



# PROGRAM & EXHIBIT GUIDE

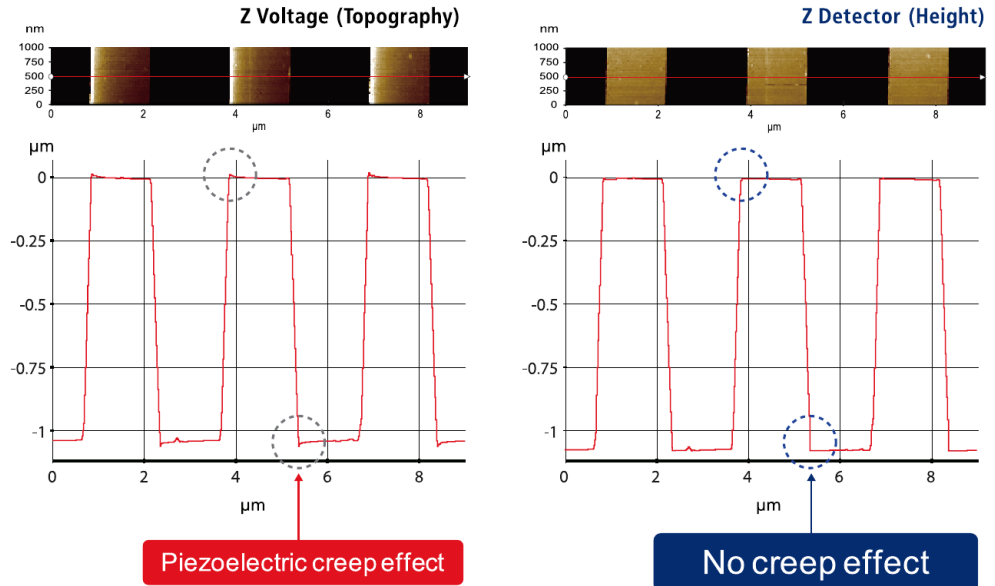
2013 MRS SPRING MEETING & EXHIBIT

April 1-5, 2013 • San Francisco, California

**MRS** MATERIALS RESEARCH SOCIETY  
*Advancing materials. Improving the quality of life.*

[www.mrs.org](http://www.mrs.org)

# ACCURATE AFM TOPOGRAPHY



Sample: 1  $\mu\text{m}$  Nominal Step Height (9  $\mu\text{m}$  x 1  $\mu\text{m}$ , 2048 pixels x 128 lines)

## 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.

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For more program information visit  
[www.mrs.org/s13-itinerary-planner](http://www.mrs.org/s13-itinerary-planner)

# Welcome to the Meeting!

2013 MRS Spring Meeting Chairs



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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<sup>2</sup>, 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 **Yunan 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



2013  
MRS  
SPRING  
MEETING

April 1–5, 2013  
San Francisco, CA

## 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

## A UNIQUE PUBLISHING OPPORTUNITY

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.

## CALL FOR PAPERS

**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](mailto:mrc@mrs.org).

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

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## 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](http://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*

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# 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.

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► **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.

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► **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.

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## VOLUNTEER OPPORTUNITIES

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/](http://www.mrs.org/MyMRS/) to complete a Volunteer Profile form today.

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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!**



LIVE

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?*



LIVE

### FEATURED EVENTS

#### Fred Kavli Distinguished Lectureship in Nanoscience

**Younan Xia**, Georgia Institute of Technology  
*Colloidal Metal Nanocrystals—Shape Control, Symmetry Breaking and Niche Applications*

#### Plenary Session

**Arun Majumdar**, Google Inc.  
*A New Industrial Revolution for a Sustainable Energy Future*

#### Student-Organized Energy Materials Forum

**Technology Innovation Forum**  
*Innovation and Entrepreneurial Excellence*

### TUTORIAL SESSIONS

#### Tutorial C

*Young Scientist Tutorial on Characterization Techniques for Thin-Film Solar Cells*

#### Tutorial F

*Material Assembly and Testing for Batteries*

#### Tutorial W

*Nanogenerators and Piezotronics—From Fundamental Science to Technological Applications*

LIVE

### TECHNICAL SESSIONS

#### Symposium E

*Materials and Integration Challenges for Energy Generation and Storage in Mobile Electronic Devices*

#### Symposium NN

*Multifunctional Biomaterials*

Plus **15 additional technical sessions** will be captured with audio and presentation slides

### POSTER SESSIONS

Each night's nominated and winning **Best Poster Presentations** will also be available OnDemand®

### BEST OF MRS

A Best of MRS broadcast premieres Thursday at 7:00 pm. View highlights from the week that was—technical Meeting content, award talks, special events, interviews and more. It's **Your MRS, Your Way!**

[www.mrs.org/on-demand](http://www.mrs.org/on-demand)



## Featured at 2013 MRS Spring Meeting

**Interview with Prof. Millie Dresselhaus**  
Millie Dresselhaus is one of the most eminent and influential women in the field of Materials Science. She spoke to MRStv about winning the Kavli Prize and a lifetime of achievements.

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](http://www.mrs.org/on-demand).



education

MRS TV is brought to you by WebsEdge/Education—experts in connecting issues and their audiences through the power of television.

# Monday · Daily Schedule of Events

EVENT TITLE	LOCATION	EVENT TIME	PAGE
Cyber Café	Mosccone West, Level 2, Lobby	7:00 am - 6:00 pm	46
Information	Mosccone West, Level 1, Lobby	7:00 am - 6:00 pm	
Publication Sales/Tutorial Notes	Mosccone West, Level 1, Lobby	7:00 am - 6:00 pm	44
Registration	Mosccone West, Level 1, Lobby	7:00 am - 6:00 pm	
Speaker Ready Room	Mosccone West, Level 3, Alcove 3024	7:30 am - 5:00 pm	
Materials Voice	Mosccone West, Level 2, Lobby	8:00 am - 4:00 pm	54
Public Outreach Center: Inside Science TV NISE Network and NanoDays NOVA MAKING STUFF Strange Matter Strange Matter Green Earth	Mosccone West, Level 2, Lobby	8:00 am - 4:00 pm	54
Symposium Assistant Desk	Mosccone West, Level 2, Lobby	8:00 am - 3:00 pm	
Tutorial Notes Pre-paid Pickup	Mosccone West, Level 2, Lobby	8:00 am - 3:00 pm	96
Tutorial DD	Mosccone West, Level 2, Room 2008	8:30 am - 5:00 pm	97
Technical Session	Mosccone West, Level 2	8:30 am - 5:00 pm	
Science as Art—Prep Only	Mosccone West, Level 2, Lobby	9:00 am - 5:00 pm	
Tutorial A	Mosccone West, Level 2, Room 2000	9:00 am - 5:00 pm	96
Tutorial C	Mosccone West, Level 2, Room 2001	9:00 am - 5:00 pm	96
Tutorial EE	Mosccone West, Level 2, Room 2007	9:00 am - 5:00 pm	97
Student-Organized Energy Materials Forum	Mosccone West, Level 2, Room 2014	9:00 am - 5:30 pm	36
Coffee Break	Mosccone West, Level 2, Lobby	9:30 am - 10:30 am	
Hands-On Nano Coffee Hours	Mosccone West, Level 2, Lobby	9:30 am - 10:30 am	55
Career Center—Job Candidate Registration	Mosccone West, Level 1, Exhibit Hall	1:00 pm - 4:00 pm	51
Tutorial D	Mosccone West, Level 2, Room 2002	1:30 pm - 5:00 pm	96
Tutorial F	Mosccone West, Level 2, Room 2004	1:30 pm - 5:00 pm	96
Tutorial S	Mosccone West, Level 2, Room 2003	1:30 pm - 5:00 pm	96
Tutorial V	Mosccone West, Level 2, Room 2005	1:30 pm - 5:00 pm	96
Tutorial W	Mosccone West, Level 2, Room 2006	1:30 pm - 5:00 pm	97
Tutorial XX	Mosccone West, Level 2, Room 2009	1:30 pm - 5:00 pm	97
Coffee Break	Mosccone West, Level 2, Lobby	2:30 pm - 3:30 pm	
Hands-On Nano Coffee Hours	Mosccone West, Level 2, Lobby	2:30 pm - 3:30 pm	55
Proceedings Editor Demonstration	Mosccone West, Level 3, Room 3002	3:00 pm - 6:00 pm	
Professional Development— Making the Most of Broadcast Media Workshop	Mosccone West, Level 3, Room 3000	3:00 pm - 5:00 pm	50
Professional Development— Mastering Science Presentations Seminar	Marriott Marquis, Yerba Buena Level, Nob Hill AB	5:30 pm - 7:00 pm	50
Symposium Assistant Training	Marriott Marquis, Golden Gate Level, Salon C2	6:00 pm - 7:00 pm	
Fred Kavli Distinguished Lectureship in Nanoscience <b>Younan Xia</b> , Georgia Institute of Technology	Marriott Marquis, Golden Gate Level, Salon AB	7:00 pm - 8:00 pm	37
Student Mixer	Marriott Marquis, Yerba Buena Level—Foyer	7:00 pm - 8:00 pm	59

## BADGES

### CONTENT

The content of this book is based on information available prior to printing.

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.



# Tuesday · Daily Schedule of Events



EVENT TITLE	LOCATION	EVENT TIME	PAGE
Cyber Café	Marriott Marquis, Golden Gate Level, Salon C3	7:30 am - 5:00 pm	46
	Moscone West, Level 2, Lobby	7:30 am - 5:30 pm	46
Information	Westin, 2nd Floor, Lobby	7:30 am - 5:30 pm	
	Moscone West, Level 1, Lobby	7:30 am - 6:00 pm	
Professional Development – Technical Poster Design Seminar	Marriott Marquis, 4th Floor, Pacific A	7:30 am - 8:30 am	50
Publications Sales/Tutorial Notes	Moscone West, Level 1, Lobby	7:30 am - 5:00 pm	44
Registration	Moscone West, Level 1, Lobby	7:30 am - 5:00 pm	
Speaker Ready Room	Moscone West, Level 3, Alcove 3024	7:30 am - 5:00 pm	
	Marriott Marquis, Golden Gate Level, Salon C3	7:30 am - 5:00 pm	
	Westin, 2nd Floor, University	7:30 am - 5:00 pm	
Symposium Assistant Desk	Marriott Marquis, Yerba Buena Level—Foyer	7:30 am - 5:00 pm	
	Moscone West, Level 2, Lobby	7:30 am - 5:00 pm	
	Westin, 2nd Floor, Lobby	7:30 am - 5:00 pm	
Materials Voice	Moscone West, Level 2, Lobby	8:00 am - 4:00 pm	54
Public Outreach Center: Inside Science TV NISE Network and NanoDays NOVA MAKING STUFF Strange Matter Strange Matter Green Earth	Moscone West, Level 2, Lobby	8:00 am - 4:00 pm	54
Science as Art—Prep Only	Moscone West, Level 2, Lobby	8:00 am - 10:00 am	
Technical Sessions	Moscone West, Levels 2 and 3	8:00 am - 5:00 pm	
	Marriott Marquis, Yerba Buena and Golden Gate Levels	8:00 am - 5:00 pm	
	Westin, 2nd and 3rd Floors	8:00 am - 5:00 pm	
Poster Session—Authors' Check-In	Marriott Marquis, Yerba Buena Level—Foyer	9:00 am - 5:00 pm	26
Poster Session—Authors Post Papers	Marriott Marquis, Yerba Buena Level, Salons 7-8-9	9:00 am - 5:00 pm	26
Coffee Break	Marriott Marquis, Yerba Buena Level—Foyer	9:30 am - 10:30 am	
	Moscone West, Levels 2 and 3, Lobby	9:30 am - 10:30 am	
	Westin, 2nd and 3rd Floors, Lobby	9:30 am - 10:30 am	
Exhibit	Moscone West, Level 1, Exhibit Hall	9:30 am - 6:00 pm	67
Exhibit Hall Event—Caricature Sketches	Moscone West, Level 1, Exhibit Hall	9:30 am - 5:00 pm	39
Hands-On Nano Coffee Hours	Moscone West, Level 2, Lobby	9:30 am - 10:30 am	55
Science as Art—Voting	Moscone West, Level 1, Exhibit Hall	9:30 am - 6:00 pm	38
Career Center	Moscone West, Level 1, Exhibit Hall	10:00 am - 5:00 pm	51
Exhibit Hall Event—FBEI Presentation: Mind/Muscle Controlled Games	Moscone West, Level 1, Exhibit Hall	10:00 am - 10:30 am	39
Exhibit Hall Event—FBEI Hands-On Activities	Moscone West, Level 1, Exhibit Hall	10:30 am - 1:00 pm	39
Graduate Student Award Finalists' Special Talk Sessions	Marriott Marquis, 4th Floor, Pacific B	12:00 pm - 2:45 pm	30
	Marriott Marquis, 4th Floor, Pacific C	12:00 pm - 2:45 pm	30
Information	Marriott Marquis, Golden Gate Level—Foyer	12:00 pm - 5:30 pm	
Outstanding Young Investigator Award Talk— Symposium X Presentation <b>Alexandra Boltasseva</b> , Purdue University	Marriott Marquis, Golden Gate Level, Salon B	12:15 pm - 1:00 pm	30
Coffee Break	Marriott Marquis, Yerba Buena Level—Foyer	2:30 pm - 3:30 pm	
	Moscone West, Levels 2 and 3, Lobby	2:30 pm - 3:30 pm	
	Westin, 2nd and 3rd Floors, Lobby	2:30 pm - 3:30 pm	
Hands-On Nano Coffee Hours	Moscone West, Level 2, Lobby	2:30 pm - 3:30 pm	55
Exhibit Hall Event—FBEI Presentation: Monitoring Happiness for Improved Workplace Performance	Moscone West, Level 1, Exhibit Hall	2:30 pm - 3:00 pm	39
Exhibit Hall Event—FBEI Hands-On Activities	Moscone West, Level 1, Exhibit Hall	3:00 pm - 5:30 pm	39
Congressional Science and Engineering Fellowship Program Information Session	Marriott Marquis, 4th Floor, Pacific E	5:00 pm - 6:00 pm	59
Exhibit Hall Event— Wine and Cheese Reception	Moscone West, Level 1, Exhibit Hall	5:00 pm - 6:00 pm	39
Poster Session—Judges ONLY	Marriott Marquis, Yerba Buena Level, Salons 7-8-9	5:00 pm - 8:00 pm	26
Professional Development – Making the Most of Broadcast Media Workshop	Marriott Marquis, 4th Floor, Pacific A	5:00 pm - 7:00 pm	50
Professional Development – ABET Retraining Session	Marriott Marquis, 2nd Floor, Foothill E	7:15 pm - 9:30 pm	51
Poster Session—Attendee Viewing	Marriott Marquis, Yerba Buena Level, Salons 7-8-9	8:00 pm - 11:00 pm	26

# Wednesday · Daily Schedule of Events

EVENT TITLE	LOCATION	EVENT TIME	PAGE
Information	Marriott Marquis, Golden Gate Level—Foyer	7:00 am - 6:30 pm	
Women in Materials Science & Engineering Breakfast	Marriott Marquis, 2nd Floor, Club Room	7:00 am - 8:30 am	52
Cyber Café	Marriott Marquis, Golden Gate Level, Salon C3	7:30 am - 5:00 pm	46
	Moscone West, Level 2, Lobby	7:30 am - 5:30 pm	46
Information	Moscone West, Level 1, Lobby	7:30 am - 5:30 pm	
	Westin, 2nd Floor, Lobby	7:30 am - 5:30 pm	
Professional Development— Mastering Science Presentations Seminar	Marriott Marquis, 4th Floor, Pacific A	7:30 am - 8:30 am	50
Publications Sales/Tutorial Notes	Moscone West, Level 1, Lobby	7:30 am - 5:00 pm	44
Registration	Moscone West, Level 1, Lobby	7:30 am - 5:00 pm	
Speaker Ready Room	Moscone West, Level 3, Alcove 3024	7:30 am - 5:00 pm	
	Marriott Marquis, Golden Gate Level, Salon C3	7:30 am - 5:00 pm	
	Westin, 2nd Floor, University	7:30 am - 5:00 pm	
Symposium Assistant Desk	Marriott Marquis, Yerba Buena Level—Foyer	7:30 am - 5:00 pm	
	Moscone West, Level 2, Lobby	7:30 am - 5:00 pm	
	Westin, 2nd Floor, Lobby	7:30 am - 5:00 pm	
Government Agency Forum	Marriott Marquis, Golden Gate Level, Salon A	8:00 am - 1:00 pm	47
Materials Voice	Moscone West, Level 2, Lobby	8:00 am - 4:00 pm	54
Public Outreach Center: Inside Science TV NISE Network and NanoDays NOVA MAKING STUFF Strange Matter Strange Matter Green Earth	Moscone West, Level 2, Lobby	8:00 am - 4:00 pm	54
Technical Sessions	Moscone West, Levels 2 and 3	8:00 am - 5:00 pm	
	Marriott Marquis, Yerba Buena and Golden Gate Levels	8:00 am - 5:00 pm	
	Westin, 2nd and 3rd Floors	8:00 am - 5:00 pm	
Energy Materials Forum	Marriott Marquis, Golden Gate Level, Salon B	9:00 am - 5:00 pm	40
Poster Session—Authors' Check-In	Marriott Marquis, Yerba Buena Level—Foyer	9:00 am - 5:00 pm	26
Poster Session—Authors Post Papers	Marriott Marquis, Yerba Buena Level, Salons 7-8-9	9:00 am - 5:00 pm	26
Coffee Break	Marriott Marquis, Yerba Buena Level—Foyer	9:30 am - 10:30 am	
	Moscone West, Levels 2 and 3, Lobby	9:30 am - 10:30 am	
	Westin, 2nd and 3rd Floors, Lobby	9:30 am - 10:30 am	
Exhibit— <b>LAST DAY!</b>	Moscone West, Level 1, Exhibit Hall	9:30 am - 5:30 pm	67
Exhibit Hall Event—Caricature Sketches	Moscone West, Level 1, Exhibit Hall	9:30 am - 5:00 pm	39
Hands-On Nano Coffee Hours	Moscone West, Level 2, Lobby	9:30 am - 10:30 am	55
Science as Art—Voting	Moscone West, Level 1, Exhibit Hall	9:30 am - 12:00 pm	38
Career Center — <b>LAST DAY!</b>	Moscone West, Level 1, Exhibit Hall	10:00 am - 5:00 pm	51
Exhibit Hall Event—FBEI Presentation: Piano and Bugs Controlled by Static Charges	Moscone West, Level 1, Exhibit Hall	10:00 am - 10:30 am	39
Exhibit Hall Event—FBEI Hands-On Activities	Moscone West, Level 1, Exhibit Hall	10:30 am - 1:00 pm	39
Mid-Career Researcher Award Talk— Symposium X Presentation <b>John A. Rogers</b> , University of Illinois at Urbana-Champaign	Marriott Marquis, Golden Gate Level, Salon B	12:15 pm - 1:00 pm	31
Coffee Break	Marriott Marquis, Yerba Buena Level—Foyer	2:30 pm - 3:30 pm	
	Moscone West, Levels 2 and 3, Lobby	2:30 pm - 3:30 pm	
	Westin, 2nd and 3rd Floors, Lobby	2:30 pm - 3:30 pm	
Hands-On Nano Coffee Hours	Moscone West, Level 2, Lobby	2:30 pm - 3:30 pm	55
Exhibit Hall Event—FBEI Presentation: LEDs Used as Solar Cells	Moscone West, Level 1, Exhibit Hall	2:30 pm - 3:00 pm	39
Exhibit Hall Event—Ice Cream Social	Moscone West, Level 1, Exhibit Hall	2:30 pm - 3:30 pm	39
Exhibit Hall Event—FBEI Hands-On Activities	Moscone West, Level 1, Exhibit Hall	3:00 pm - 5:30 pm	39
Science as Art—Announcement of Winners	Moscone West, Level 1, Exhibit Hall	3:00 pm - 3:15 pm	38
Poster Session—Judges ONLY	Marriott Marquis, Yerba Buena Level, Salons 7-8-9	5:00 pm - 8:00 pm	26
Professional Development— Technical Poster Design Seminar	Marriott Marquis, 4th Floor, Pacific A	5:00 pm - 6:00 pm	50
MRS Awards Ceremony and Plenary Session <b>Arun Majumdar</b> , Google, Inc.	Marriott Marquis, Golden Gate Level, Salon AB	6:30 pm - 8:00 pm	41
Poster Session—Attendee Viewing	Marriott Marquis, Yerba Buena Level, Salons 7-8-9	8:00 pm - 11:00 pm	26



# Thursday · Daily Schedule of Events



EVENT TITLE	LOCATION	EVENT TIME	PAGE
Information	Marriott Marquis, Golden Gate Level—Foyer	7:00 am - 6:00 pm	
Cyber Café	Mosccone West, Level 2, Lobby	7:30 am - 5:30 pm	46
Information	Mosccone West, Level 1, Lobby	7:30 am - 5:30 pm	
	Westin, 2nd Floor, Lobby	7:30 am - 5:30 pm	
Publications Sales/Tutorial Notes	Mosccone West, Level 1, Lobby	7:30 am - 5:00 pm	44
Registration	Mosccone West, Level 1, Lobby	7:30 am - 5:00 pm	
Speaker Ready Room	Mosccone West, Level 3, Alcove 3024	7:30 am - 5:00 pm	
	Westin, 2nd Floor, University	7:30 am - 5:00 pm	
Symposium Assistant Desk	Marriott Marquis, Golden Gate Level—Foyer	7:30 am - 5:00 pm	
	Mosccone West, Level 2, Lobby	7:30 am - 5:00 pm	
	Westin, 2nd Floor, Lobby	7:30 am - 5:00 pm	
Materials Voice	Mosccone West, Level 2, Lobby	8:00 am - 4:00 pm	54
Public Outreach Center: Inside Science TV NISE Network and NanoDays NOVA MAKING STUFF Strange Matter Strange Matter Green Earth	Mosccone West, Level 2, Lobby	8:00 am - 4:00 pm	54
Technical Sessions	Mosccone West, Levels 2 and 3	8:00 am - 5:00 pm	
	Marriott Marquis, Yerba Buena and Golden Gate Levels	8:00 am - 5:00 pm	
	Westin, 2nd and 3rd Floors	8:00 am - 5:00 pm	
Science as Art—Viewing	Mosccone West, Level 2	8:30 am - 5:00 pm	38
Poster Session—Authors' Check-In	Marriott Marquis, Golden Gate Level—Foyer	9:00 am - 5:00 pm	26
Poster Session—Authors Post Papers	Marriott Marquis, Yerba Buena Level, Salons 7-8-9	9:00 am - 5:00 pm	26
Coffee Break	Marriott Marquis, Golden Gate Level—Foyer	9:30 am - 10:30 am	
	Mosccone West, Levels 2 and 3, Lobby	9:30 am - 10:30 am	
	Westin, 2nd and 3rd Floors, Lobby	9:30 am - 10:30 am	
Hands-On Nano Coffee Hours	Mosccone West, Level 2, Lobby	9:30 am - 10:30 am	55
Technology Innovation Forum V	Mosccone West, Level 3, Room 3003	9:30 am - 3:15 pm	42
Innovation in Materials Characterization Award Talk—Symposium X Presentation <b>D. Bruce Chase</b> , University of Delaware and Pair Technologies LLC	Marriott Marquis, Golden Gate Level, Salon B	12:05 pm - 12:45 pm	33
Innovation in Materials Characterization Award Talk—Symposium X Presentation <b>John F. Rabolt</b> , University of Delaware	Marriott Marquis, Golden Gate Level, Salon B	12:45 pm - 1:25 pm	33
Coffee Break	Marriott Marquis, Golden Gate Level—Foyer	2:30 pm - 3:30 pm	
	Mosccone West, Levels 2 and 3, Lobby	2:30 pm - 3:30 pm	
	Westin, 2nd and 3rd Floors, Lobby	2:30 pm - 3:30 pm	
Hands-On Nano Coffee Hours	Mosccone West, Level 2, Lobby	2:30 pm - 3:30 pm	55
Poster Session—Judges ONLY	Marriott Marquis, Yerba Buena Level, Salons 7-8-9	5:00 pm - 8:00 pm	26
Poster Session—Attendee Viewing	Marriott Marquis, Yerba Buena Level, Salons 7-8-9	8:00 pm - 11:00 pm	26

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EVENT TITLE	LOCATION	EVENT TIME	PAGE
Cyber Café	Moscone West, Level 2, Lobby	7:30 am - 1:30 pm	46
Information	Moscone West, Level 1, Lobby	7:30 am - 1:30 pm	
Registration	Moscone West, Level 1, Lobby	7:30 am - 12:00 pm	
Speaker Ready Room	Moscone West, Level 3, Alcove 3024	7:30 am - 3:00 pm	
Symposium Assistant Desk	Moscone West, Level 2, Lobby	7:30 am - 5:00 pm	
Public Outreach Center: Inside Science TV NISE Network and NanoDays NOVA MAKING STUFF Strange Matter Strange Matter Green Earth	Moscone West, Level 2, Lobby	8:00 am - 12:00 pm	54
Technical Sessions	Moscone West, Levels 2 and 3	8:00 am - 5:00 pm	
Science as Art—Viewing	Moscone West, Level 2, Lobby	8:30 am - 12:00 pm	38
Coffee Break	Moscone West, Levels 2 and 3, Lobby	9:30 am - 10:30 am 2:30 pm - 3:30 pm	

## High Resolution RBS

MRS Booth 305

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.

