raoux, IBM T.J. Watson Research Center
Stephen R. Elliott, University of Cambridge, United Kingdom
Agostino Pirovano, Micron, Italy
Matthew J. BrightSky, IBM T.J. Watson Research Center

DD Fundamentals of Emerging Nonvolatile Memories
9:00 am – 5:00 pm
Room 2007
9:30 am – 10:45 am
Matthew J. BrightSky

Cheol Seong Hwang will review recent trends in semiconductor materials and technologies, and the current understanding on the ultimate achievable performance and integration densities. As an alternative to the straight-forward scaling trend, new strategies combining the existing technologies and new functionalities of novel materials will be introduced.

Downscaling is reaching physical limits, alternative strategies for memory storage that integrate multiple functionalities or added values are sought. One important advance in that direction is the development of nonvolatile solid-state memories with high-performance, high-density and fast access times. Resistive RAM (RRAM) technology based on resistive switching in solid-state memories with high-performance, high-density and fast access times. Resistive RAM (RRAM) technology based on resistive switching in solid-state memories with high-performance, high-density and fast access times.

Yoshitaka Matsumoto will review recent trends in the field of spintronics and related topics. He will cover the fundamentals of magnetic tunnel junctions, spin-transfer torque and MRAM.

Cheol Seong Hwang

Massachusetts Institute of Technology
Cheol Seong Hwang, Seoul National University, Republic of Korea
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These books are scheduled for publication by fall or early winter 2013.

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ISBN: 978-1-60511-529-0 Volume: 1552
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Top images: Benefits of low voltage operation: ZnO on Sapphire Images courtesy of P. Vennéguès - CRHEA-CNRS, France.
Bottom images: Images at increasing magnification, all stored in Gatan DigitalMicrograph®; left from PIPS™ II optical camera, others from Gatan Orius™SC2000 camera on TEM, at 200 kV SrRuO_3/PZT/SrRuO_3 thin film on SrTiO_3 (200) with PIPS™ II final polishing step at 300 kVatts.