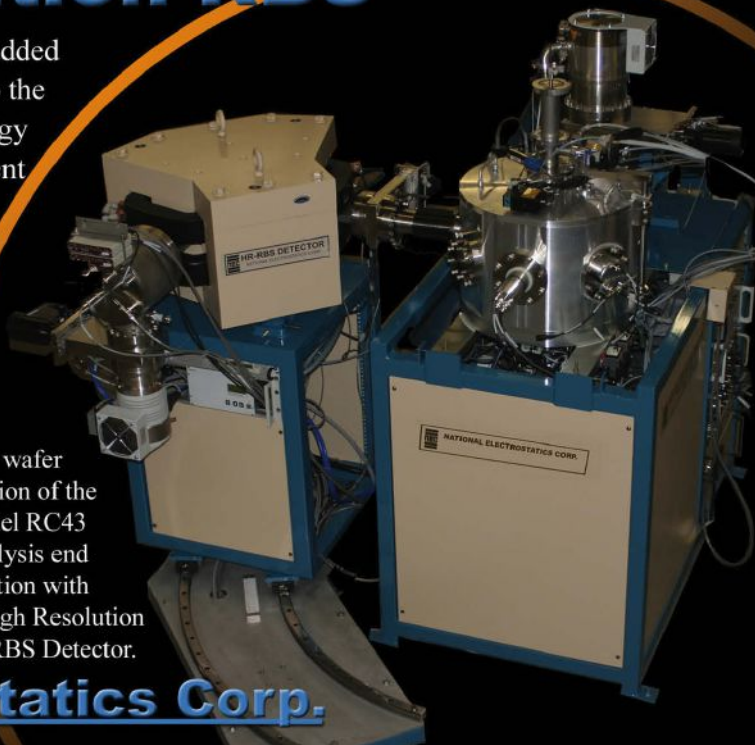
Full wafer version of the model RC43 analysis end station with High Resolution RBS Detector.

[www.pelletron.com](http://www.pelletron.com)

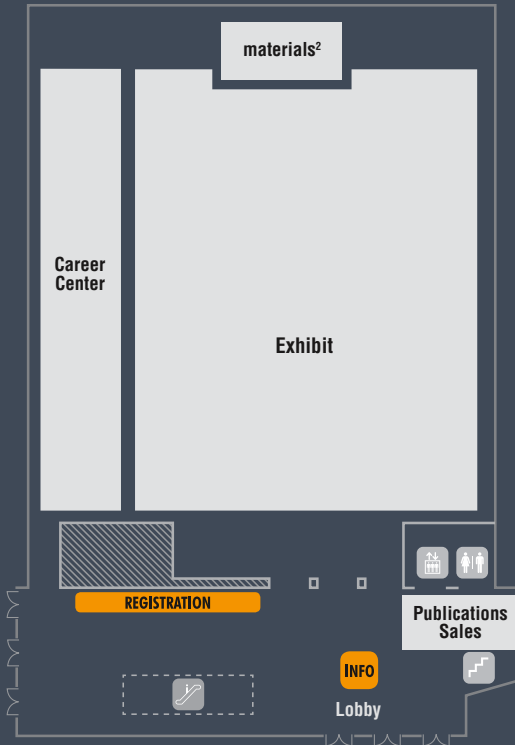
Phone: 608-831-7600

E-mail: [nec@pelletron.com](mailto:nec@pelletron.com)

**National Electrostatics Corp.**

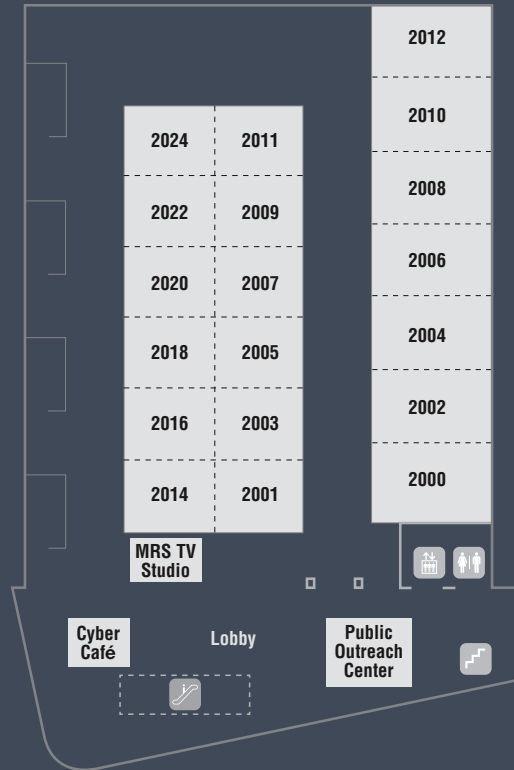






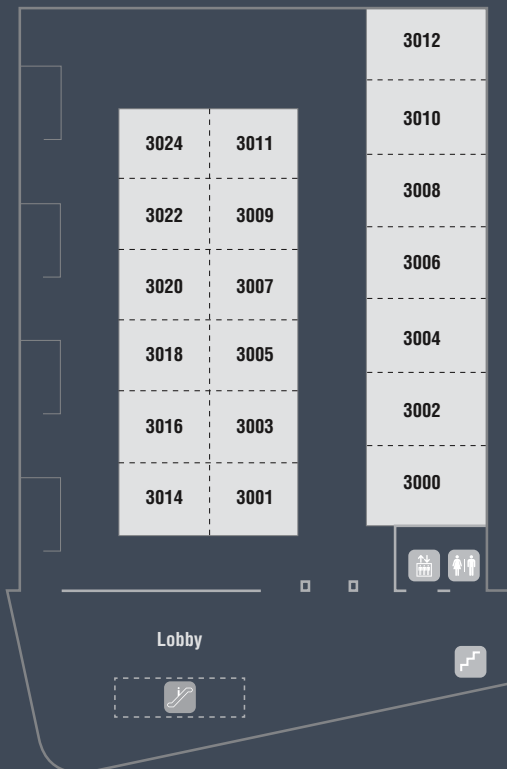
## LEVEL ONE

Caricature Sketches .....	Exhibit Hall
Ice Cream Treats .....	Exhibit Hall
Science as Art Competition .....	Exhibit Hall
Wine and Cheese Reception .....	Exhibit Hall
Career Center .....	Exhibit Hall
Functionalized Bricks with Embedded Intelligence Presentations .....	Exhibit Hall



## LEVEL TWO

Hands-on Nano Coffee Break .....	Lobby
Science as Art Preparation .....	Lobby
Symposium Assistant Desk .....	Lobby
Technical Sessions .....	2000-2024
Tutorials .....	2000-2009
Student-Organized Energy Materials Forum .....	2014



## LEVEL THREE

Speaker Ready Room .....	Alcove 3014
Technical Sessions .....	3000-3024
Technology Innovation Forum .....	3003
Proceedings/Editor Demo Training .....	3002
Making the Most of Broadcast Media Workshop .....	3000

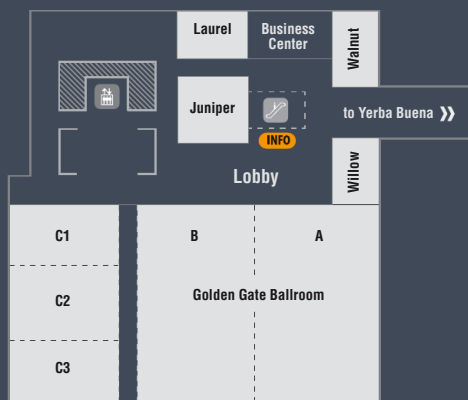


# San Francisco Marriott Marquis



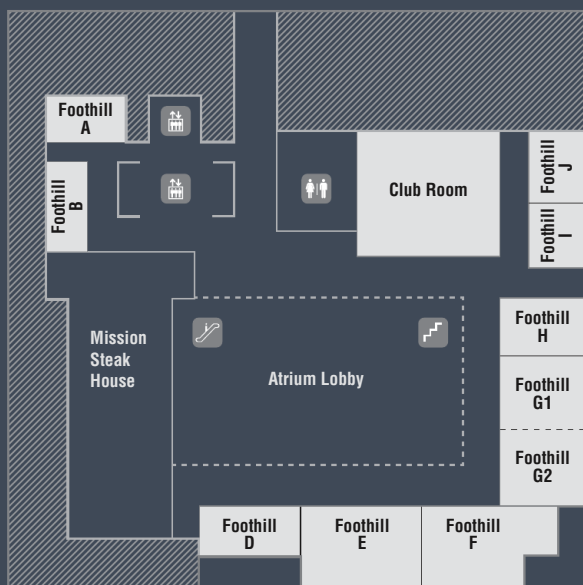
## YERBA BUENA LEVEL

Poster Sessions ..... Salons 7-9  
 Student Mixer ..... Foyer  
 Mastering Science  
 Presentations Seminar ..... Nob Hill A/B  
 Symposium Assistant Desk ..... Foyer



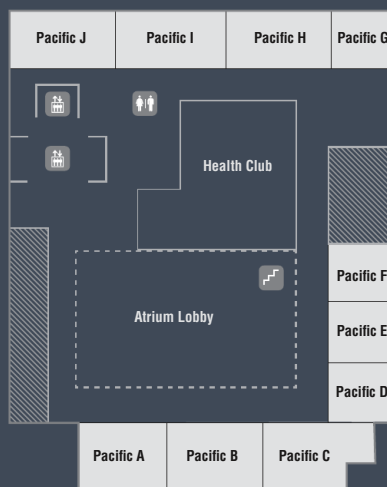
## GOLDEN GATE LEVEL

Information ..... Lobby  
 Symposium Assistant Desk ..... Lobby  
 Awards Ceremony & Plenary Session ..... AB  
 Energy Materials Forum ..... B  
 Fred Kavli Distinguished  
 Lectureship in Nanoscience ..... B  
 Symposium X/Award Talks ..... B  
 Symposium Assistants Training ..... C2  
 Speaker Ready Room ..... C3  
 Cyber Café ..... C3  
 Government Agency Forum ..... A



## 2ND FLOOR

ABET Retraining Session ..... Foothill E  
 University Chapter  
 Representatives Luncheon ..... Club Room  
 Women in Materials Science  
 & Engineering Breakfast ..... Club Room



## 4TH FLOOR

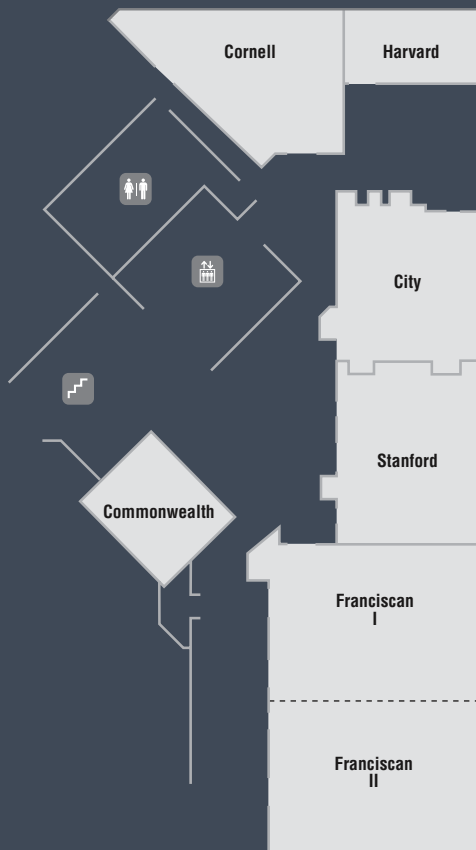
Graduate Student Award Finalists'  
 Special Talk Sessions ..... Pacific B/C  
 Graduate Student Award—  
 Judges Luncheon ..... Pacific D  
 Making the Most of Broadcast  
 Media Workshop ..... Pacific A  
 Mastering Science Presentations Seminar ..... Pacific A  
 Technical Poster Design Seminar ..... Pacific A  
 Congressional Fellowship  
 Program Information Session ..... Pacific E





## SECOND FLOOR

Speaker Ready Room ..... University  
 Technical Sessions ..... Metropolitan Ballroom I, II, III  
 Technical Sessions ..... Olympic  
 Technical Sessions ..... Concordia  
 Information ..... Lobby  
 Symposium Assistant Desk ..... Lobby



## THIRD FLOOR

Technical Sessions ..... Franciscan I, II  
 Technical Sessions ..... Stanford  
 Technical Sessions ..... City

# Oral Presentations

Poster session details for each symposium can be found on page 26 and complete Tutorial details on page 36

	SYMPOSIUM	LOCATION	MONDAY		TUESDAY		
			AM	PM	AM	PM	Poster
ENERGY	<b>A</b> Film Silicon Science and Technology	Moscene West, Room 2000	Tutorial	Tutorial	A1: Amorphous and Nanocrystalline Silicon Solar Cells (Dedicated to Stanford Ovshinsky) A2: Amorphous and Nanocrystalline Silicon Solar Cells—Industrial Applications	A3: Light Trapping in Film Si Solar Cells A4: Material and Device Characterization and Simulation	
	<b>B</b> Organic and Hybrid Photovoltaic Materials and Devices	Moscene West, Room 2014			B1: New Donor Materials	B2: Morphology	
	<b>C</b> Thin-Film Compound Semiconductor Photovoltaics	Moscene West, Room 2001	Tutorial	Tutorial	C1: Solar Cell Characterization I C2: CIGS Growth	C3: Kesterite I C4: CIGS Electronic Structure I	C5
	<b>D</b> From Molecules to Materials—Pathways to Artificial Photosynthesis	Moscene West, Room 2002		Tutorial	D1: CO <sub>2</sub> Sequestration D2: Dye-Sensitized Solar Cells	D3: From Theory to Devices	
	<b>E</b> Materials and Integration Challenges for Energy Generation and Storage in Mobile Electronic Devices	Moscene West, Room 2003			E1: Supercapacitors	E2: Electronics for Mobile Devices	E3
	<b>F</b> Materials for Vehicular and Grid Energy Storage	Moscene West, Room 2004		Tutorial	F1: Anne Dillon Memorial Talk F2: Lithium-Ion Cathode I	F3: Lithium-Ion Cathode II F4: Modeling	F5
	<b>G</b> Electrochemical Interfaces for Energy Storage and Conversion—Fundamental Insights from Experiments and Computations	Moscene West, Room 2005			G1: Batteries—Cathodes I G2: Batteries—Phase Transformation	G3: Batteries—Anodes G4: Batteries—Cathodes II	G5
	<b>H</b> Nanoscale Thermoelectrics—Materials and Transport Phenomena II	Moscene West, Room 2006			H1: Novel Materials and New Approaches I	H2: Superlattices and Thin Films	H3
	<b>I</b> Materials for Solid-State Refrigeration	Moscene West, Room 2007			I1: Magnetocaloric Effect for Solid-State Refrigeration I I2: Magnetocaloric Effect for Solid-State Refrigeration II	I3: Engineering Thermal Conductivity	I4
	<b>J</b> <i>In Situ</i> Characterization Methods in Energy Materials Research	Moscene West, Room 2008			J1: Electron Microscopy I J2: Electron Microscopy II	J3: Neutron and Synchrotron Radiation J4: Scanning Probe and Electron Microscopies	
	<b>K</b> Materials for Sustainable Development	Moscene West, Room 2020					

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# Oral Presentations



	WEDNESDAY			THURSDAY			FRIDAY	
	AM	PM	Poster	AM	PM	Poster	AM	PM
<b>A</b>	A5: Silicon Heterojunction Solar Cells A6: Defect and Transport (Dedicated to J. David Cohen)	A7: Novel Silicon-Based Devices A8: Silicon Film Materials and Devices—30 Years at MRS		A9: Crystalline Si-Based Novel Solar Cells and Device Architectures A10: Nanostructured Silicon and Related Novel Materials I	A11: Nanostructured Silicon and Related Novel Materials II A12: Fabrication of Silicon Layers and Structures	A13 A14 A15 A16 A17 A18 A19	A20: Crystallization of Thin-Film Silicon A21: Recent Advances in Film Silicon Devices and Materials	
<b>B</b>	B3: Interface B4: New Acceptor Materials	B5: Advanced Device Structures	B6	B7/JJ9: Joint Session: Spectroscopy and Microstructure of Organic Photovoltaic Materials; Moscone West, Room 2010/2012 B8: Light Trapping	B9: Device Physics B10: Transparent Electrodes	B11	B12: Quantum Dots Photovoltaic Materials and Devices B13: Hybrid Solar Cell and Dye-Sensitized Solar Cells I	B14: Hybrid Solar Cell and Dye-Sensitized Solar Cells II B15: Stability and Large Area Production
<b>C</b>	C6: Kesterite II C7: CIGS Electronic Structure II	C8: Grain Boundaries C9: Solar Cell Characterization II	C10	C11: Buffer Layers C12: Kesterite III	C13: CdTe Electronic Structure C14: New Processes and Materials		C15: Interfaces and Contacts C16: Manufacturing Issues	
<b>D</b>	D4: <i>In situ</i> and Operando Studies D5: Nanostructures and Self-Assembly for Solar Water Splitting	D6: Nano-Bio Hybrid Systems	D7	D8: Catalytic Processes	D9: Charge Transfer across Interfaces		D10: New Materials and Optimization Methods	
<b>E</b>	E4: Energy Storage Devices I	E5: Energy Storage Devices II	E6	E7: Energy Storage	E8: Energy Generation and Harvesting I		E9: Energy Generation and Harvesting II	
<b>F</b>	F6: Lithium-Ion Anodes	F7: Diagnostics and Coatings F8: Capacitor	F9	F10: Lithium-Sulfur Batteries F11: Lithium Sulfur and Lithium-Air Batteries	F12: Flow Batteries F13: Aqueous Batteries and Mg-Ion Batteries	F14	F15: Sodium-Ion Batteries F16: Titanates and Titanium Dioxides	F17: Advanced Electrolytes F18: Graphene
<b>G</b>	G6: High Temperature Electrochemistry—Cathodes	G7: High Temperature Electrochemistry—Anodes G8: High Temperature Electrochemistry—Interfaces		G9: Liquid Electrocatalysis	G10: Electrochemical Double Layer	G11	G12: Photoelectrochemical Interfaces G13: Membranes	
<b>H</b>	H4: Nanostructured Bulk and Composites	H5: Novel Materials and New Approaches II H6: Nanowires and Nanotubes I	H7	H8: Nanowires and Nanotubes II	H9: Novel Characterization Methods		H10: Modeling/Theory H11: Thin Film II and Organic Materials	
<b>I</b>	I5: Thermoelectric Materials for Solid-State Refrigeration I6: Special Topics in Solid-State Refrigeration	I7: Electrocaloric Effect for Solid-State Refrigeration						
<b>J</b>	J5: XRAY I (Diffraction) J6: XRAY II (XS)	J7: Electronic Structure and Transport J8: XRAY III (XAS)	J9	J10: Spectroscopy I (Raman) J11: Spectroscopy II	J12: Novel Methods J13: XRAY IV	J14		
<b>K</b>				K1: Materials for Sustainable Energy	K2: Materials for Sustainable Transportation, Buildings and Infrastructure	K3	K4: Materials for Environment Remediation	K5: Biomaterials and Materials for Sustainable Use of Water



# Oral Presentations

Poster session details for each symposium can be found on page 26 and complete Tutorial details on page 36

SYMPOSIUM		LOCATION	MONDAY		TUESDAY			
			AM	PM	AM	PM	Poster	
NANOMATERIALS	L	Nanoparticle Manufacturing, Functionalization, Assembly and Integration	Moscone West, Room 2011			L1: Nanoparticle Manufacturing and Self-Assembly I	L2: Nanoparticle Manufacturing and Characterizations	L3
	M	Solution Synthesis of Inorganic Functional Materials—Films, Nanoparticles and Nanocomposites	Moscone West, Room 2024			M1: Ferroelectrics and Multiferroics I	M2: Ferroelectrics and Multiferroics II M3: Thin-Film Preparation	M4
	N	Nanomaterials in the Subnanometer-Size Range	Moscone West, Room 2022			N1: Nanoclusters—Synthesis, Characterization, Modeling	N2: Nanocluster Applications—Catalysis and Energy	N3
	O	Beyond Graphene—2D Atomic Layers from Layered Materials	Moscone West, Room 2009					
	P	Graphene and Related Carbon Nanomaterials	Moscone West, Room 2010/2012	P1: Synthesis I	P2: Special Session: Characterization and Properties	P3: Graphene Nanoelectronics and Optoelectronics	P4/ZZ3: Joint Session: Carbon Nanomaterials for Bio-Applications	P5
	Q	Surfaces of Nanoscale Semiconductors	Moscone West, Room 2018			Q1: 0D to 1D Nanostructures—Surface Chemistry and Optical Properties	Q2: Mechanics, Photovoltaics and Doping	Q3
	R	Nanostructured Semiconductors and Nanotechnology	Moscone West, Room 2016			R1: Group IV Nanostructure and Self-Assembly	R2: Nanostructuring Semiconductors	R3
	S	Nanostructured Metal Oxides for Advanced Applications	Moscone West, Room 3001		Tutorial; Moscone West, Room 2003	S1: Photovoltaics and Batteries	S2: Capacitors S3: Technological Applications	S4
	T	Electrical Contacts to Nanomaterials and Nanodevices	Moscone West, Room 3000			T1/AA1: Joint Session: New Materials for Interconnects and Nanocontacts; Moscone West, Room 3006	T2: Si, Ge and III-Vs	T3
	U	Measurements of Atomic Arrangements and Local Vibrations in Nanostructured Materials	Moscone West, Room 3003			U1: Transmission Electron Microscopy	U2: X-Ray and Neutron Scattering	U3
	V	Nanoscale Heat Transport—From Fundamentals to Devices	Moscone West, Room 3002		Tutorial; Moscone West, Room 2005	V1: Interfaces	V2: Superlattices V3: Nanowires	
	W	Piezoelectric Nanogenerators and Piezotronics	Moscone West, Room 3005		Tutorial; Moscone West, Room 2006	W1: Piezoelectric Nanogenerators and MEMs	W2: Nanogenerators from Flexible Materials	
X	X	Frontiers of Materials Research	Marriott Marquis, Golden Gate Level, Salon B				X1: OYI Award Talk	
NANOMATERIALS	Y	Advances in Scanning Probe Microscopy for Imaging Functionality on the Nanoscale	Moscone West, Room 3004			Y1	Y2	
	Z	Nanotechnology and Sustainability	Moscone West, Room 3007			Z1: Nanotechnology and Sustainability I	Z2: Nanotechnology and Sustainability II	

# Oral Presentations



	WEDNESDAY			THURSDAY			FRIDAY	
	AM	PM	Poster	AM	PM	Poster	AM	PM
<b>L</b>	L4: Nanoparticle Applications	L5: Nanoparticle Theory, Modeling and Computation	L6	L7: Nanoparticle Application	L8: Nanoparticle Manufacturing and Self-Assembly II	L9		
<b>M</b>	M5: Thin Films Related to Energy and Electronic Devices I	M6: Thin Films Related to Energy and Electronic Devices II	M7	M8: Thin Films Related to Energy and Electronic Devices III M9: Hybrids and Nanocomposites	M10: Self-Assembly and Memoporous and Nanostructured Materials M11: Nanoparticles, Nanorods, Quantum Dots and Nanocrystals I	M12	M13: Nanoparticles, Nanorods, Quantum Dots and Nanocrystals II	M14: Nanoparticles, Nanorods, Quantum Dots and Nanocrystals III M15: Non-Oxide Nanomaterials
<b>N</b>	N4: Nanoclusters— Luminescence, Magnetic Properties, Imaging	N5: Nanowires and Assembled Structures						
<b>O</b>	O1/P6: Joint Session: Graphene and Beyond Graphene; Moscone West, Room 2012/2012	O2: Synthesis of 2D-Layered Materials	O3	O4: Transport in 2D-Layered Materials	O5: Characterization of 2D-Layered Materials	O6	O7: Optical Properties of 2D-Layered Materials	O8: Theory and Characterization of 2D-Layered Materials
<b>P</b>	P6/O1: Joint Session: Graphene and Beyond Graphene	P7: Functionalization, Doping and Nanoribbons	P8	P9: Synthesis II	P10: Characterization and Properties II	P11	P12: Nanostructured Carbon—Theory, Properties, Devices and Applications	P13: Novel Properties and Applications
<b>Q</b>	Q4: Impact of Surfaces on Electronic Properties	Q5: Surfaces Chemistry and Passivation		Q6: Synthesis of Nanoscale Semiconductors	Q7: Charge Transfer at Nanoscale Surfaces			
<b>R</b>	R4: Synthesis and Characterization I	R5: Synthesis and Characterization II	R6	R7: Synthesis and Characterization III	R8: Quantum Dot-Based Photovoltaic Devices R9: Optical Properties of Nanostructured Semiconductor	R10	R11: Magnetic Properties of Nanostructured Semiconductors R12: Electron Transport and Production in Semiconductor Quantum Dots and Nanowires for Photovoltaic Applications	R13: Transport Properties in Nanostructures R14: Nanowires and Quantum Dots Applications in Optoelectronic Devices
<b>S</b>	S5: Catalysis S6: Nanoenergy	S7: Sensors and Other Devices		S8: Heterostructures S9: Optoelectronics	S10: Photonics S11: VO and IR Applications	S12	S13: Other Oxides S14: Magnetic Applications	S15: LED S16: Growth
<b>T</b>	T4: Nanowires	T5: Molecules and Organics						
<b>U</b>	U4: X-Ray Imaging and Spectroscopy	U5: Scattering, Spectroscopy and Imaging						
<b>V</b>	V4: Graphene	V5: Carbon Nanotubes V6: CNT Networks and Composites	V7	V8: Organic and Hybrid Materials V9: Measurement Techniques I	V10: Measurement Techniques II V11: Simulation Techniques		V12: Thermal Transport	V13: Fluids and Phase Change Materials
<b>W</b>	W3: Piezotronics— Fundamentals and Applications	W4: Application of Piezotronics in Energy Conversion W5: Piezotronics-Enhanced Nanodevices	W6	W7: Advanced Ferroelectric Nanomaterials for Mechanical Energy Harvesting W8: Modeling of Piezoelectric and Piezotronic Materials and Systems	W9: Piezoelectric Properties at the Nanoscale	W10	W11: Application of Piezotronics in Biomedical Devices W12: Novel Nanomaterial Design for Efficient Nanogenerators	
<b>X</b>		<b>X2: Mid-Career Researcher Award Talk</b>			<b>X3: Innovation in Materials Characterization Award Talk</b>			
<b>Y</b>	Y3	Y4	Y5	Y6	Y7		Y8	
<b>Z</b>	Z3: Nanotechnology and Sustainability III	Z4: Nanotechnology and Sustainability IV	Z5	Z6: Nanotechnology and Sustainability V	Z7: Nanotechnology and Sustainability VI	Z8	Z9: Nanotechnology and Sustainability VII	Z10: Nanotechnology and Sustainability VIII



# Oral Presentations

Poster session details for each symposium can be found on page 26 and complete Tutorial details on page 36

	SYMPOSIUM	LOCATION	MONDAY		TUESDAY			
			AM	PM	AM	PM	Poster	
ELECTRONICS/PHOTONICS	AA	Advanced Interconnects for Micro- and Nanoelectronics— Materials, Processes and Reliability	Moscone West, Room 3006			AA1/T1: Joint Session: New Materials for Interconnects and Nanocontacts	AA2: New Materials for Interconnects	
	BB	Evolutions in Planarization— Equipment, Materials, Techniques and Applications	Moscone West, Room 2009			BB1: CMP for State-of-the-Art Technologies	BB2: CMP Simulation and Prediction BB3: CMP for Emerging Materials and Applications	
	CC	Gate Stack Technology for End-of-Roadmap Devices in Logic, Power and Memory	Moscone West, Room 3009			CC1: III-V MOSFET Processing	CC2: III-V Passivation	
	DD	Emerging Materials and Devices for Future Nonvolatile Memories	Moscone West, Room 3008	Tutorial; Moscone West, Room 2008	Tutorial; Moscone West, Room 2008	DD1: Advanced Flash DD2: Organic Memories	DD3: MRAM-FeRAM DD4: Memristors	DD5
	EE	Phase-Change Materials for Memory, Reconfigurable Electronics and Cognitive Applications	Moscone West, Room 3011	Tutorial; Moscone West, Room 2007	Tutorial; Moscone West, Room 2007	EE1: Crystallization Kinetics I	EE2: Crystallization Kinetics II EE3: Fundamentals of Electronic Properties EE4: Resistance Drift	EE5
	FF	Compound Semiconductors for Generating, Emitting and Manipulating Energy II	Moscone West, Room 3010			FF1: Compound Semiconductors	FF2: Solar Cells	
	GG	Single-Dopant Semiconductor Optoelectronics	Moscone West, Room 2020			GG1: Charge Control of Single Magnetic Impurity Properties GG2: Detection and Manipulation of Single Dopant Properties	GG3: Single Dopants and Effects on Transport GG4: Single Dopants for Spin Qubits	
	HH	Materials for High-Performance Photonics II	Moscone West, Room 3024			HH1	HH2	HH3
	II	Resonant Optics in Metallic and Dielectric Structures— Fundamentals and Applications	Moscone West, Room 3022			II1: Optical Metamaterials	II2: Resonant Optics in Dielectric Structures	II3
	JJ	Fundamental Processes in Organic Electronics	Moscone West, Room 3020			JJ1: Molecular Considerations JJ2: New Materials and Materials Design	JJ3: Microstructure Characterization	JJ4
KK	Charge and Spin Transport in Organic Semiconductor Materials	Moscone West, Room 3018			KK1: Transistors I KK2: New Materials I	KK3: New Materials II KK4: Single Crystals		
BIOMATERIALS	LL	Hybrid Inorganic-Biological Materials	Westin, Metropolitan Ballroom II			LL1: Drug Delivery and Tissue Engineering	LL2: Bionanomaterials	LL3
	MM	New Tools for Cancer Using Nanomaterials, Nanostructures and Nanodevices	Westin, Franciscan I			MM1: Imaging Using Nanotechnology	MM2: Nanotools to Elucidate Cancer Biology	
	NN	Multifunctional Biomaterials	Westin, Metropolitan Ballroom III			NN1: Different Aspects of Multifunctional Biomaterials NN2: Biomaterials for Tissue Regeneration	NN3: Hydrogel-Based Biomaterials NN4: Interface Design of Biomaterials	NN5

# Oral Presentations



	WEDNESDAY			THURSDAY			FRIDAY	
	AM	PM	Poster	AM	PM	Poster	AM	PM
<b>AA</b>	AA3: Low-k Materials	AA4: Metallization	AA5	AA6: Integrations and Barriers AA7: Reliability	AA8: Advanced Packaging			
<b>BB</b>	BB4: CMP Slurries and Consumables							
<b>CC</b>	CC3: MOSFET Part I	CC4: MOSFET Part II	CC5	CC6/DD10: Joint Session: Memory I	CC7/DD12: Joint Session: Memory II CC8: GaN and Novel Materials			
<b>DD</b>	DD6/EE6: Joint Session: Phase-Change Memory DD7/EE7: Joint Session: Vanadium Oxide	DD8: Resistive Memories I	DD9	DD10/CC6: Joint Session: Memory I; Moscone West, Room 3009 DD11: Resistive Memories II DD12/CC7: Joint Session: Memory II; Moscone West, Room 3009	DD13: Resistive Memories III	DD14	DD15: Memory Materials	
<b>EE</b>	EE6/DD6: Joint Session: Phase-Change Memory; Moscone West, Room 3008 EE7/DD7: Joint Session: Vanadium Oxide; Moscone West, Room 3008	EE8: Neuromorphic Hardware/ Reconfigurable Electronics EE9: Thermal Aspects and Fabrication		EE10: Structure and Bonding EE11: Structural Dynamics	EE12: Transport in the Crystalline Phase EE13: Epitaxy and Single Crystals		EE14: Alternative Materials EE15: Effects of Doping	
<b>FF</b>	FF3: Nano-Devices	FF4: Optoelectronics	FF5	FF6: GaN LEDs	FF7: High Power Devices		FF8: Wide Bandgap Materials	
<b>GG</b>	GG5: Connecting Single Dopant Spins GG6: Single Dopants near Conducting Surfaces							
<b>HH</b>	HH4	HH5						
<b>II</b>	II4: Resonant Optics for Absorption Engineering and Energy Conversion	II5: Optomechanics and Optoelectronics	II6	II7: Classical and Quantum Plasmonics	II8: Exotic Plasmonic Materials and Phenomena	II9	II10: Plasmonic Devices for Imaging, Sensing and Light Emission	II11: Plasmon-Exciton Coupling and Cavity QED
<b>JJ</b>	JJ5/KK5: Joint Session: Synthesis and Microstructure of Thin-Film Transistor Materials JJ6: Structure Formation and Processing	JJ7: Interfaces and Doping JJ8: Microstructure for Organic Photovoltaic Materials		JJ9/B7: Joint Session: Spectroscopy and Microstructure of Organic Photovoltaic Materials; Moscone West, Room 2010/2012 JJ10: Structure-Property Relationships for Organic Photovoltaic Materials	JJ11: Spectroscopy of Organic Photovoltaic Materials JJ12: Photophysics of Organic Photovoltaic Materials	JJ13	JJ14: Device Physics and Device Engineering of Organic Solar Cells JJ15: Novel and Supramolecular Devices	JJ16: Bio and Electrochemical Devices
<b>KK</b>	KK5/JJ5: Joint Session: Synthesis and Microstructure of Thin-Film Transistor Materials; Moscone West, Room 3020 KK6: Surface/Interfaces	KK7: Charge Injection KK8: Photoconduction	KK9	KK10: Spin Transport	KK11: Ionic Liquids KK12: Transistors II			
<b>LL</b>	LL4: Materials-Biomolecule Interfaces	LL5: Materials for Implantation	LL6	LL7: Biomaterials for Sensing and Catalysis	LL8: Bioluminescence Resonance Energy Transfer between Quantum Rods and Firefly Luciferase			
<b>MM</b>	MM3: Bio-Nano-Materials for Cancer	MM4: Theranostics for Cancer Imaging and Therapy	MM5	MM6: Nanocarriers for Drug Delivery	MM7: Tools for Disease Diagnosis			
<b>NN</b>	NN6/PP3: Joint Session: Adaptive Multicomponent Biomaterials NN7: Polymer Networks-Based Biomaterials	NN8: Biomaterials with Shape-Memory Capability NN9: Shape-Memory and/or Magnetically Active Biomaterials	NN10	NN11: Stimuli-Sensitive Polymer Systems NN12: Stimuli-Sensitive Gels	NN13: Self-Assembling Biomaterials NN14: Light and Electrical Current Sensitive Biomaterials	NN15	NN16: Processing of Biomaterials; Moscone West, 2008	NN17: Multifunctional Biomaterials for Pharmaceutical Applications; Moscone West, Room 2008 NN18: Biomaterials in Sensors and Applications; Moscone West, Room 2008

# Oral Presentations

Poster session details for each symposium can be found on page 26 and complete Tutorial details on page 36

SYMPOSIUM		LOCATION	MONDAY		TUESDAY			
			AM	PM	AM	PM	Poster	
BIOMATERIALS	OO	Design of Cell-Instructive Materials	Westin, Stanford			OO1: Cell-Instructive Materials for Mechanotransduction OO2: Cell-Instructive Materials for Vascularization	OO3: Immunomodulating Cell-Instructive Materials	OO4
	PP	Adaptive Soft Matter through Molecular Networks	Westin, Franciscan II			PP1: Programmable/Reconfigurable Materials I	PP2: Programmable/Reconfigurable Materials II	
	QQ	Conjugated Polymers in Sensing and Biomedical Applications	Westin, Olympic			QQ1: Conjugated Polymer in Chemical and Biological Sensing I	QQ2: Conjugated Polymer in Chemical and Biological Sensing II	QQ3
	RR	Lanthanide Nanomaterials for Imaging, Sensing and Optoelectronics	Westin, Concordia			RR1: Lanthanide Nanomaterials I	RR2: Lanthanide Nanomaterials II	RR3
	SS	Bioelectronics—Materials, Interfaces and Applications	Westin, Metropolitan Ballroom I			SS1: Electron Transfer in Biological Systems	SS2: Bioelectronics with Nanowires, Carbon Nanotube and FET Devices	SS3
	TT	Materials and Processes for Electronic Skins	Westin, City			TT1: Stretchable Electronic/Materials	TT2: Electronic Skin/Sensors TT3: Devices and Sensors	TT4
GENERAL	UU	Plasma and Low-Energy Ion-Beam-Assisted Processing and Synthesis of Energy-Related Materials	Moscone West, Room 2007					
	VV	Materials Applications of Ionic Liquids	Marriott, Golden Gate Salon C2			VV1	VV2	VV3
	WW	Nuclear Radiation Detection Materials	Marriott, YB Salon 2-3			WW1: Materials I WW2: Scintillators I	WW3: Materials II	WW4
	XX	Oxide Thin Films and Heterostructures for Advanced Information and Energy Technologies	Moscone West, Room 3016	Tutorial; Moscone West, Room 2009		XX1: Oxide Catalysts and Surface Electrochemistry	XX2: Interface Engineering for Oxide Electronics	XX3
	YY	Titanium Dioxide—Fundamentals and Applications	Marriott, YB Salon 4-6			YY1	YY2	
	ZZ	Carbon Functional Interfaces II	Moscone West, Room 3014			ZZ1: Emerging Applications of Carbon Nanomaterials ZZ2: Electron Emission	ZZ3/P4: Joint Session: Carbon Nanomaterials for Bio-Applications Moscone West, Room 2010/2012	
	AAA	Superconducting Materials—From Basic Science to Deployment	Marriott, YB Salon 10-11			AAA1: 2G Coated Conductors Development and Applications I AAA2: Superconductor—Basic Science and Energy Technology	AAA3: Iron-Based Superconductors I—Bulks and Films I AAA4: BSCCO I—Wires, Films and Application	
	BBB	Size-Dependent and Coupled Properties of Materials	Marriott, YB Salon 12-13			BBB1: Coupled Properties of Materials BBB2: Structural Design	BBB3: Computational Studies BBB4: Surface/Size Related Properties of Materials	
	CCC	Novel Functionality by Reversible Phase Transformation	Marriott, YB Salon 14-15			CCC1: Celebrating Manfred Wittig's 80th Birthday I—Exploring Ferroc Materials and Elastocaloric Cooling	CCC2: Celebrating Manfred Wittig's 80th Birthday II—Oxides and Adaptive Phases	
	DDD	Extreme Environments—A Route to Novel Materials	Marriott, YB Nob Hill AB			DDD1: New Synthesis Routes and Chemical Reactions	DDD2: Electronic Structure and Dynamics	
EEE	Materials Education—Toward a Lab-to-Classroom Initiative	Marriott, YB Nob Hill C			EEE1: Lab to Classroom—Innovation in Content	EEE2: Lab to Classroom—Innovations in Pedagogy and Content Delivery		



# Oral Presentations



	WEDNESDAY			THURSDAY			FRIDAY	
	AM	PM	Poster	AM	PM	Poster	AM	PM
<b>OO</b>	OO5: Cell-Instructive Materials for Protein and Gene Delivery	OO6: Cell-Instructive Materials for Directing Cell Phenotype		OO7: Cell-Instructive Materials				
<b>PP</b>	PP3/NN6: Joint Session: Adaptive Multicomponent Biomaterials; Westin, Metropolitan Ballroom III PP4: Adaptive Materials and Non-Equilibrium Self-Assembly I	PP5 Adaptive Materials and Non-Equilibrium Self-Assembly II	PP6	PP7: Bioinspired and Stimuli-Responsive Materials				
<b>QQ</b>	QQ4: Conjugated Polymers in Tissue Engineering, Bionics and Drug Delivery I	QQ5: Conjugated Polymers in Tissue Engineering, Bionics and Drug Delivery II		QQ6: Conjugated Polymer Self-Assembly and Device Applications				
<b>RR</b>	RR4: Lanthanide Nanomaterials III	RR5: Lanthanide Nanomaterials IV						
<b>SS</b>	SS4: Cell and Tissue Bioelectronic Interfaces	SS5: Bioelectronic Devices and Integrated Sensors		SS6: Energy Harvesting, Photosynthesis and Optoelectronics				
<b>TT</b>	TT5: Soft Robotics/Tactile Skin	TT6: Bio-Interface/Implants TT7: Bio-Electronics						
<b>UU</b>				UU1: Plasma Applications and Ion-Beam Methods—Thin-Film Morphology, Patterning and Mechanical Properties I	UU2: Plasma Applications and Ion-Beam Methods—Thin-Film Morphology, Patterning and Mechanical Properties II UU3: Plasmas and Surface Functionalization for Energy Applications	UU4	UU5: Plasma Applications: Photovoltaics and TCOs	
<b>VV</b>	VV4	VV5		VV6				
<b>WW</b>	WW5: Scintillators II WW6: Materials III	WW7: CdTe-Based Materials WW8: Semiconductor Materials		WW9: Neutron Detectors WW10: Scintillators III				
<b>XX</b>	XX4: Field-Effect Transistors and Junctions for Nonvolatile Data Storage	XX5: Energy Harvesting and Conversion		XX6: Magnetic and Electronic Oxides	XX7: Oxide Interfaces for Electronics and Electrochemistry	XX8	XX9: Phase Coupled Heterostructures I	XX10: Phase Coupled Heterostructures II
<b>YY</b>	YY3	YY4		YY5	YY6	YY7		
<b>ZZ</b>	ZZ4: Energy Conversion ZZ5: Catalytic Processes	ZZ6: Biofunctional Surfaces ZZ7: Devices and Applications	ZZ8	ZZ9: Energy Storage ZZ10: Functional Carbon for Medical Applications	ZZ11: Solution Processing ZZ12: Charge Transport Phenomena			
<b>AAA</b>	AAA5: Iron-Based Superconductors I—Bulks and Films II AAA6: 2G Coated Conductors Development and Applications II	AAA7: 2G Coated Conductors Development and Applications III AAA8: Materials Synthesis and RF Cavities	AAA9	AAA10: Iron-Based Superconductors III—Thin Films and Applications AAA11: 2G Coated Conductors Development and Applications IV	AAA12: BSOCO II—Applications and HTS Microstructures AAA13: YBCO Films and Flux Pinning		AAA14: Characterization and Thin-Film Growth; Moscone West, Room 2011 AAA15: Flux Dynamics, Pinning and Nanowires; Moscone West, Room 2011	
<b>BBB</b>	BBB5: Topologically Designed Materials BBB6: Mechanical Testing I—Nanoindentation and Thin Films	BBB7: Mechanical Testing II—Soft Matter and Biomaterials BBB8: Mechanical Testing III—1-Dimensional Structures	BBB9	BBB10: Advanced Experimental Methods BBB11: Phase Transformations				
<b>CCC</b>	CCC3: Reversible Phase Transformations in Multiferroics	CCC4: Microstructure and Domain Engineering in Transforming Compounds	CCC5	CCC6: Ferromagnetic Shape-Memory Alloys	CCC7: Ferromagnetic Shape-Memory Alloys—Energy and Cooling Applications and Thin Films			
<b>DDD</b>	DDD3: Amorphous and Liquid Materials and Defects	DDD4: Experimental and Computational Techniques	DDD5	DDD6: Manipulating Structure and Properties from Nano to Mesoscale				
<b>EEE</b>	EEE3: Workforce Development and Collaborations with Industry	EEE4: Lab to Classroom—Reaching Diverse Audiences						



# MRS Poster Session Schedule

Tuesday through Thursday, 8:00 pm – 11:00 pm  
Marriott Marquis, Yerba Buena Level, Salons 7-8-9

**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.

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.)

## TUESDAY • April 2

C5	Posters
E3	Posters
F5	Posters
G5	Posters
H3	Nanoscale Thermoelectrics
I4	Materials for Solid-State Refrigeration
L3	Nanoparticle Manufacturing, Functionalization & Assembly
M4	Posters
N3	Posters
P5	Synthesis, Characterization & Properties
Q3	Surfaces of Nanoscale Semiconductors
R3	Posters
S4	Growth, Sensing, Magnetic, Optical & Electronic Properties of Oxides
T3	Nanocontacts
U3	Posters
DD5	Flash and Organic Memories
EE5	Posters
HH3	Materials for High Performance Photonics II
II3	Posters
JJ4	Organic Photovoltaics
LL3	Biomaterials I
NN5	Multifunctional Biomaterials I
OO4	Cell Instructive Materials
QQ3	Conjugated Polymers in Sensing & Biomedical Applications
RR3	Posters
SS3	Bioelectronics
TT4	Posters
VV3	Posters
WW4	Posters
XX3	Complex Oxide Materials for Emerging Energy Technologies I

## WEDNESDAY • April 3

B6	Organic & Hybrid Photovoltaic Materials & Devices
C10	Posters
D7	Artificial Photosynthesis
E6	Posters
F9	Posters
H7	Nanoscale Thermoelectrics
J9	Posters
L6	Nanoparticle Manufacturing, Functionalization & Assembly
M7	Posters
O3	Synthesis and Transport of 2D Layered Materials
P8	Doping & Applications
R6	Posters
V7	Nanoscale Heat Transport—From Fundamentals to Devices
W6	Piezoelectric Nanogenerators
Y5	Posters
Z5	Posters
AA5	Posters
CC5	Posters
DD9	FeRAM, MRAM & Memristive
FF5	Posters
II6	Posters
KK9	Charge and Spin Transport in Organic Semiconductor Materials
LL6	Biomaterials II
MM5	New Tools for Cancer Using Nanomaterials, Nanostructures & Nanodevices
NN10	Multifunctional Biomaterials II
PP6	Adaptive Materials & Molecular Networks
ZZ8	Carbon Functional Interfaces
AAA9	Posters
BBB9	Size-Dependent and Coupled Properties of Materials
CCC5	Mechanisms of Reversible Transformations
DDD5	Posters

## THURSDAY • April 4

A13	Solar Cells
A14	Defects & Transport
A15	Crystallization
A16	Fabrication of Silicon Layers & Structures
A17	Materials & Devices Characterization & Simulation
A18	Nanostructured Silicon & Related Novel Materials
A19	Novel Silicon-Based Devices
B11	Photovoltaic Materials & Device
F14	Posters
G11	Posters
J14	Posters
K3	Posters
L9	Nanoparticle Assembly & Integration
M12	Posters
O6	Characterization & Optical Properties of 2D Layered Materials
P11	Nanostructured Carbon
R10	Posters
S12	Energy Harvesting, Harnessing & Storage
W10	Piezoelectric Properties & Piezotronics
Z8	Posters
DD14	ReRAM
II9	Posters
JJ13	Organic Transistors & Light-Emitting Devices
NN15	Multifunctional Biomaterials III
UU4	Plasma & Low-Energy Ion-Beam-Assisted Processing & Synthesis of Energy-Related Materials
XX8	Complex Oxide Materials for Emerging Information Technologies II
YY7	Posters



## Student Poster Award Exchange Program

**TUESDAY ONLY!**

The Materials Research Society (MRS) and the Sociedad Mexicana de Materiales (SMM) participate in an annual Poster Award Exchange Program.

The three most outstanding poster winners from the XXI International Materials Research Congress 2012 will be displayed at the Tuesday Poster Session in the San Francisco Marriott Marquis Hotel from 8:00 pm to 11:00 pm.

These are the authors of the award-winning posters:

**Dagoberto Cardona Ramírez**

Universidad Nacional Autónoma de México, México

**Abigail Moreno Martell**

Universidad Nacional Autónoma de México, México

**Carolina Sámano Valencia**

Universidad Autónoma de San Luis Potosí, México

In exchange, three selected Poster Award Winners from the 2013 MRS Spring Meeting will display their work during the XXII IMRC 2013 in Cancun in August.

**Congratulations to the Poster Award Winners!**

## 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.

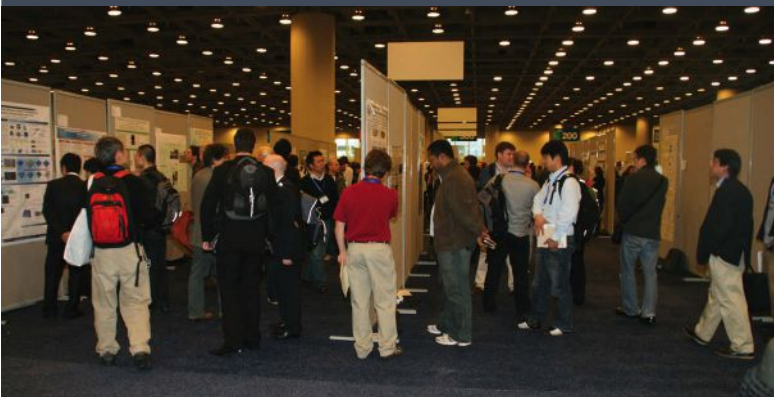
### BEST POSTER AWARDS

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.**

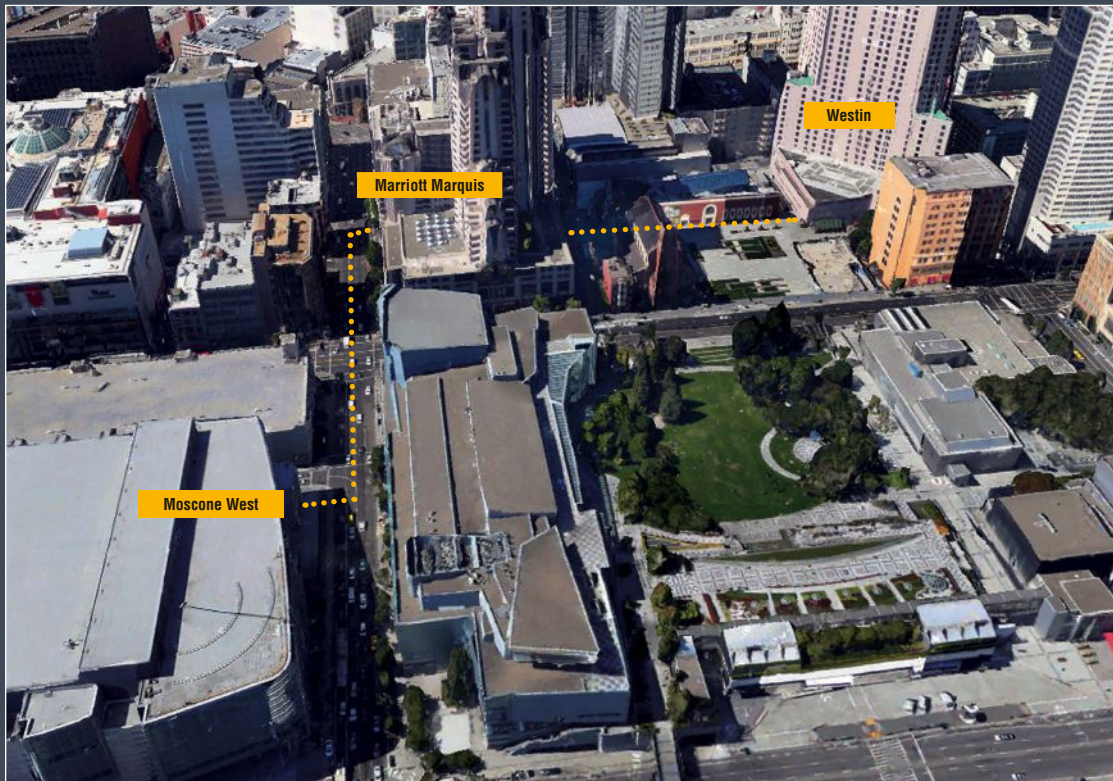
**Optimal Poster Viewing Area:**  
**3.5 feet wide by 5 feet tall**







# San Francisco Street Layout



## Travel Resources

MRS does not endorse or sponsor any of the listings. Information is provided as a courtesy to our attendees.



San Francisco Marriott Marquis  
55 Fourth Street  
San Francisco, California 94103  
Phone: 415-896-1600  
Fax: 415-486-8101  
Toll-free: 1-888-575-8934



The Westin San Francisco  
Market Street  
50 Third Street  
San Francisco, California 94103  
Phone: 415-974-6400  
Fax: 415-543-8268



Intercontinental San Francisco  
888 Howard Street,  
San Francisco, CA 94103  
Phone : 415-616-6500

**TRANSPORTATION** Visit [www.bart.gov](http://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](http://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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MATERIALS RESEARCH SOCIETY  
**FOUNDATION**

The Materials Research Society  
Foundation serves the scientific  
community with its Awards Program.





## Outstanding Young Investigator Award Talk Symposium X Presentation

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



The MRS Outstanding Young Investigator Award recognizes outstanding, interdisciplinary scientific work in materials research by a young scientist or engineer. The award recipient must also show exceptional promise as a developing leader in the materials area.

*“for pioneering research to develop novel materials for advanced plasmonic, metamaterial and transformation optics devices with potential applications in future nanoscale photonic technologies”*

**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



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.

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	<b>Matthew McDowell</b> , Stanford University	G3.01
12:15	<b>Guang Zhu</b> , Georgia Institute of Technology	W2.06
12:30	<b>Xiaofeng Feng</b> , University of California, Berkeley	P5.62
12:45	<b>Aaron Rathmell</b> , Duke University	T4.01
1:00	<b>Runzhe Tao</b> , University of Illinois at Chicago	AAA8.05
1:15	BREAK	
1:30	<b>William Woodford</b> , Massachusetts Institute of Technology	G1.05
1:45	<b>You Zhou</b> , Harvard University	XX4.02
2:00	<b>Sriharsha Aradhya</b> , Columbia University	Y3.05
2:15	<b>Wei Bao</b> , University of California, Berkeley	Y3.05
2:30	<b>Ryan Comes</b> , University of Virginia	XX8.14

### SESSION 2 - Pacific C

TIME	SPEAKER	PAPER OR POSTER
12:00	<b>Woon Teck Yap</b> , Northwestern University	OO3.02
12:15	<b>Kedar Hippalgaonkar</b> , University of California, Berkeley	V3.05
12:30	<b>Benjamin Chee Keong Tee</b> , Stanford University	TT1.02
12:45	<b>Lito de la Rama</b> , University of Illinois at Urbana-Champaign	BBB4.03
1:00	<b>Juanjuan Du</b> , University of California, Los Angeles	OO3.09
1:15	BREAK	
1:30	<b>Jongwoo Lim</b> , University of California, Berkeley	H1.05
1:45	<b>Le He</b> , University of California, Riverside	L8.07
2:00	<b>Wei Gao</b> , University of California, San Diego	LL4.10
2:15	<b>Ziliang Ye</b> , University of California, Berkeley	II7.09
2:30	<b>Jingqing Zhang</b> , Massachusetts Institute of Technology	P12.03





## Mid-Career Researcher Award Talk Symposium X Presentation

Wednesday, April 3, 12:15 pm – 1:00 pm  
Marriott Marquis, Golden Gate Level, Salon B



The Mid-Career Researcher Award recognizes exceptional achievements in materials research made by mid-career professionals.

*“for fundamental and applied contributions to materials, mechanics designs, and assembly techniques for stretchable/flexible electronic systems”*

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

### 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.

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## MRS Awards Ceremony & Plenary Session

Wednesday, April 3, 6:30 pm – 8:00 pm  
Marriott Marquis, Golden Gate Level, Salon AB

Before the Plenary Talk this evening, join us as we honor our distinguished award recipients at the 2013 MRS Spring Meeting Awards Ceremony.

The **Outstanding Young Investigator Award**, **Innovation in Materials Characterization Award**, the **Mid-Career Researcher Award** and **Graduate Student Awards** will be presented, and the newly elected **MRS Fellows** will be recognized.

Then be sure to stay for the Plenary Talk—**Arun Majumdar**, Vice President for Energy at Google, for his talk, A New Industrial Revolution for a Sustainable Energy Future.

## MRS Award Nomination Deadlines

The MRS Awards Program acknowledges outstanding contributions to the progress of materials research, honoring those whose work has already impacted the field, as well as those whose work shows great promise for the future leadership.

NOMINATE A COLLEAGUE TODAY!

August 15, 2013

2013 MRS Fall Meeting Graduate Student Awards  
and the Arthur Nowick Graduate Student Award\*

October 1, 2013

MRS Fellow  
Innovation in Materials Characterization Award\*\*  
Mid-Career Researcher Award\*\*\*  
MRS Outstanding Young Investigator Award

April 1, 2014

Von Hippel Award  
David Turnbull Lectureship Award  
MRS Medal Award  
Materials Theory Award\*\*

[www.mrs.org/awards](http://www.mrs.org/awards)

MRS acknowledges the generosity of the following for their endowments:

- \* Joan Nowick
- \*\* Toh-Ming Lu and Gwo-Ching Wang
- \*\*\* Aldrich Materials Science





## 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, nanofoams 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 biomaterial 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.



## Innovation in Materials Characterization Award Talks—Symposium X Presentations

Thursday, April 4, 12:05 pm – 1:25 pm  
Marriott Marquis, Golden Gate Level, Salon B



**D. Bruce Chase**  
University of Delaware and Pair Technologies, LLC

The Innovation in Materials Characterization Award honors an outstanding advance in materials characterization that notably increases our knowledge of the structure, composition, *in situ* behavior under outside stimulus, electronic, mechanical, or chemical behavior, or other characterization feature, of materials.

*“for the development of Fourier Transform Raman Spectroscopy and the demonstration of its utility for examining the chemical structure and properties of organic molecules and polymers in solids, thin films, and solutions”*



**John F. Rabolt**  
University of Delaware

12:05 pm – 12:45 pm

### FT-Raman Spectroscopy— A Catalyst for Raman Scattering

Raman scattering has been recognized to be a powerful tool for the characterization of molecular level structure in polymeric materials since the 1960s. However, there were very few real-world applications due to the severe limitation imposed by background fluorescence. Multiple approaches for fluorescence rejection were tried, including temporal rejection, quenching and photo bleaching among others, without significant success. Since the fluorescence process has a threshold energy related to the excited states which are emitting, one approach to minimizing fluorescence was to reduce the energy of the incident laser photons below that threshold, which would be in the red to near-infrared region of the spectrum. The immediate problem was how to detect the scattered photons since they were of too low an energy to use photomultipliers. The answer was to use detectors available in the 1–2 micron region and compensate for the poor noise figure of the detector with a multiplexing instrument such as an interferometer. The performance of an FT-Raman was excellent and allowed the investigation of a wide variety of materials. It clearly opened up the field of Raman scattering to materials research in a significant way.

**BRUCE CHASE** received his BA degree from Williams College in 1970 and his PhD degree in Physical Chemistry from Princeton University in 1975. He then joined E. I. DuPont de Nemours as a research chemist in the Spectroscopy Division of the Central Research Department. Chase retired from DuPont in 2009 as a DuPont Fellow and Chair of the DuPont Fellows Forum. He is now a research professor in the Department of Materials Science and Engineering at the University of Delaware and the Chief Technical Officer of Pair Technologies, LLC.

Chase's primary area of research is in vibrational spectroscopy, FT-IR and Raman techniques and applications to structure/property/process relationships in polymers. In collaboration with Tomas Hirschfeld (deceased), he developed an FT-Raman spectrometer that demonstrated the utility of near-infrared excitation and proceeded to collaborate with John Rabolt on the applications to polymeric materials.

Chase was the 1989 winner of the Williams-Wright Award and the 1990 EAS New York Section Gold Medal Awardee. He received the 1994 SSP Award from the Spectroscopy Society of Pittsburgh and is co-winner of the 1994 Bunsen-Kirchhoff Prize from the German Chemical Society. He received the 1998 Bomem-Michelson Award in March of 1998, and received the ACS Analytical Division Award in Spectrochemical Analysis in November 1999. In 2002, Chase received the Anachem Award and in 2005, the EAS Award for Analytical Chemistry. In 2007, he was recognized with the Hasler Award.

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12:45 pm – 1:25 pm

### Innovations in Spectroscopic Instrumentation— Evolution, Revolution or Back to the Future?

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 21<sup>st</sup> century.

**JOHN F. RABOLT** is currently the Karl W. and Renate Boer Professor and Founding-Chair of the Department of Materials Science and Engineering at the University of Delaware where he also holds a position as Professor of Biomedical Engineering. Before joining the University of Delaware in 1996 as Chair of the Department of Materials Science and Engineering, Rabolt was a research staff member (1977–1996) at the IBM Almaden Research Center where he served as Co-Director of the NSF Center on Polymer Interfaces and Macromolecular Assemblies (CPIMA), a Stanford/IBM/University of California, Davis Materials Research Science and Engineering Center. His research interests are in the area of polymer deformation and orientation, electrospinning, organic thin films, IR/Raman spectroscopy and biomolecular materials for tissue engineering. Rabolt received the 2008 New York Society of Applied Spectroscopy's Gold Medal. He has received the 2005 Pittsburgh Spectroscopy Award, the Bomem-Michelson Award in Molecular Spectroscopy in 2000, the 1993 Ellis Lippincott Award in Vibrational Spectroscopy, the 1992 Louis A. Strait Award in Applied Spectroscopy, the 1990 Williams-Wright Award in Molecular Spectroscopy and the 1985 Coblentz Award. In addition to serving as Chair of three Gordon Conferences (Organic Thin Films-1996; Polymers [West]-1990; and Vibrational Spectroscopy-1990), Rabolt is a Fellow of the American Physical Society (APS) and also served as an associate editor of the ACS Journal Macromolecules from 1992 to 2001. He served (1997–2003) as a member of the Gordon Research Conference's Scheduling and Selection Committee and was a recent member of NASA's Microgravity Materials Science Advisory Committee. Rabolt has co-authored more than 215 peer-reviewed publications, 1 book and 10 patents.

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MRS acknowledges the generosity of Professors **GWO-CHING WANG** and **TOH-MING LU** in endowing this award.

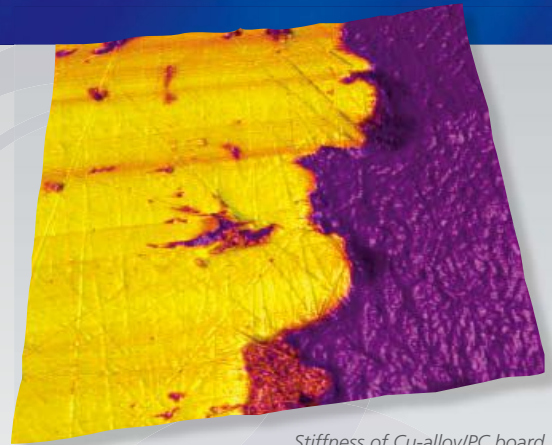


# Measure Stiffness with Extreme Sensitivity on the Hardest Materials

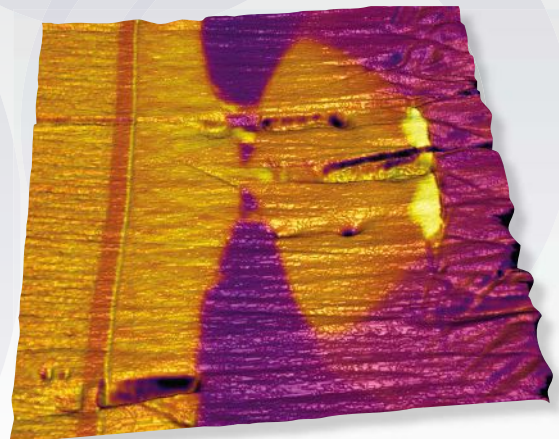
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*Stiffness of Cu-alloy/PC board junction, 12 $\mu$ m scan. Sample courtesy Dr. Hahn, Korea Research Institute of Standards and Science*



*Stiffness of active region of hard disk read-write head, 6 $\mu$ m scan*



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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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LIVE

## Student-Organized Energy Materials Forum

Monday, April 1, 9:00 am – 5:30 pm  
Moscone West, Level 2, Room 2014

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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  
**Chaoyang Jiang**, University of South Dakota  
**Ranjit Koodali**, University of South Dakota

AGENDA

#### SESSION ONE

9:00 am – 9:05 am  
9:05 am – 9:45 am

**CHAIR: Ying Bao**, University of South Dakota

**Ying Bao**—Opening Remarks  
**Victor I. Klimov**, Los Alamos National Laboratory  
*Semiconductor Nanostructures and Solar Energy Conversion*  
**Elena Hillenborg**, NSF, East Asia and Pacific Summer Institutes Program  
*East Asia and Pacific Summer Institutes (EAPSI) Program for U.S. Graduate Students in Science and Engineering*  
 Break

#### SESSION TWO

10:30 am – 11:10 am  
11:10 am – 11:40 am  
11:40 am – 12:10 pm  
12:10 pm – 1:30 pm

**CHAIR: Lauren Misch**, University of California, Santa Barbara

**Yury Gogotsi**, Drexel University  
*Carbon Materials for Electrochemical Capacitors—Challenges and Opportunities*  
**Bin Chen**, NASA  
*Nanomaterials for Energy Storage Devices*  
**Marie Mapes**, U.S. Department of Energy  
*The Status of Solar Energy Worldwide and DOE's Response*  
 Break

#### SESSION THREE

1:30 pm – 2:10 pm  
2:10 pm – 2:40 pm  
2:40 pm – 3:10 pm  
3:10 pm – 3:15 pm  
3:15 pm – 3:30 pm

**CHAIRS: Luther Mahoney**, University of South Dakota  
**Kate Barteau**, University of California, Santa Barbara

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

#### SESSION FOUR

3:30 pm – 5:30 pm

**CHAIRS: Ying Bao**, University of South Dakota  
**Luther Mahoney**, University of South Dakota

Poster Session

IGERT ORGANIZATIONS



## 10 Complimentary Tutorial Sessions

See pages 96–97 for details

Monday, April 1, Moscone West, Level 2

**A** Thin-Film Silicon and Related Materials for Solar Cells and Displays  
9:00 am – 5:00 pm, Room 2000

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

[www.mrs.org/on-demand](http://www.mrs.org/on-demand)

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

**F** Material Assembly and Testing for Batteries  
1:30 pm – 5:00 pm, Room 2004

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

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

**W** Nanogenerators and Piezotronics—From Fundamental Science to Technological Applications  
1:30 pm – 5:00 pm, Room 2006

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**DD** Fundamentals of Emerging Nonvolatile Memories  
8:30 am – 5:00 pm, Room 2008

**EE** Overview of Phase-Change Materials—Physics and Applications  
9:00 am – 5:00 pm, Room 2007

**XX** New Perspectives for Oxide Applications  
1:30 pm – 5:00 pm, Room 2009

### PURCHASE NOTES

Limited supply available at Publications Sales Moscone West, Level 1, Lobby (during sales hours)



## 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

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](http://www.kavlifoundation.org).



**Younan Xia**  
Georgia Institute of Technology

  
[www.mrs.org/on-demand](http://www.mrs.org/on-demand)

### 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. LaMer 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 129. 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.



## MATERIALS RESEARCH SOCIETY FOUNDATION Announces Inaugural Project Grants

The Materials Research Society Foundation benefits a wide range of innovative grassroots, member-driven initiatives—from student chapter proposals, to local or regional education/outreach projects, to those with the potential to impact the materials enterprise worldwide.

**Join us as the  
Materials Research Society Foundation  
announces its inaugural project grants!**

**MRS Awards Ceremony & Plenary Session  
Wednesday, 6:30 pm  
Marriott Marquis, Golden Gate Level, Salon AB**

**Learn how you can help make  
a difference or apply for project funding.**

**The next proposal cycle begins late-summer  
2013, with grants announced at the  
2013 MRS Fall Meeting in Boston.**

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## Science as Art Competition

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.

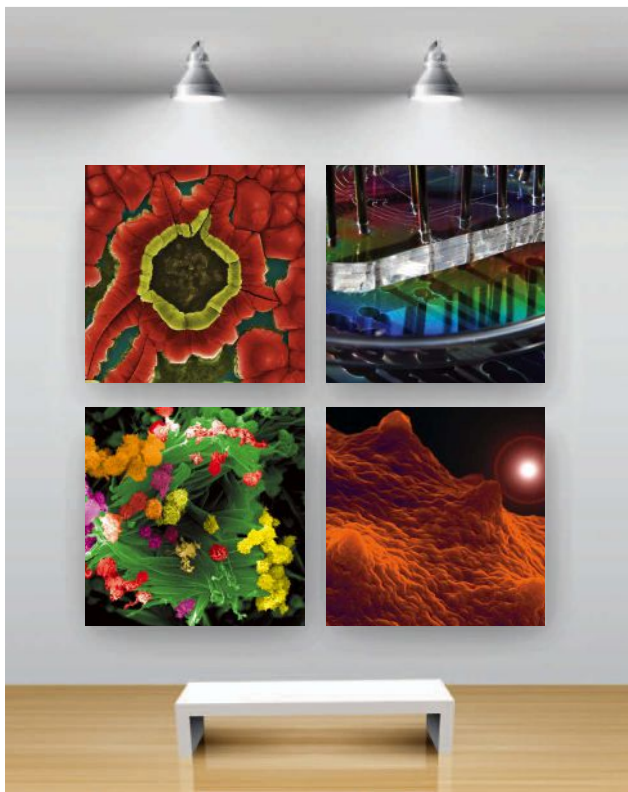
Science as Art NOTE CARDS—available for purchase. See page 44 for details.

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, materials<sup>2</sup>
- ✦ **WINNERS ANNOUNCED**  
Wednesday 3:00 pm – 3:15 pm  
Moscone West, Level 1, Exhibit Hall, materials<sup>2</sup>
- ✦ **ARTWORK DISPLAYED**  
Tuesday through Wednesday  
Moscone West, Level 1, Exhibit Hall, materials<sup>2</sup>  
  
Thursday through Friday morning  
Moscone West, Level 2



Sponsored in part by MMR Technologies, Inc. Booth 407 [www.mmr-tech.com](http://www.mmr-tech.com)



## 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.

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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

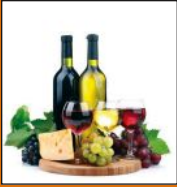
**John F. Rabolt**  
University of Delaware

### Innovations in Spectroscopic Instrumentation—Evolution, Revolution or Back to the Future?

Innovation in Materials Characterization Award Talk







### 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



### Caricature Sketches

Stop by and have your caricature drawn by **Doug Shannon**, the Bay Area's premier caricature artist.

**TUESDAY and WEDNESDAY**  
9:30 am to 5:00 pm

# materials<sup>2</sup>

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

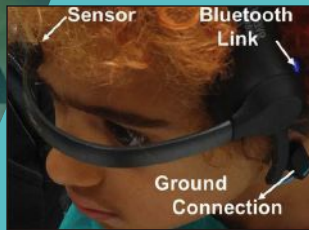
### Functionalized Bricks with Embedded Intelligence Presentations

#### 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. FBEL 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 FBEL 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 FBEL hands-on demonstrations until 5:30 pm.*

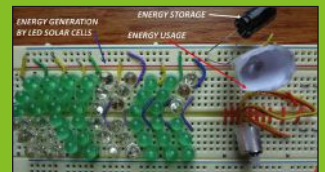
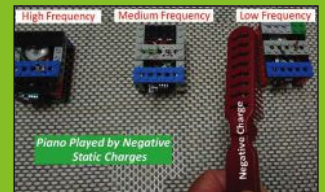
### Functionalized Bricks with Embedded Intelligence Presentations

#### WEDNESDAY

10:00 am to 10:30 am

#### Piano and Bugs Controlled by Static Charges

Computer switches embedded in FBEL 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 FBEL 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 FBEL 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

#### Alternative Energy Research Perspectives

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

#### Advancing Alternative Technologies and Other Topics

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

#### 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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## MRS AWARDS CEREMONY & PLENARY SESSION

Wednesday, April 3, 6:30 pm – 8:00 pm  
Marriott Marquis, Golden Gate Level, Salon AB

Prior to the **Plenary Talk**, join us as we honor our distinguished award recipients. The **Outstanding Young Investigator, Innovation in Materials Characterization**, the **Mid-Career Researcher** and **Graduate Student Awards** will be presented, and the newly elected **MRS Fellows** will be recognized. Then be sure to stay for the Plenary Talk, where **Arun Majumdar**, Google Inc., will discuss a new industrial revolution for a sustainable energy future.



**Arun Majumdar**  
Google Inc.

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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.





# Technology Innovation Forum V

Thursday, April 4, 9:30 am – 3:15 pm  
Moscone West, Level 3, Room 3003

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Energy Materials  
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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](http://www.mrs.org/spring-2013-technology-innovation-forum-v)

### Keynote Address



9:30 am

#### 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.



10:30 am

#### 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 CuInGaSe, 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?



10:50 am

#### 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.





11:10 am

**Katharine Ku**

Director, Technology Licensing  
Stanford University

## 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.



1:50 pm

**Michael F. Toney**

Head, Materials Sciences Division  
Stanford Synchrotron Radiation Lightsource  
SLAC National Accelerator Laboratory

## 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.

11:30 am

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

**John P. Benner**

Bay Area PV Consortium  
Session Chair and Panel Moderator



2:10 pm

**Yoel Fink**

Director, Research Laboratory of Electronics  
Massachusetts Institute of Technology

## 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.

## 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.



1:30 pm

**R. Ramesh**

Purnendu Chatterjee Professor  
of Energy Technologies  
University of California, Berkeley  
(Former) Director, SunShot Initiative,  
U.S. Department of Energy

## 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.

2:30 pm

## 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](http://www.mrs.org/innovation).

**purchase**

## at MRS Publications Sales

Monday 7:00 am – 6:00 pm  
Tuesday–Thursday 7:30 am – 5:00 pm

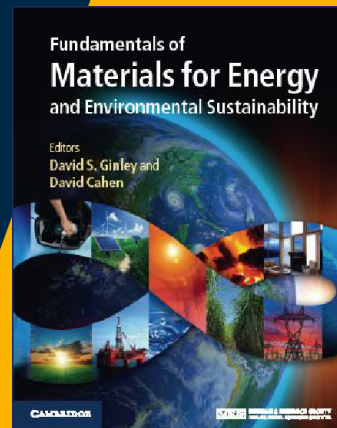
Moscone West, Level 1, Lobby

### Fundamentals of Materials for Energy and Environmental Sustainability

Editors  
David S. Ginley and David Cahen

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### Handbook of Modern Ion Beam Materials Analysis, 2<sup>nd</sup> Edition

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Yongqiang Wang and Michael Nastasi

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### 2013 MRS Spring Meeting Symposium Proceedings

Order during the meeting week and enjoy discounted pricing.

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#### Abstracts

of the 2013 MRS Spring Meeting

Searchable DVD Format

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#### Tutorial Notes

10 Spring Meeting Tutorials

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See pages 96-97 for tutorial information.



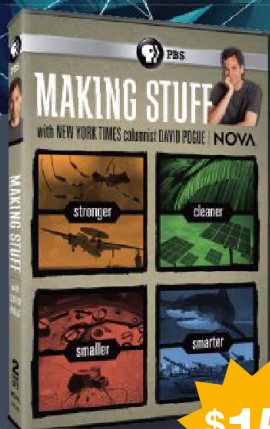
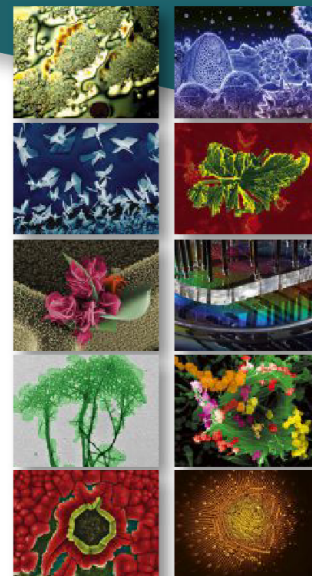


## Science *as Art* NOTE CARDS

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## NOVA **MAKING STUFF** WITH DAVID POGUE

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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.

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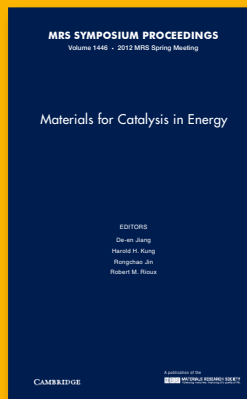


## BOOK SALE

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[www.mrs.org/spring-2013-itinerary-planner](http://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
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### 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](http://www.mrs.org/socialmedia) #s13mrs



## 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](http://www.mrs.org/meeting-scene)



## 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](http://www.mrs.org/meetings-blog)



## 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](http://www.mrs.org/on-demand)





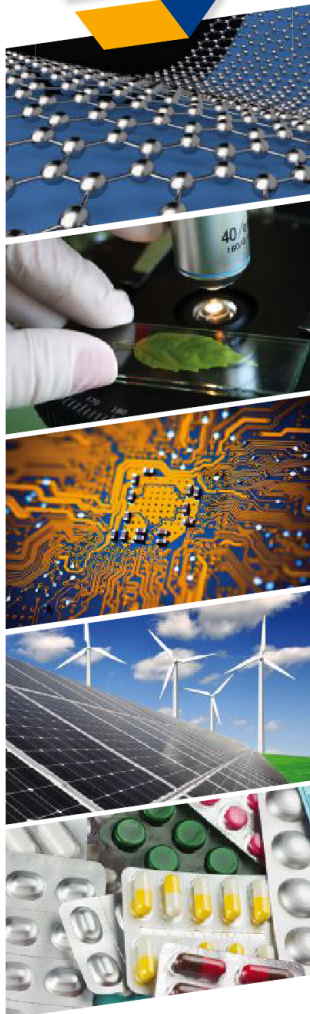
## GOVERNMENT AGENCY FORUM

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
  - 9:30 am – 10:15 am U.S. Department of Energy-Office of Basic Energy Sciences
  - 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)



# MRS PUBLISHING

www.mrs.org/mrs-publishing

**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

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## PROFESSIONAL DEVELOPMENT

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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MATERIALS RESEARCH SOCIETY  
**FOUNDATION**

The Materials Research Society Foundation serves the scientific community with its Professional Development programs.





# 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.



**Tim Miller**  
Spoken Science

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.

## 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.

## 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.

## 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.

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

Moscone West, Level 1, Exhibit Hall



Do the research  
to advance your career...  
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### 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/](http://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://websvp.mrs.org/rsvp.aspx?meeting\\_id=78](http://websvp.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/>.

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 **Journal of  
MATERIALS RESEARCH**

 **MRS Communications**

## 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**  
University of Texas at Dallas

**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**  
Johns Hopkins University  
Applied Physics Laboratory

**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.

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## SCIENCE EDUCATION AND PUBLIC OUTREACH

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.

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The Materials Research Society Foundation serves the scientific community with its Education and Outreach efforts.





# Discover an MRS Community of Science Education & Outreach

Monday, April 1 – Thursday, April 4 8:00 am – 4:00 pm  
Friday, April 5 8:00 am – 12:00 pm  
Moscone West, Level 2, Lobby

The Materials Research Society is playing a major role in bringing the education, research and industrial communities together at the 2013 MRS Spring Meeting. Join us for exciting hands-on activities, demonstrations, information areas and seminars to engage future materials scientists and engineers.



MATERIALS RESEARCH SOCIETY  
FOUNDATION



## MATERIALS VOICE

Your Message Resonating on Capitol Hill

### PUBLIC ADVOCACY



[www.mrs.org/materials-voice](http://www.mrs.org/materials-voice)

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.

Find out how you can participate and be a part of the excitement as we bring the science of materials to the general public.



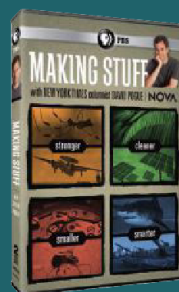
### NOVA MAKING STUFF

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 rebroadcasted 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](http://www.pbs.org/wgbh/nova/tech/making-stuff.html)

### MAKING STUFF— Four-part series boxed DVD set

Step behind the headlines as *MAKING STUFF* dramatizes the human stories woven into the current wave of technological innovations. Hosted by the *New York Times* lively technology correspondent David Pogue, each hour in this four-part series explores the talent, luck, and determination that can turn a wild idea into a cutting-edge material or high-tech breakthrough.



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Level 1, Lobby



STRANGE MATTER—North American Tour

## strange MATTER

[www.strangematterexhibit.com](http://www.strangematterexhibit.com)

### 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.

This exhibition and its tour are made possible by the generous support of our sponsors



RioTinto Alcan







### 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](http://www.nisenet.org).



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](http://www.insidescience.org/television)

# Strange Matter. Green Earth.

Experience the Power of Materials for a Sustainable World—The Stuff That Matters

**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



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Science Center of Minnesota  
Museum of Life and Science  
U.S. Department of Energy Ames Laboratory  
Red de Popularización de la Ciencia y la Tecnología en América Latina y el Caribe  
U.S. Department of Commerce - National Institute of Standards and Technology  
Museo Nazionale della Scienza e della Tecnologia Leonardo da Vinci  
Materials Science and Engineering Expert Committee (MatSEEC)  
Instituto de Física Gleb Wataghin Universidade Estadual de Campinas  
Sociedad Mexicana para la Divulgación de la Ciencia y la Técnica  
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## STUDENT ACTIVITIES AND OPPORTUNITIES

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.

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International MRS University Chapters	



The Materials Research Society Foundation serves the scientific community with its support of Student Activities and Opportunities.





# Student Activities & Opportunities

# THANKS!

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

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University of California, Irvine  
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## COLORADO

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## CONNECTICUT

Southern Connecticut State University  
University of Connecticut

## DELAWARE

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## FLORIDA

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Northwestern University  
University of Illinois  
at Urbana-Champaign

## INDIANA

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## KENTUCKY

University of Kentucky

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## MASSACHUSETTS

Boston University  
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Massachusetts Institute of Technology  
Northeastern University  
University of Massachusetts Lowell

## MICHIGAN

University of Michigan

## MINNESOTA

University of Minnesota

## NEVADA

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University of North Carolina  
at Chapel Hill

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North Dakota State University

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Virginia Polytechnic Institute  
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## WASHINGTON

Washington State University

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## 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 Activities & Opportunities

## Student Mixer

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

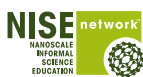
**Mingle with colleagues, enjoy good food  
and drink and have fun exploring science!**

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



## Congressional Science and Engineering Fellowship Program Information Session

Tuesday, April 2, 5:00 pm – 6:00 pm  
Marriott Marquis, 4th Floor, Pacific E

**Kevin Whittlesey**  
Chair, Congressional Fellow SC/GAC

## Become a Congressional Science and Engineering Fellow!

MRS offers exciting opportunities for scientists to learn about the field of science policy by spending one year as a Special Legislative Assistant in the U.S. Congress in Washington, DC. Come learn about the MRS/OSA and MRS/TMS Congressional Fellowships and hear from former Fellows about their experiences as scientists in the Senate and House of Representatives.

Kevin Whittlesey is a Science Officer at the California Institute for Regenerative Medicine. He was the 2006–2007 MRS/OSA Congressional Fellow and currently serves as Chair of the Congressional Fellow Subcommittee of the MRS Government Affairs Committee.

## University Chapter Representatives Luncheon

Wednesday, April 3, 12:00 pm – 2:00 pm  
Marriott Marquis, 2nd Floor, Club Room

This event is by invitation only and advance reservations were required prior to the Meeting.

Current Chapter officers and faculty advisors will gather for a meeting of MRS University Chapter representatives. University Chapters are a vital part of MRS, providing discussion between students and faculty and promoting student interest in materials science.

▶▶ **Want to forge a new path?  
Start an MRS University Chapter!**

## Student Opportunities

### 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](http://www.mrs.org/fall-2013-symposium-assistants)

### 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](http://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 brainstorm 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/](http://www.mrs.org/international-university-chapters/).



## MRS Corporate Affiliates

# THANKS!

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## 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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## Upcoming Meetings and Events

# 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](http://www.mrs.org/IMRC2013)

# XXII INTERNATIONAL MATERIALS RESEARCH CONGRESS (IMRC) 2013

August 11–16, 2013  
Cancun, Mexico





## Upcoming Meetings and Events



# CALL FOR PAPERS

Abstract Deadline—June 19, 2013

Abstract Submission Site Opens May 19, 2013

2013  
MRS  
FALL  
MEETING  
& EXHIBIT

December 1–6  
Boston, MA

### SYMPOSIA

#### BIOMATERIALS 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
- Y Physics of Organic and Hybrid Organic-Inorganic Solar Cells
- Z 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

### MEETING CHAIRS

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[www.mrs.org/fall2013](http://www.mrs.org/fall2013)



## 2014 MRS Spring Meeting & Exhibit

April 21–25, 2014 • San Francisco, California



### MEETING CHAIRS

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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



### MEETING CHAIRS

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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 74<sup>th</sup> 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

Abstract Deadline	April 12, 2013
Preregistration Open	Early May, 2013
Preregistration Ends	Late August, 2013

For more information about the 2013 JSAP-MRS Joint Symposia, including a complete list of symposia topics, visit [www.mrs.org/jsap-2013](http://www.mrs.org/jsap-2013).



# 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 (SMMIB 2013)**  
Kuşadası, Izmir, Turkey

# THANKS!

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

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### SCIENCE AS ART

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MRS

# EXHIBITS

Moscone West • Level 1

Tuesday, April 2

9:30 am – 6:00 pm

Wednesday, April 3

9:30 am – 5:30 pm

## WELCOME TO THE MRS SPRING EXHIBIT

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 FBEL learning modules, developed at Michigan State University, spark your interest in engineering education and research during hands-on activities on Tuesday and Wednesday. FBEL 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.

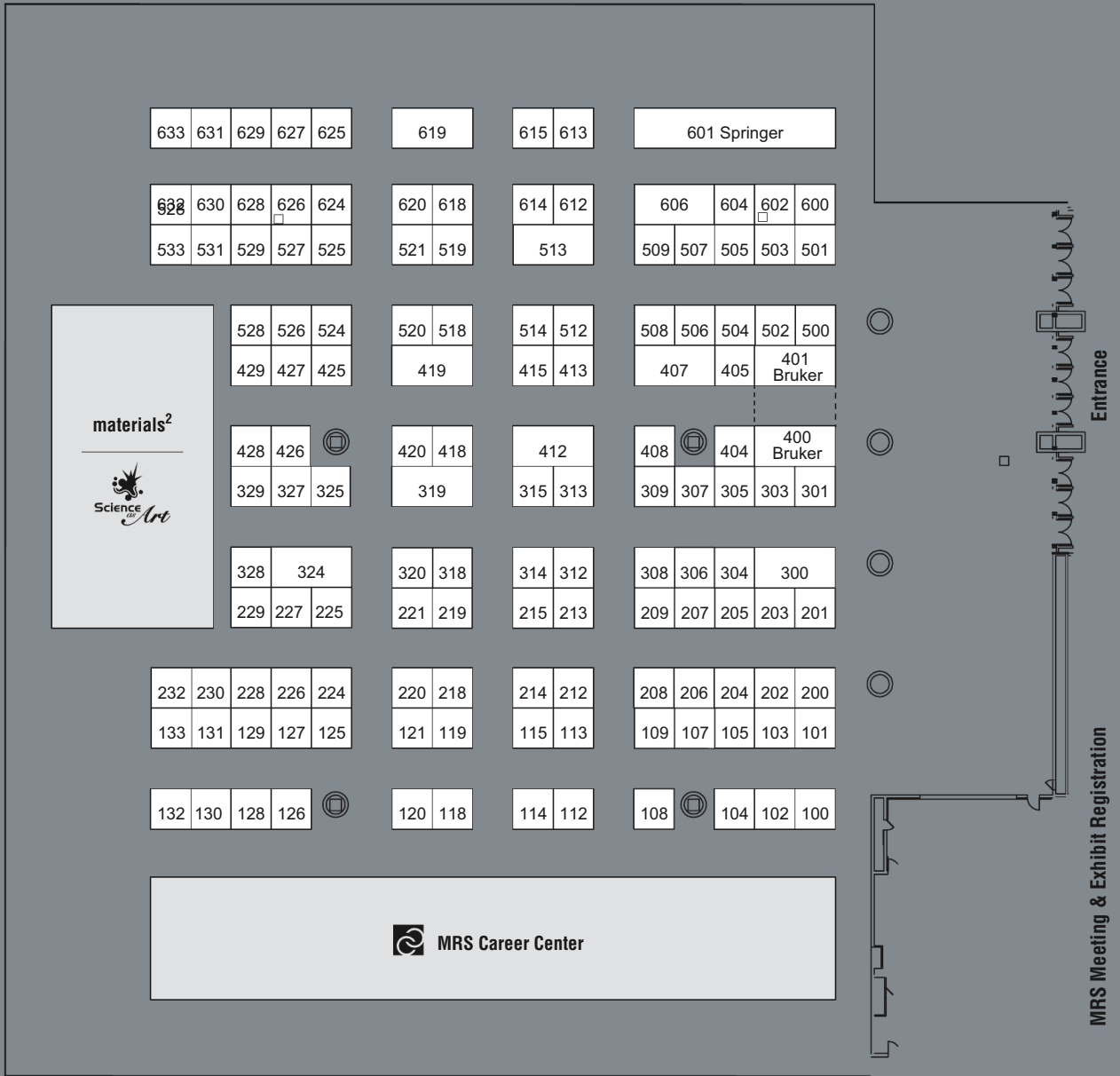
### CARICATURE SKETCHES

Stop by materials<sup>2</sup> 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.







- 126 1-Material Inc.
- 328 2-DTech Ltd.
- 208 A & N Corporation
- 114 AdValue Technology, LLC
- 312 Advanced Research Systems, Inc.
- 300 Agilent Technologies
- 600 AIP Publishing
- 229 AIST-NT, Inc.
- 508 AIXTRON SE
- 415 AJA International, Inc.
- 227 Aladdin Industrial Corporation
- 425 Aldrich Materials Science
- 504 Alfa Aesar, a Johnson Matthey Company
- 104 Angstrom Thin Film Technologies
- 215 Annealsys
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- 313 Asylum Research, an Oxford Instruments Company
- 115 Balazs NanoAnalysis, a Division of Air Liquide Electronics U.S. LP
- 525 Barnett Technical Services LLC
- 207 BaySpec, Inc.
- 125 Beijing Mikrouna Mechatronics Technology Company, Ltd.
- 121 Biolin Scientific, Inc.
- 118 BioLogic USA
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- 613 CRC Press-Taylor & Francis
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- 201 Gatan, Inc.
- 633 Hadland Technologies, Inc.
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- 120 KD Scientific
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- 327 Lucas Scientific LLC
- 221 MANTIS Deposition Ltd.
- 132 Materials Analysis Technology Inc.
- 429 Metrohm USA, Inc.
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- 407 MMR Technologies, Inc.
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- 102 NanoAndMore USA Inc.
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- 626 Nanometrics Incorporated
- 503 Nanovea
- 305 National Electrostatics Corp.
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- 625 National User Facility Organization
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- 619 NIST
- 618 NIST/CNST
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- 212 NT-MDT Co.
- 315 Omicron NanoTechnology USA
- 133 Optofluidics, Inc.
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- 418 Park Systems Inc.
- 630 PhaseX Corporation
- 631 Photonic Cleaning Technologies
- 519 Physical Electronics
- 209 Plasmaterials, Inc.
- 204 Protochips, Inc.
- 303 PVD Products, Inc.
- 420 Quantum Design, Inc.
- 109 R.D. Mathis Company
- 405 Radiant Technologies, Inc.
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- 101 RHK Technology, Inc.
- 514 Rigaku Americas Corporation
- 119 RKI Instruments, Inc.
- 230 Rocky Mountain Vacuum Tech
- 615 Royal Society Publishing
- 602 RSC Publishing
- 518 Seki Diamond Systems
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- 103 Simpleware Ltd.
- 318 Solartron Analytical (AMETEK)
- 220 SonoPlot, Inc.
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- 500 SPI Supplies/Structure Probe, Inc.
- 601 Springer
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- 529 Sunpower Inc.
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- 426 Surfx Technologies
- 224 SVT Associates, Inc.
- 413 Ted Pella, Inc.
- 419 Thermo Scientific
- 632 Toshiba Manufacturing Co., Ltd.
- 232 United Mineral & Chemical Corporation
- 213 VG Scienta, Inc.
- 225 Vigor Gas Purification Technologies Inc.
- 100 WITec Instruments Corp.
- 524 XEI Scientific, Inc.
- 105 Xradia, Inc.



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

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**Booth 328**

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

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

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**Booth 114**

**Key Products:** Crucibles; Tubes; Alumina and Quartz

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**Booth 312**

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

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**Key Products:** Atomic Force, Scanning Probe, Field Emission Scanning Electron and Scanning Electron Microscopes; Nanomechanical Testing Systems

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**Key Products:** Physics Journals; Online Hosting; Conference Proceedings

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**Key Products:** Atomic Force/Scanning Probe Microscopes; Combined AFM & Raman Spectroscopy Systems

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**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.

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**Booth 415**

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

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**Booth 227**

**Key Products:** Aladdin Reagents

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**Aldrich Materials Science**  
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[www.sigma-aldrich.com/matsci](http://www.sigma-aldrich.com/matsci)

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

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**Alfa Aesar, a Johnson Matthey Company**  
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**Booth 504**

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

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**Booth 104**

**Key Products:** Atomic Layer Deposition System

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**Booth 215**

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

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**Booth 113**

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

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**Booth 528**

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

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

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**Booth 115**

**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**  
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**Booth 525**

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

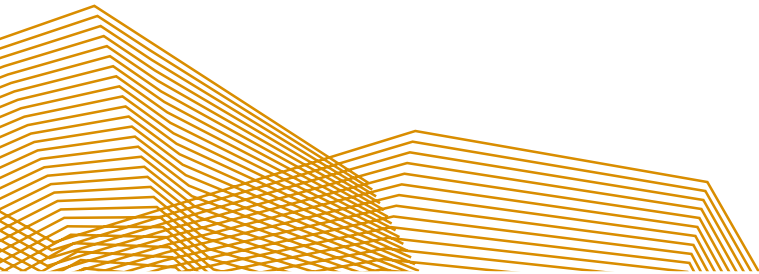
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**Booth 207**

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

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# Exhibitor Profiles

**Beijing Mikrouna Mechatronics Technology Co., Ltd.**  
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www.mikrouna.com

**CORPORATE AFFILIATE**  
Booth 125

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

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us@biolinscientific.com  
www.biolinscientific.com

**CORPORATE AFFILIATE**  
Booth 121

**Key Products:** Quartz Crystal Microbalance with Dissipation Monitoring; Farfield Dual Polarization Interferometer; Attension Theta Optical Tensiometer

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**Bio-Logic USA, LLC**  
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Booth 118

**Key Products:** Research Instruments; Battery Research; Electrochemical

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www.bluewavesemi.com

Booth 520

**Key Products:** Substrate Wafer Heaters; Thin Film Deposition Systems; Thin Films and Coating Materials; R&D Services

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**Key Products:** X-Ray Diffraction; Atomic Force Microscopy; Spectroscopy

Bruker specializes in high-end X-ray diffraction and scattering solutions performing a wealth of applications in materials analysis. Our technology is used to investigate complex samples including thin films, nanostructured materials, powders and polymers. We are the market leader in XRD, offering the largest, highest quality portfolio of cutting edge diffraction components and software. Our products include the D8 DISCOVER, D8 ADVANCE, D2 PHASER, NANOSTAR, and the recently introduced N8 HORIZON for dedicated small angle x-ray scattering (SAXS), exhibited for the first time in North America at MRS.

**California Analytical Instruments, Inc.**  
info@gasanalyzers.com  
www.gasanalyzers.com

Booth 128

**Key Products:** FTIR

California Analytical Instruments, Inc. has been providing quality gas analyzers and systems used in Industrial, Environmental, Process and Automotive Emissions applications for over 25 years. CAI utilizes technologies such as Chemiluminescence, Non-Dispersive Infrared (NDIR), Flame Ionization Detection (FID), Paramagnetic, FTIR, and Photoacoustic Infrared Spectroscopy (PAS) for measurement of CO, CO<sub>2</sub>, NO, NO<sub>2</sub>, N<sub>2</sub>O, NH<sub>3</sub>, O<sub>2</sub>, CH<sub>4</sub>, SO<sub>2</sub>, SF<sub>6</sub>, HF, HCl and many other gases. CAI's computer controlled analyzers are currently installed in thousands of facilities in over a hundred countries.

**Cambridge University Press**  
information@cambridge.org  
www.cambridge.org/us

Booth 606

**Key Products:** Books; Journals

Cambridge publishes the journals of the Materials Research Society: *MRS Communications*, *MRS Bulletin*, *Journal of Materials Research* and the *MRS Online Proceedings Library*. Visit our booth to peruse these journals and the latest in materials science books, including *Fundamentals of Materials for Energy and Environmental Sustainability* by David S. Ginley and David Cahen, *Structures of Materials, 2nd Edition* by Marc De Graef and Michael E. McHenry, *Graphene* by Mikhail I. Katsnelson, and *Dendrimers, Dendrons, and Dendritic Polymers* by Donald A. Tomalia, Jørn B. Christensen and Ulrik Boas. Buy now and receive a special 20% discount off the listed price.

**Chemat Technology, Inc.**  
marketing@chemat.com  
www.chemat.com

Booth 404

**Key Products:** Spin Coating; Dip Coating; Chemical Precursors

Chemat Technology, Inc. is one of the leading worldwide resources for advanced materials processing. Chemical products offered, in research and bulk quantities, include: high purity of metal alkoxides, dialkylamides, organo-polymers, high surface area powders, colloidal solutions and functional solutions for the sol-gel and/or CVD processes. As the manufacturer of the least expensive quality spincoater in the world, Chemat also designs and distributes thin film coating equipment, fiber drawing machine, rotary evaporators, microscopes and diverse laboratory instruments.

**COSMOTEC Corporation**  
[www.feedthrough.net](http://www.feedthrough.net)

**Booth 228**

**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](mailto:sales@microspectra.com)  
[www.microspectra.com](http://www.microspectra.com)

**Booth 428**

**Key Products:** Microspectrophotometers; Raman

CRAIC Technologies builds UV-visible-NIR microscopes, microspectrophotometers, Raman microspectrometers as well as tools for 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](mailto:orders@crcpress.com)  
[www.crcpress.com](http://www.crcpress.com)

**Booth 613**

**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](mailto:info@crystamaker.com)  
[www.crystalmaker.com](http://www.crystalmaker.com)

**Booth 325**

**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](mailto:info@cvdequipment.com)  
[www.cvdequipment.com](http://www.cvdequipment.com)

**Booth 304**

**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](http://www.cvdequipment.com), [www.firstnano.com](http://www.firstnano.com), [www.cvdmaterialscorporation.com](http://www.cvdmaterialscorporation.com), [www.stainlessdesign.com](http://www.stainlessdesign.com)

**cyberTECHNOLOGIES USA, LLC**  
[www.cybertechnologies.com](http://www.cybertechnologies.com)

**Booth 527**

**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](mailto:sales@ecopia21.co.kr)  
[www.ecopia21.co.kr](http://www.ecopia21.co.kr)

**Booth 202**

**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](http://www.emsdiasum.com)

**Booth 319**

**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 microtomy, including the unique UltraSonic Oscillating Diamond knife for compression free sections.



# Exhibitor Profiles

**Fabsave, Inc.**  
semidevice@yahoo.com  
www.fabsave.com

Booth 526

**Key Products:** Mask Aligner Used Equipment

Proving CUSTOMIZED MASK ALIGNERS fit to the CUSTOMERS' APPLICATIONS. Fabsave represents Midas System who develops and produces MASK ALIGNERS and SPIN COATERS required by labs and companies related to semiconductor, MEMS, bio element and nanotechnologies. We produce and supply MASK ALIGNERS based upon customized design to fit to demanded applications from R&D institutes as well as mass production fabs.

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

Booth 205

**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

CORPORATE AFFILIATE

Booth 309

**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 NanoMill® 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.

**FlackTek, Inc.**  
speedmixer@flacktek.net  
www.speedmixer.com

Booth 531

**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.

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

Booth 107

**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

Booth 127

**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

Booth 108

**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

Booth 226

**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](mailto:info@gatan.com)  
[www.gatan.com](http://www.gatan.com)

**Booth 201**

**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](mailto:xray.service@hadtek.com)  
[www.hadtek.com](http://www.hadtek.com)

**Booth 633**

**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.**  
[techsales@cathode.com](mailto:techsales@cathode.com)  
[www.cathode.com](http://www.cathode.com)

**Booth 502**

**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](mailto:info@himt.de)  
[www.himt.de](http://www.himt.de)

**Booth 629**

**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](mailto:info-sci@horiba.com)  
[www.horiba.com/scientific](http://www.horiba.com/scientific)

**Booth 509**

**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 spectrofluorometers 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 Uvisel2 Ellipsometer with computer controlled sample alignment, autofocus, spot size selection and mapping functions, and a Sincerity CCD Detector.

**Hummingbird Scientific**  
[hummingbird@hummingbirdscientific.com](mailto:hummingbird@hummingbirdscientific.com)  
[www.hummingbirdscientific.com](http://www.hummingbirdscientific.com)

**Booth 307**

**Key Products:** TEM Specimen Holders

Hummingbird Scientific offers custom engineering services and products for cutting-edge electron and ion microscopy applications, with an emphasis on products for Transmission Electron Microscopes (TEM). We handle all aspects of these complex systems—from mechanical, electrical, and software design to fabrication and assembly. In close collaboration with our customers, we develop solutions for applications in nanotechnology, materials science, and biology.

**Hysitron, Inc.**  
[info@hysitron.com](mailto:info@hysitron.com)  
[www.hysitron.com](http://www.hysitron.com)

**CORPORATE AFFILIATE**

**Booth 412**

**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 PicoIndenter® products, Hysitron's quantitative depth-sensing indenters capable of direct-observation testing in a TEM or SEM.

# Exhibitor Profiles

**Innovative Technology, Inc.**  
info@gloveboxes.com  
www.gloveboxes.com

Booth 214

**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

Booth 533

**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@iopubusa.com  
publishing.iop.org

Booth 612

**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

Booth 206

**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

**CORPORATE AFFILIATE**

Booth 501

**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

**CORPORATE AFFILIATE**

Booth 614

**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.

## JANIS

### Cryogen Free Probe Stations



- Applications include nano science, materials and spintronics
- <5 K - 675 K cryocooler-based systems
- Vibration isolated for sub-micron sample stability
- Up to 8 probes, DC to 67 GHz, plus fiber optics
- Zoom optics with camera and monitor
- Horizontal, vertical or vector magnetic field options are available

Other configurations: LHe, LN<sub>2</sub>, room temperature and UHV systems

Contact us today:  
sales@janis.com +1 978 657-8750  
www.janis.com/CryogenFreeProbeStation.aspx  
www.facebook.com/JanisResearch

MRS Booth 501





**JASCO**  
[sales@jascoinc.com](mailto:sales@jascoinc.com)  
[www.jascoinc.com](http://www.jascoinc.com)

**Booth 218**

**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.

**JEOL USA, Inc.**  
[salesinfo@jeol.com](mailto:salesinfo@jeol.com)  
[www.jeolusa.com](http://www.jeolusa.com)

**CORPORATE AFFILIATE**

**Booth 200**

**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.

**KD Scientific**  
[info@kdscientific.com](mailto:info@kdscientific.com)  
[www.kdscientific.com](http://www.kdscientific.com)

**Booth 120**

**Key Products:** Syringe Pumps; Syringes; Laboratory Research Instruments; Fluid Handling Instruments; Electro Spinning Instruments

KD Scientific is recognized worldwide for our solutions to deliver precise and smooth flow. We have the broadest line of syringe pumps at economical prices. Featured are microliter, nanoliter and our newest picoliter flow pumps as well as dispensers and glass, plastic or stainless steel syringes. Customized OEM systems can be designed. Newest generation of pumps—the Legato Series—is on display. Free application consultations and demonstrations.

**Koei Chemical Company, Limited**  
[www.koeichem.com](http://www.koeichem.com)

**Booth 427**

**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™.

**KP Technology Ltd.**  
[sales@kelvinprobe.com](mailto:sales@kelvinprobe.com)  
[www.kelvinprobe.com](http://www.kelvinprobe.com)

**Booth 507**

**Key Products:** Air Photoemission, Scanning and UHV Kelvin Probe Systems

KP Technology will be exhibiting their latest range of Ambient Scanning Work Function (Kelvin) Probes with our Surface Photovoltage Spectrometer module 400-1000nm, and a small range of our Ultra High Vacuum Work Function (Kelvin) Probes. Our latest addition to our world-leading equipment, the dual-probe, Air Photoemission System plus Scanning Work Function (Kelvin) probe, will also be available. Professor Iain Baikie, CEO of KP Technology, will be available at booth number 507 for hands-on experience of our innovative, user-friendly, specialist tools and software.

**Kurt J. Lesker Company**  
[salesus@lesker.com](mailto:salesus@lesker.com)  
[www.lesker.com](http://www.lesker.com)

**Booth 301**

**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, Isoflux Inverted Cylindrical Magnetrons, electron beam and thermal evaporation, organic electronics, and atomic layer deposition (ALD) for your materials research challenges.

**Labtec Sales Partners LLC**  
[info@labtecsp.com](mailto:info@labtecsp.com)  
[www.labtecsp.com](http://www.labtecsp.com)

**Booth 219**

**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.**  
[sales@lakeshore.com](mailto:sales@lakeshore.com)  
[www.lakeshore.com](http://www.lakeshore.com)

**CORPORATE AFFILIATE**

**Booth 308**

**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 characterizations systems exploring electronic and magnetic properties. Lake Shore serves an international base of scientists at leading university, government, and commercial research institutions and is supported by a global sales network.



# Exhibitor Profiles

**Lucas Scientific LLC**  
info@lucasscientific.com  
www.lucasscientific.com

**Booth 327**

**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

**CORPORATE AFFILIATE**

**Booth 221**

**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

**Booth 132**

**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

**Booth 429**

**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.

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**Micro Photonics Inc.**  
[info@microphotonics.com](mailto:info@microphotonics.com)  
[www.microphotonics.com](http://www.microphotonics.com)

**Booth 628**

**Key Products:** Micro CT; X-ray Cameras; X-ray Diffraction

Micro Photonics is a leading source of advanced X-ray scientific research instrumentation for micro-CT, XRD, Laue and SAXS. The Skyscan micro-CTs allow you to non-destructively image the internal features of materials and analyze features such as porosity, pore size distribution, crack propagation, fiber orientation...all in 3D. The Hecus S3-Micro provides a laboratory instrument capable of measuring SAXS, SWAXS and GISAXS for protein solutions, nanoparticle sizing, thin film structure analysis and more. STOE powder and single crystal diffractometers, Photonic Science Laue Cameras and Xenocs X-ray sources/optics complete the line of diffraction systems and components available. Laboratory services available.

**Microtrac Inc.**  
[www.microtrac.com](http://www.microtrac.com)

**Booth 112**

**Key Products:** Nanotrac Wave; DIA; 3500; BELSORP-mini; Lab Services

Microtrac, a global pioneer of particle characterization technologies, strives to provide the world with innovative, reliable, and repeatable instruments that deliver insight and solutions to company's complex product and process problems. Microtrac's instruments can provide particle sizing, zeta potential, 3-D dynamic image analysis, molecular weight, surface analysis, and particle counting measurements. Microtrac also offers contract laboratory services, as well as, custom service plans designed to meet and exceed customer expectations.

**MMR Technologies, Inc.**  
[sales@mmr-tech.com](mailto:sales@mmr-tech.com)  
[www.mmr-tech.com](http://www.mmr-tech.com)

**Booth 407**

**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.

**MTI Corporation**  
[info@mtixtl.com](mailto:info@mtixtl.com)  
[www.mtixtl.com](http://www.mtixtl.com)

**Booth 513**

**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.

**Nano-Master, Inc.**  
[main@nanomaster.com](mailto:main@nanomaster.com)  
[www.nanomaster.com](http://www.nanomaster.com)

**Booth 320**

**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).

**NanoAndMore USA Inc.**  
[usa@nanoandmore.com](mailto:usa@nanoandmore.com)  
[www.nanoandmore.com](http://www.nanoandmore.com)

**Booth 102**

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

NanoAndMore, the leader in AFM probes, supplies SPM and AFM probes and calibration standards from NanoWorld™, NANOSENSORS™, nanotools™, BudgetSensors™, sQube™ and MikroMasch™. NanoAndMore USA also provides scientific instrumentation. Solutions include Digital Holographic Microscopes, specialized Nano-Particle Size and Zeta Potential analyzers along with a line of affordable Digital-Optical Microscopes. Visualize occurrences live in 3-D, stop motion the fastest MEMS devices and measure deflection changes in real-time as voltage and frequency shift. Our products are at home in clean-rooms, research labs and remote sensing environments 6 kilometers deep. Call and order Toll Free at 877-521-1108 or [usa@nanoandmore.com](mailto:usa@nanoandmore.com).

**Nanomechanics, Inc.**  
[info@nanomechanicsinc.com](mailto:info@nanomechanicsinc.com)  
[www.nanomechanicsinc.com](http://www.nanomechanicsinc.com)

**CORPORATE AFFILIATE**

**Booth 624**

**Key Products:** InSEM; InSEM High Temp; Analytical Services

Nanomechanics, Inc. is comprised of scientists and engineers with unparalleled expertise in materials science, precision mechanical design, and advanced instrumentation software. Over the last 20 years, our staff has stayed at the forefront of technology focused on nano-scale mechanical testing. We bring our decades of experience in the fields of nanomechanics and advanced instrumentation to bear in providing contract services, *in situ* mechanical testing equipment, and custom solutions.

**Nanometrics Incorporated**  
[contact@nanometrics.com](mailto:contact@nanometrics.com)  
[www.nanometrics.com](http://www.nanometrics.com)

**Booth 626**

**Key Products:** 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.





# Exhibitor Profiles

**Nanovea**  
info@nanovea.com  
www.nanovea.com

Booth 503

**Key Products:** Nano/Micro/Macro Mechanical Tester; 3D Non-Contact Profilometers; Tribometers

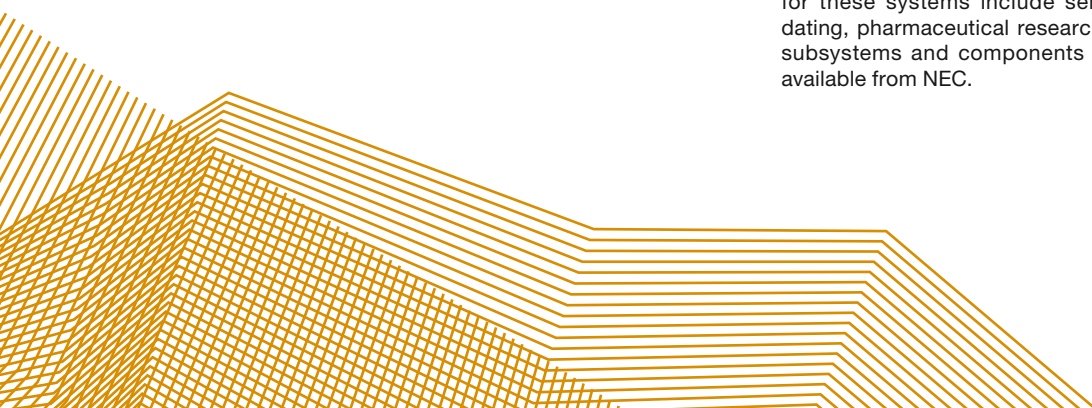
From the Irvine, CA office, Nanovea designs and manufactures Profilometers, Mechanical Testers and Tribometers to combine the most advanced testing capabilities in the industry: scratch adhesion, indentation hardness, wear friction and 3D non-contact metrology at the nano, micro and macro range. Unlike 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

Booth 305

**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.



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- Microprobe Systems
- Integration of Temperature into Optical, AFM, SEM, X-Ray and Custom Vacuum Systems

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**National Nanotechnology  
Infrastructure Network**  
[www.nnin.org](http://www.nnin.org)

**Booth 620**

**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](mailto:info@nufo.org)  
[www.nufo.org](http://www.nufo.org)

**Booth 625**

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](mailto:sales@neocera.com)  
[www.neocera.com](http://www.neocera.com)

**Booth 314**

**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](mailto:nib-sales@netzsch.com)  
[www.netzsch-thermal-analysis.com](http://www.netzsch-thermal-analysis.com)

**Booth 521**

**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 +2400C, 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* thermoset cure monitoring, and ARC calorimeters to measure thermal and pressure properties of chemical reactions.

**NIST**  
[www.nist.gov/srm](http://www.nist.gov/srm)

**Booth 619**

**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](http://www.cnst.nist.gov)

**Booth 618**

**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](mailto:ncsales@n-c.com)  
[www.n-c.com](http://www.n-c.com)

**Booth 408**

**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](http://www.n-c.com) for more information.

## Exhibitor Profiles

**NT-MDT Co.**  
info@ntmdt.ie  
www.ntmdt.com

Booth 212

**Key Products:** SPM/AFM/STM; Raman TERS; Spectroscopy

NT-MDT has been creating the equipment for nanotechnology for 20 years. The range of products is represented with different equipment lines: training scientific laboratories, AFM/STM instruments for research centers, Probe NanoLaboratories integrating AFM with other techniques and the modular nanofactories. NT-MDT offers expert service and applications development through 5 representative offices and more than 40 distributors around the globe. We've installed more than 2000 instruments, promoting growth of both lab and research programs worldwide.

**Omicron Nanotechnology USA, LLC** **CORPORATE AFFILIATE**  
info@omicronus.com  
www.omicron-instruments.com

Booth 315

**Key Products:** UHV SPM; Surface Science Instrumentation; MBE

Omicron NanoTechnology is the world's leading supplier of analytical instrumentation in nanotechnology R&D. We create innovative and tailored solutions and uniquely combine thin-film techniques with sophisticated *Multi-Technique* analytics into integrated UHV-systems. This year we'd like to introduce the first results from the new TESLA SPM, a new low temperature microscope based on the Joules-Thomson cooling principle. Also, the new Fermi SPM, a lower cost low temperature SPM with tip and sample at equal temperatures. The ARGUS electron analyzer will be on display.

**Optofluidics, Inc.**  
info@opfluid.com  
www.optofluidicscorp.com

Booth 133

**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.

**PANalytical Inc.**  
amec.info@panalytical.com  
www.panalytical.com

Booth 506

**Key Products:** X-ray Diffraction; Computed Tomography; Small Angle X-ray Scattering; X-ray Fluorescence

PANalytical is the innovation leader for X-ray Diffraction (XRD) and X-ray Fluorescence (XRF) solutions. Come hear about Empyrean, a true optical bench for the most XRD applications, including Computed Tomography (CT), and the cost effective X'Pert Powder system. PIXcel<sup>3D</sup> detector on X'Pert PRO MRD/MRDXL delivers ultra-fast RSMs and topography images. XRF innovations include no-drift ZETA technology tubes on all Axios<sup>max</sup> WDXRF and available on Axios 1KW, and the new benchtop XRF range Epsilon3 and 3XL.

**Park Systems Inc.**  
psi@parkafm.com  
www.parkafm.com

Booth 418

**Key Products:** Atomic Force Microscopes—Park NX10 and Park NX20

Park Systems is a world leading manufacturer of atomic force microscopy (AFM) systems with a complete range of products for researchers and industry engineers in biological science, materials research, semiconductor, and storage industries. Park's AFM provides the highest data accuracy, superior productivity, and lowest operating cost. See our new Park NX10 and Park NX20, the most accurate AFMs at <http://www.parkafm.com>.

**Phasex Corporation**  
www.phasex4scf.com

Booth 630

**Key Products:** Development & Manufacturing Services; Supercritical Fluid Services

Improve your photoresists, ARCs, and surfactants performance through the process of supercritical fluid (SCF) fractionation to produce narrow molecular weight cuts. Purity enhancement of your electronic material and polymers via the removal of low molecular weight impurities. We use SCF technology to improve your materials and polymers in ways you never thought possible.

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

Booth 631

**Key Products:** First Contact Polymer Products

Manufacturer of First Contact Polymers™—"THE Cleaning and Protection System." Apply liquid polymer solutions to surfaces and peel the resulting dried film leaving the surface nearly atomically clean. Independent XPS/ESCA and Laser Damage Threshold testing shows no residue down to the molecular level! Safe with high power laser optics. Remove Dust and Fingerprints. Reduce Solvent Waste. Non-Toxic Inert Polymer and solvents. Clean Nanostructures, Gratings and Masks! Protect and clean microscope objectives and CCD Sensors. Safe. Low Adhesion. No residue.





**Physical Electronics**  
[sales@phi.com](mailto:sales@phi.com)  
[www.phi.com](http://www.phi.com)

**Booth 519**

**Key Products:** Scanning Auger; XPS; TOF-SIMS; Materials Analysis; Surface Analysis

Physical Electronics is a subsidiary of ULVAC-PHI, the world's leading supplier of UHV surface analysis instrumentation used for research and development of advanced materials. Fields of application for our products include: nanotechnology, microelectronics, photovoltaics, data storage, bio-materials and catalysis. PHI's innovative XPS, AES and TOF-SIMS technologies provide our customers with unique tools to solve challenging materials problems and accelerate the development of new materials and products. For more information visit our website at [www.phi.com](http://www.phi.com).

**Plasmaterials, Inc.**  
[info@plasmaterials.com](mailto:info@plasmaterials.com)  
[www.plasmaterials.com](http://www.plasmaterials.com)

**Booth 209**

**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.

**Protochips, Inc.**  
[contact@protochips.com](mailto:contact@protochips.com)  
[www.protochips.com](http://www.protochips.com)

**Booth 204**

**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](mailto:sales@pvdproducts.com)  
[www.pvdproducts.com](http://www.pvdproducts.com)

**Booth 303**

**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.

**Quantum Design, Inc.**  
[info@qdusa.com](mailto:info@qdusa.com)  
[www.qdusa.com](http://www.qdusa.com)

**Booth 420**

**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 magnet fields 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](mailto:info@rdmathis.com)  
[www.rdmathis.com](http://www.rdmathis.com)

**Booth 109**

**Key Products:** Evaporation Sources; Power Supplies; Gas Purifier

Celebrating our 50<sup>th</sup> 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](mailto:radiant@ferrodevices.com)  
[www.ferrodevices.com](http://www.ferrodevices.com)

**CORPORATE AFFILIATE**

**Booth 405**

**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.

# Exhibitor Profiles

**Renishaw Inc.**  
usa@renishaw.com  
www.renishaw.com

Booth 306

**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  $10 \text{ cm}^{-1}$  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

Booth 101

**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

Booth 514

**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 SCXmini 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

Booth 119

**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

Booth 230

**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

Booth 615

**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>.

**RSC Publishing**  
marketing@rsc.org  
www.rsc.org/publishing

CORPORATE AFFILIATE

Booth 602

**Key Products:** Journals; Books

The internationally acclaimed publishing arm of the Royal Society of Chemistry, Europe's largest organization for advancing the chemical sciences. Visit Booth #602 to find out how to stay in touch with the latest cutting-edge research, or find the best place to publish your work. Our materials that matter include recently announced journal *Materials Horizons*, high impact new journal *Biomaterials Science* and the *RSC Smart Materials* books series.

**Seki Diamond Systems**  
www.sekidiamond.com

CORPORATE AFFILIATE

Booth 518

**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.

**Semicore Equipment Inc.**  
[sales@semicore.com](mailto:sales@semicore.com)  
[www.semicore.com](http://www.semicore.com)

**Booth 324**

**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](http://www.semicore.com).

**Simpleware Ltd.**  
[sales@simpleware.com](mailto:sales@simpleware.com)  
[www.simpleware.com](http://www.simpleware.com)

**Booth 103**

**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 to leading commercial FEA and CFD solvers (e.g., Abaqus, LS-Dyna, Fluent, Comsol), and allows users to produce better models in a fraction of the time taken with alternative techniques. Simpleware has support and sales locations worldwide.

**Solartron Analytical (AMETEK)**  
[solartron.info@ametek.com](mailto:solartron.info@ametek.com)  
[www.solartronanalytical.com](http://www.solartronanalytical.com)

**Booth 318**

**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](mailto:sales@sonoplot.com)  
[www.sonoplot.com](http://www.sonoplot.com)

**Booth 220**

**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.

**SPECS Surface Nano Analysis, Inc.** **CORPORATE AFFILIATE**  
[usa@specs.com](mailto:usa@specs.com)  
[www.specs.com](http://www.specs.com)

**Booth 203**

**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.

**SPI Supplies/Structure Probe, Inc.** **CORPORATE AFFILIATE**  
[spi3spi@2spi.com](mailto:spi3spi@2spi.com)  
[www.2spi.com](http://www.2spi.com)

**Booth 500**

**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.

**Springer**  
[exhibits-ny@springer.com](mailto:exhibits-ny@springer.com)  
[www.springer.com](http://www.springer.com)

**Booth 601**

**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/materials](http://springer.com/materials).

**STAIB Instruments, Inc.** **CORPORATE AFFILIATE**  
[staib-us@staibinstruments.com](mailto:staib-us@staibinstruments.com)  
[www.staibinstruments.com](http://www.staibinstruments.com)

**Booth 512**

**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.



**SunaTech Inc.**  
[info@sunatech.com](mailto:info@sunatech.com)  
[www.sunatech.com](http://www.sunatech.com)

**Booth 329**

**Key Products:** OLED; OPV; Intermediates

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.

**Sunpower Inc.**  
[www.sunpower.com](http://www.sunpower.com)

**Booth 529**

**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.

**SURFACE Systems & Technology GmbH & Co. KG**  
[info@surface-tec.com](mailto:info@surface-tec.com)  
[www.surface-tec.com](http://www.surface-tec.com)

**Booth 505**

**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 nanoindenters, 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.

**Surfx Technologies**  
[info@surfxtechnologies.com](mailto:info@surfxtechnologies.com)  
[www.surfxtechnologies.com](http://www.surfxtechnologies.com)

**Booth 426**

**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.

**SVT Associates, Inc.**  
[sales@svta.com](mailto:sales@svta.com)  
[www.svta.com](http://www.svta.com)

**Booth 224**

**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. Epiwafer and advanced device manufacturing services are available.

**Ted Pella, Inc.**  
[sales@tedpella.com](mailto:sales@tedpella.com)  
[www.tedpella.com](http://www.tedpella.com)

**Booth 413**

**Key Products:** Vacuum Coaters; Calibration; Microscopy Sample Preparation & Supplies/Accessories

Ted Pella, Inc. is the premier supplier of quality consumables and specimen preparation tools for SEM, TEM, FIB, AFM/SPM, light microscopy and nanotechnology. Offers a full range of compact versatile bench top coaters for thin film research and electron microscopy application, which can be equipped with thickness monitors and multi-angle rotary stages. Manufacturer of SEM specimen mounts and holders, TEM support films, microscopy calibration tools, sample storage and vacuum components and supplies.

**Thermo Scientific**  
[analyze.us@thermofisher.com](mailto:analyze.us@thermofisher.com)  
[www.thermoscientific.com/materialscience](http://www.thermoscientific.com/materialscience)

**CORPORATE AFFILIATE**

**Booth 419**

**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.

**Toshima Manufacturing Co., Ltd.**  
[staff@material-sys.com](mailto:staff@material-sys.com)  
[www.material-sys.com](http://www.material-sys.com)

**Booth 632**

**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.



**United Mineral & Chemical Corporation**  
[inquiry@umccorp.com](mailto:inquiry@umccorp.com)  
[www.umccorp.com](http://www.umccorp.com)

**Booth 232**

**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 Scientia, Inc.**  
[usasales@vgscientia.com](mailto:usasales@vgscientia.com)  
[www.vgscientia.com](http://www.vgscientia.com)

**Booth 213**

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

VG Scientia 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 Scientia 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](mailto:info@vigor-glovebox.com)  
[www.vigor-glovebox.com](http://www.vigor-glovebox.com)

**Booth 225**

**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](mailto:info@witec-instruments.com)  
[www.witec-instruments.com](http://www.witec-instruments.com)

**Booth 100**

**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](mailto:info@evactron.com)  
[www.evactron.com](http://www.evactron.com)

**Booth 524**

**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](mailto:info@xradia.com)  
[www.xradia.com](http://www.xradia.com)

**CORPORATE AFFILIATE**

**Booth 105**

**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.

# Exhibit Resource Guide

MRS



EXHIBITS

Following is an array of exhibitors who have products and/or services directly related to your research.

## Biological, Biomedical, Bio-related

AdValue Technology, LLC  
Aldrich Materials Science  
Alfa Aesar, a Johnson Matthey Company  
Anton Paar USA  
Asahi Spectra Co., Ltd.  
Electron Microscopy Sciences/Diatome U.S.  
Fischione Instruments  
FUJIFILM Dimatix, Inc.  
Gatan, Inc.  
JASCO  
KD Scientific  
Lucas Scientific LLC  
Metrohm USA, Inc.  
Micro Photonics Inc.  
NanoAndMore USA Inc.  
National Electrostatics Corp.  
NIST  
NT-MDT Co.  
Optofluidics, Inc.  
Phasex Corporation  
Photonic Cleaning Technologies, LLC  
Physical Electronics  
Protochips, Inc.  
Renishaw Inc.  
Rigaku Americas Corporation  
SonoPlot, Inc.  
Sunpower Inc.  
Surfx Technologies  
Xradia, Inc.

## Cryogenic Systems

Advanced Research Systems, Inc.  
Electron Microscopy Sciences/Diatome U.S.  
Janis Research Company, LLC  
KD Scientific  
Lake Shore Cryotronics, Inc.  
MMR Technologies, Inc.  
NIST  
NIST/CNST  
Quantum Design, Inc.  
RHK Technology, Inc.  
Rigaku Americas Corporation  
Sunpower Inc.  
Xradia, Inc.

## Deposition Equipment, Processes and Materials

AIXTRON SE  
AJA International, Inc.  
Aldrich Materials Science  
Angstrom Thin Film Technologies LLC  
Annealsys

Asahi Spectra Co., Ltd.  
Beijing Mikrouna Mechatronics Technology Company, Ltd.  
Blue Wave Semiconductors  
CVD Equipment Corporation  
Electron Microscopy Sciences/Diatome U.S.  
FUJIFILM Dimatix, Inc.  
Gamry Instruments  
Innovative Technology, Inc.  
KD Scientific  
Kurt J. Lesker Company  
Labtec Sales Partners LLC  
MANTIS Deposition Ltd.  
MTI Corporation  
Nano-Master, Inc.  
Neocera, LLC  
NIST  
NIST/CNST  
Omicron NanoTechnology USA, LLC  
Photonic Cleaning Technologies, LLC  
Plasmaterials, Inc.  
PVD Products, Inc.  
R.D. Mathis Company  
Rocky Mountain Vacuum Tech, Inc.  
Semicore Equipment Inc.  
SonoPlot, Inc.  
SPI Supplies/Structure Probe, Inc.  
STAIB Instruments, Inc.  
Surfx Technologies  
SVT Associates, Inc.  
Ted Pella, Inc.  
Toshima Manufacturing Co., Ltd.  
VG Scienta, Inc.

## Electronic and Electrical Properties Instruments

AdValue Technology, LLC  
Advanced Research Systems, Inc.  
Agilent Technologies  
Barnett Technical Services LLC  
BioLogic USA  
Blue Wave Semiconductors  
Ecopia Corp.  
Gamry Instruments  
Hysitron Inc.  
KP Technology Ltd.  
Labtec Sales Partners LLC  
Lake Shore Cryotronics, Inc.  
Metrohm USA, Inc.  
MMR Technologies, Inc.  
MTI Corporation  
Nanometrics Incorporated  
NIST  
NIST/CNST  
Omicron NanoTechnology USA, LLC  
Protochips, Inc.  
PVD Products, Inc.  
Quantum Design, Inc.  
Radiant Technologies, Inc.  
RHK Technology, Inc.  
STAIB Instruments, Inc.

## Energy

Aldrich Materials Science  
Beijing Mikrouna Mechatronics Technology Company, Ltd.  
BioLogic USA  
CrystalMaker Software Ltd.  
Ecopia Corp.  
Fischione Instruments  
FUJIFILM Dimatix, Inc.  
Gamry Instruments  
JASCO  
Kurt J. Lesker Company  
MTI Corporation  
Neocera, LLC  
NIST  
Physical Electronics  
Protochips, Inc.  
PVD Products, Inc.  
STAIB Instruments, Inc.  
Xradia, Inc.

## Ion Beam Systems

AJA International, Inc.  
Asahi Spectra Co., Ltd.  
Fischione Instruments  
Gatan, Inc.  
Integrated Dynamics Engineering  
JEOL USA, Inc.  
Labtec Sales Partners LLC  
Nano-Master, Inc.  
National Electrostatics Corp.  
Neocera, LLC  
NIST/CNST  
Physical Electronics  
PVD Products, Inc.  
Rocky Mountain Vacuum Tech, Inc.  
Semicore Equipment Inc.  
Surfx Technologies

## Lasers and Related Equipment

Labtec Sales Partners LLC  
Microtrac Inc.  
Neocera, LLC  
NT-MDT Co.  
Optofluidics, Inc.  
Photonic Cleaning Technologies, LLC  
PVD Products, Inc.  
Rigaku Americas Corporation  
Rocky Mountain Vacuum Tech, Inc.  
Surfx Technologies  
SVT Associates, Inc.





## Macro-, Micro- and Nano-scale Mechanical Testing

Agilent Technologies  
 Barnett Technical Services LLC  
 Fischer Technology, Inc.  
 Gatan, Inc.  
 Hysitron Inc.  
 Lucas Scientific LLC  
 Micro Photonics Inc.  
 Nanomechanics, Inc.  
 Nanovea  
 Neocera, LLC  
 NT-MDT Co.  
 Rigaku Americas Corporation

## Magnets and Magnetic Materials

AJA International, Inc.  
 Aldrich Materials Science  
 Ecopia Corp.  
 Kurt J. Lesker Company  
 Lake Shore Cryotronics, Inc.  
 MMR Technologies, Inc.  
 MTI Corporation  
 Neocera, LLC  
 NIST  
 NIST/CNST  
 NT-MDT Co.  
 Plasmaterials, Inc.  
 PVD Products, Inc.  
 Quantum Design, Inc.

## Materials and Chemicals

2-DTech Ltd.  
 AdValue Technology, LLC  
 AJA International, Inc.  
 Aldrich Materials Science  
 Alfa Aesar, a Johnson Matthey Company  
 Asahi Spectra Co., Ltd.  
 Balazs NanoAnalysis, a Division  
 of Air Liquide Electronics U.S. LP  
 Beijing Mikrouna Mechatronics  
 Technology Company, Ltd.  
 CVD Equipment Corporation  
 Electron Microscopy Sciences/Diatome U.S.  
 iXRF Systems, Inc.  
 JASCO  
 KD Scientific  
 Koei Chemical Company, Limited  
 Kurt J. Lesker Company  
 MTI Corporation  
 NIST  
 NIST/CNST  
 Omicron NanoTechnology USA, LLC  
 Phasex Corporation  
 Plasmaterials, Inc.

PVD Products, Inc.  
 Quantum Design, Inc.  
 R.D. Mathis Company  
 Rigaku Americas Corporation  
 Seki Diamond Systems  
 SPI Supplies/Structure Probe, Inc.  
 STAIB Instruments, Inc.  
 SunaTech Inc.  
 Toshima Manufacturing Co., Ltd.  
 United Mineral & Chemical Corporation  
 WITec Instruments Corp.

## Materials Characterization Equipment

AdValue Technology, LLC  
 Advanced Research Systems, Inc.  
 Agilent Technologies  
 AIST-NT, Inc.  
 Asylum Research, an Oxford  
 Instruments Company  
 Barnett Technical Services LLC  
 BioLogic USA  
 Bruker  
 cyberTECHNOLOGIES USA, LLC  
 Ecopia Corp.  
 Fischer Technology, Inc.  
 Fischione Instruments  
 Gamry Instruments  
 Gatan, Inc.  
 HORIBA Scientific  
 Hummingbird Scientific  
 Hysitron Inc.  
 iXRF Systems, Inc.  
 JASCO  
 KD Scientific  
 KP Technology Ltd.  
 Lake Shore Cryotronics, Inc.  
 Lucas Scientific LLC  
 Microtrac Inc.  
 MMR Technologies, Inc.  
 Nanometrics Incorporated  
 Nanovea  
 National Electrostatics Corp.  
 Neocera, LLC  
 NIST  
 NT-MDT Co.  
 Omicron NanoTechnology USA, LLC  
 Optofluidics, Inc.  
 PANalytical Inc.  
 Physical Electronics  
 Quantum Design, Inc.  
 Radiant Technologies, Inc.  
 Renishaw Inc.  
 Rigaku Americas Corporation  
 STAIB Instruments, Inc.  
 Sunpower Inc.  
 Thermo Scientific  
 VG Scientia, Inc.  
 Xradia, Inc.

## Materials Processing Equipment

AIXTRON SE  
 Annealsys  
 Beijing Mikrouna Mechatronics  
 Technology Company, Ltd.  
 Blue Wave Semiconductors  
 CVD Equipment Corporation  
 Electron Microscopy Sciences/Diatome U.S.  
 HORIBA Scientific  
 KD Scientific  
 Labtec Sales Partners LLC  
 MTI Corporation  
 Nano-Master, Inc.  
 Neocera, LLC  
 NIST/CNST  
 PVD Products, Inc.  
 Rigaku Americas Corporation  
 Semicore Equipment Inc.  
 STAIB Instruments, Inc.  
 Surfx Technologies  
 Ted Pella, Inc.  
 United Mineral & Chemical Corporation

## Metrology and Equipment

Agilent Technologies  
 Anton Paar USA  
 Asylum Research, an Oxford  
 Instruments Company  
 Barnett Technical Services LLC  
 cyberTECHNOLOGIES USA, LLC  
 Ecopia Corp.  
 Electron Microscopy Sciences/Diatome U.S.  
 Fischer Technology, Inc.  
 Fischione Instruments  
 Hadland Technologies, Inc.  
 HORIBA Scientific  
 Hysitron Inc.  
 Integrated Dynamics Engineering  
 JASCO  
 Lake Shore Cryotronics, Inc.  
 Nanovea  
 Neocera, LLC  
 NIST  
 NT-MDT Co.  
 Optofluidics, Inc.  
 Photonic Cleaning Technologies, LLC  
 SVT Associates, Inc.  
 Thermo Scientific

## Microscopes, Electron Microscopy and Instrumentation

Agilent Technologies  
 AIST-NT, Inc.  
 Asahi Spectra Co., Ltd.  
 Barnett Technical Services LLC  
 BaySpec, Inc.  
 Bruker  
 CRAIC Technologies, Inc.  
 CrystalMaker Software Ltd.  
 cyberTECHNOLOGIES USA, LLC  
 Electron Microscopy Sciences/Diatome U.S.  
 Fischione Instruments  
 Gatan, Inc.  
 Hadland Technologies, Inc.  
 HORIBA Scientific  
 Hummingbird Scientific  
 Hysitron Inc.  
 Integrated Dynamics Engineering  
 iXRF Systems, Inc.  
 JASCO  
 JEOL USA, Inc.  
 KD Scientific  
 Labtec Sales Partners LLC  
 NanoAndMore USA Inc.  
 Nanomechanics, Inc.  
 NT-MDT Co.  
 Omicron NanoTechnology USA, LLC  
 Photonic Cleaning Technologies, LLC  
 Physical Electronics  
 Protochips, Inc.  
 PVD Products, Inc.  
 Quantum Design, Inc.  
 Renishaw Inc.  
 RHK Technology, Inc.  
 SPECS Surface Nano Analysis, Inc.  
 SPI Supplies/Structure Probe, Inc.  
 STAIB Instruments, Inc.  
 Ted Pella, Inc.  
 Thermo Scientific  
 Xradia, Inc.

## Nanotechnology

Advanced Research Systems, Inc.  
 Agilent Technologies  
 AIST-NT, Inc.  
 AIXTRON SE  
 AJA International, Inc.  
 Aldrich Materials Science  
 Angstrom Thin Film Technologies LLC  
 Annealsys  
 Anton Paar USA  
 Asylum Research, an Oxford Instruments Company  
 Blue Wave Semiconductors  
 CrystalMaker Software Ltd.  
 CVD Equipment Corporation  
 Fischione Instruments  
 FUJIFILM Dimatix, Inc.  
 Gatan, Inc.  
 HeatWave Labs, Inc.  
 HORIBA Scientific  
 Hysitron Inc.  
 Integrated Dynamics Engineering

Janis Research Company, LLC  
 JASCO  
 JEOL USA, Inc.  
 KD Scientific  
 Kurt J. Lesker Company  
 Labtec Sales Partners LLC  
 MANTIS Deposition Ltd.  
 Microtrac Inc.  
 Nano-Master, Inc.  
 NanoAndMore USA Inc.  
 Nanomechanics, Inc.  
 Neocera, LLC  
 NIST  
 NIST/CNST  
 NT-MDT Co.  
 Omicron NanoTechnology USA, LLC  
 Optofluidics, Inc.  
 Park Systems Inc.  
 Photonic Cleaning Technologies, LLC  
 Physical Electronics  
 Protochips, Inc.  
 PVD Products, Inc.  
 Renishaw Inc.  
 RHK Technology, Inc.  
 Rigaku Americas Corporation  
 Rocky Mountain Vacuum Tech, Inc.  
 Seki Diamond Systems  
 SonoPlot, Inc.  
 SPECS Surface Nano Analysis, Inc.  
 SPI Supplies/Structure Probe, Inc.  
 STAIB Instruments, Inc.  
 SVT Associates, Inc.  
 Ted Pella, Inc.  
 Thermo Scientific  
 VG Scienta, Inc.  
 Xradia, Inc.

## Optical Components and Equipment

Asahi Spectra Co., Ltd.  
 BaySpec, Inc.  
 cyberTECHNOLOGIES USA, LLC  
 HORIBA Scientific  
 JASCO  
 Labtec Sales Partners LLC  
 MMR Technologies, Inc.  
 MTI Corporation  
 Neocera, LLC  
 NT-MDT Co.  
 Photonic Cleaning Technologies, LLC  
 PVD Products, Inc.  
 STAIB Instruments, Inc.

## Publishers and Information Services

AIP Publishing  
 Cambridge University Press  
 CRC Press-Taylor & Francis  
 CrystalMaker Software Ltd.  
 IOP Publishing  
 Japan Society of Applied Physics  
 Royal Society Publishing  
 RSC Publishing  
 Springer

## Research Centers and Organizations

CVD Equipment Corporation  
 HeatWave Labs, Inc.  
 Integrated Dynamics Engineering  
 KD Scientific  
 National Nanotechnology Infrastructure Network  
 National User Facility Organization  
 Neocera, LLC  
 NIST/CNST  
 Phasex Corporation

## Research Instrumentation and Equipment

Advanced Research Systems, Inc.  
 Agilent Technologies  
 AIST-NT, Inc.  
 AJA International, Inc.  
 Angstrom Thin Film Technologies LLC  
 Annealsys  
 Anton Paar USA  
 Asylum Research, an Oxford Instruments Company  
 Barnett Technical Services LLC  
 BaySpec, Inc.  
 Beijing Mikrouna Mechatronics Technology Company, Ltd.  
 BioLogic USA  
 Blue Wave Semiconductors  
 Bruker  
 CVD Equipment Corporation  
 cyberTECHNOLOGIES USA, LLC  
 Fabsave, Inc.  
 Fischer Technology, Inc.  
 Fischione Instruments  
 FUJIFILM Dimatix, Inc.  
 Gamry Instruments  
 Gatan, Inc.  
 Hadland Technologies, Inc.  
 HORIBA Scientific  
 Hummingbird Scientific  
 Hysitron Inc.  
 Integrated Dynamics Engineering  
 iXRF Systems, Inc.  
 Janis Research Company, LLC  
 JASCO  
 JEOL USA, Inc.  
 KD Scientific  
 KP Technology Ltd.  
 Labtec Sales Partners LLC  
 Lake Shore Cryotronics, Inc.  
 Lucas Scientific LLC  
 MANTIS Deposition Ltd.  
 Micro Photonics Inc.  
 MMR Technologies, Inc.  
 MTI Corporation  
 NanoAndMore USA Inc.  
 Nanometrics Incorporated  
 Nanovea  
 Neocera, LLC  
 NIST/CNST  
 Nor-Cal Products, Inc.  
 NT-MDT Co.  
 Omicron NanoTechnology USA, LLC



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# TECHNICAL PROGRAM

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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## 10 Complimentary Tutorial Sessions

Monday, April 1, Moscone West, Level 2

**A Thin-Film Silicon and Related Materials for Solar Cells and Displays**

9:00 am – 5:00 pm, Room 2000

- 9:00 am – 10:00 am **Eric A. Schiff**  
*Properties of Thin-Film Si and Related Materials*  
Break
- 10:00 am – 10:30 am **Qi Wang**  
*Growth Processes and Technologies*
- 10:30 am – 11:15 am **Eric A. Schiff**  
*Basics of Thin-Film Solar Cells*
- 11:15 am – 12:00 pm **Qi Wang**  
*Tandem and Triple Multijunction and a-Si/c-Si Heterojunction Solar Cells*  
Break
- 1:30 pm – 2:45 pm **Qi Wang**  
*Basics of Thin-Film Transistors and Displays*
- 2:45 pm – 3:15 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

**C Young Scientist Tutorial on Characterization Techniques for Thin-Film Solar Cells**

9:00 am – 5:00 pm, Room 2001


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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-Miréidin**, Max Planck Institute for Iron Research, Germany  
**Ana Kanevce**, National Renewable Energy Laboratory

**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.

**Krisztina Gajda-Schranz***Photoelectrochemical (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  
**Krisztina Gajda-Schranz**, Swiss Federal Laboratories for Materials Science and Technology (EMPA), Switzerland

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.

**F Material Assembly and Testing for Batteries**

1:30 pm – 5:00 pm, Room 2004


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- 1:30 pm – 2:20 pm **Venkat Srinivasan**  
*Electrochemical System Modeling*
- 3:00 pm – 3:50 pm **Vince Battaglia**  
*Laboratory Cell Fabrication and Testing*
- 4:00 pm – 4:50 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

**S 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

**V 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 3 $\Omega$  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




**W Nanogenerators and Piezotronics—  
From Fundamental Science to  
Technological Applications**

1:30 pm – 5:00 pm, Room 2006

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**Nanogenerators**

Ever since the wide-range applications of laptop computers and cell phones, the search for power sources for driving portable electronics has become increasingly important. The current technology mainly relies on rechargeable batteries. But for the near future, micro-/nanosystems will be widely used in health monitoring, infrastructure and environmental monitoring, the internet of things and defense technologies. Traditional batteries may not be the choice for power sources. With the increasing shrinkage in size, the total micro-/nanosystem size could be largely dominated by the size of the battery rather than the devices. Second, the number and density of micro-/nanosystems to be used for sensor network could be large; replacing batteries for these mobile devices could become challenging and even impractical. Lastly, the power needed to drive a micro-/nanosystem is rather small, in the range of micro- to milliwatt range. The nanogenerator was invented to meet these technological challenges. Three effects are commonly used for converting tiny physical motion into electricity: piezoelectric, triboelectric and pyroelectric effect.

**Piezotronics**

Piezoelectricity, a phenomenon known for centuries, is an effect of the production of electrical potential in a substance as the pressure on it changes. The most well-known material that has piezoelectric effect is the perovskite structured  $\text{Pb}(\text{Zr}, \text{Ti})\text{O}_3$  (PZT), which has found huge applications in electromechanical sensors, actuators and energy generators. But PZT is an electric insulator that is less useful for building electronic devices. Wurtzite structures, such as ZnO, GaN, InN and ZnS, also have piezoelectric properties, but they are not extensively used as much as PZT in piezoelectric sensors and actuators due to their small piezoelectric coefficients. In fact, due to the polarization of ions in a crystal that has non-central symmetry, a piezoelectric potential (*piezopotential*) is created in the crystal by applying a stress. For materials such as ZnO, GaN, InN in the wurtzite structure family, the effect of piezopotential to the transport behavior of charge carriers is significant due to their multiple functionalities of piezoelectricity, semiconductor and photon excitation. By utilizing the advantages offered by these properties, a few new fields have been created. Electronics fabricated by using inner-crystal piezopotential as a “gate” voltage to tune/control the charge transport behavior are named *piezotronics*, with applications in strain/force/pressure triggered/controlled electronic devices, sensors and logic units. *Piezo-phototronic effect* is a result of three-way coupling among piezoelectricity, photonic excitation and semiconductor transport, which allows tuning and controlling of electro-optical processes by strain-induced piezopotential.

Instructor:

**Zhong Lin Wang**, Georgia Institute of Technology

**DD Fundamentals of Emerging Nonvolatile Memories**

8:30 am – 5:00 pm, Room 2008

- 8:30 am – 10:00 am **Hyunsang Hwang**  
*ReRAM and CBRAM*
- 10:00 am – 10:30 am Break
- 10:30 am – 12:00 pm **Shinji Yuasa**  
*Fundamentals of Magnetic Tunnel Junctions,  
Spin-Transfer Torque and MRAM*
- 12:00 pm – 1:30 pm Break
- 1:30 pm – 3:00 pm **Gabriel Molas**  
*Advanced Flash Memories*
- 3:00 pm – 3:30 pm Break
- 3:30 pm – 5:00 pm **Jane Yater**  
*Nanocrystal Memories*

Due to the technological limitation of flash memory, a significant number of new nonvolatile memories are now being proposed. Technological details of ReRAMs and CBRAMs, MRAMs, advanced flash memories and memories using nanocrystals will be introduced. Each segment will include the principles and the physics behind the technologies.

Instructors:

**Hyunsang Hwang**, Pohang University of Science and Technology (POSTECH), Republic of Korea

**Shinji Yuasa**, National Institute of Advanced Industrial Science and Technology (AIST), Japan

**Gabriel Molas**, CEA-LETI MINATEC-Campus, France

**Jane Yater**, Freescale Semiconductor, Inc.

**EE Overview of Phase-Change Materials—  
Physics and Applications**

9:00 am – 5:00 pm, Room 2007

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

**XX New Perspectives for Oxide Applications**

1:30 pm – 5:00 pm, Room 2009

1:30 pm – 2:30 pm, *Oxide Photonics and Electronics*

**Akira Ohtomo** will review the state-of-the-art of ZnO heterostructures toward photonics and electronics applications as well as novel prospects for oxides in this field. Among oxide materials, zinc oxide (ZnO) has outstanding optical and electronic properties, such as large exciton-binding energy, excellent luminescent properties, high electron mobility, piezoelectricity and a direct wide bandgap. These features and the growth of ZnO nanostructures have spurred the investigation of these materials for a large scope of photonics and electronics applications, including light-emitting diodes (LEDs), photodetectors and transparent field-effect transistors.

2:30 pm – 3:00 pm Break

3:00 pm – 4:00 pm, *Ionic Oxides for Surface Chemistry and Energy Application*

**Yang Shao-Horn** will give an overview on transition-metal oxide surface probes and design principles of electrocatalytic activities. One of the fundamental recent breakthroughs on transition-metal oxides is the recognition that surface electronic states are intimately linked to the chemical reactivity, opening novel routes for optimized catalytic devices with oxides. Based on the nature of multivalency offered from some transition-metal oxides, chemical activities on an oxide surface have fundamental implications and potential for a variety of energy-storage technologies, such as rechargeable metal-air batteries and hydrogen production from water splitting.

4:00 pm – 5:00 pm, *Semiconductor Memory Technology: It Is Time to Shift the Paradigm*

**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 straightforward scaling trend, new strategies combining the existing technologies and new functionalities of novel materials will be introduced.

As 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 oxides is a serious contender with the capability to enter this novel paradigm.

Instructors:

**Akira Ohtomo**, Tokyo Institute of Technology, Japan

**Yang Shao-Horn**, Massachusetts Institute of Technology

**Cheol Seong Hwang**, Seoul National University, Republic of Korea



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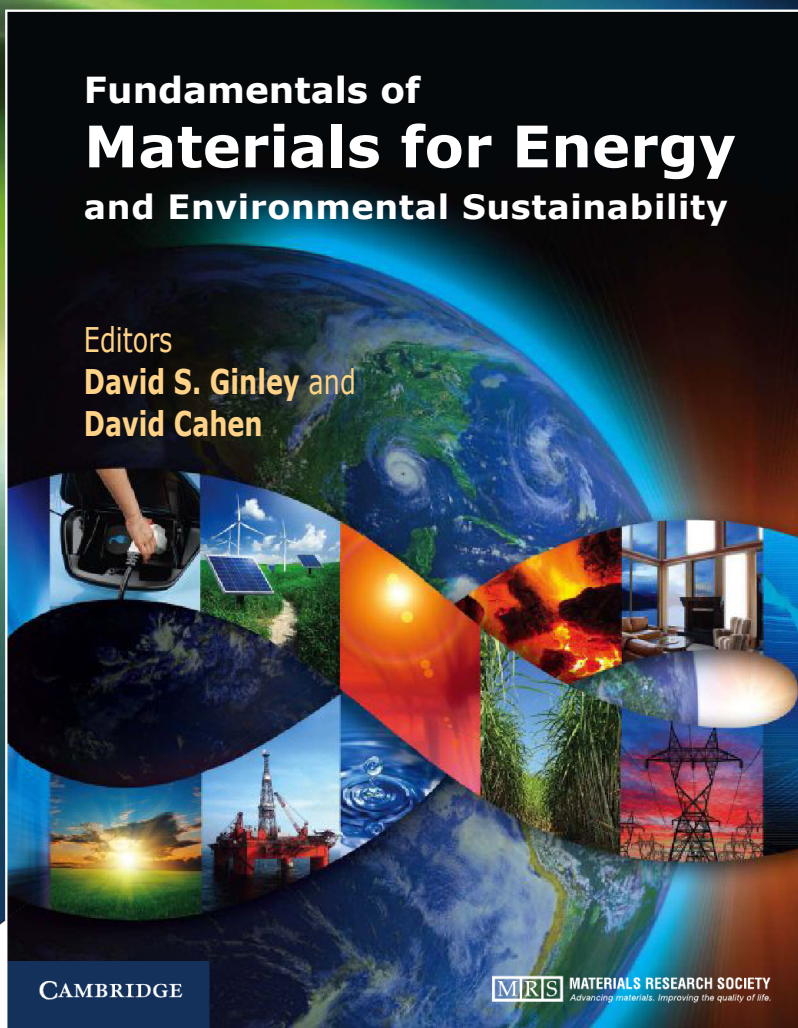
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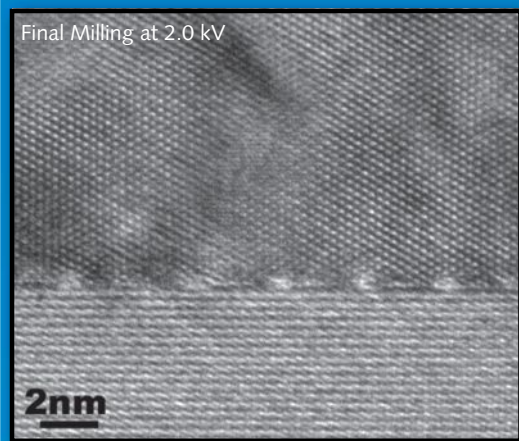
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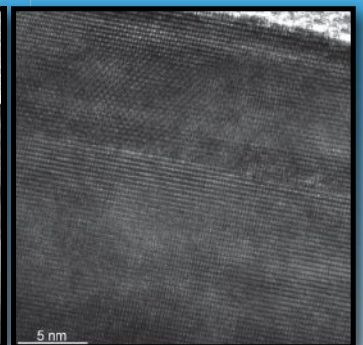
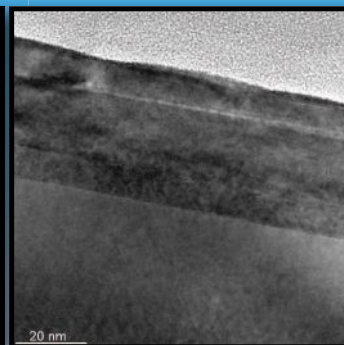
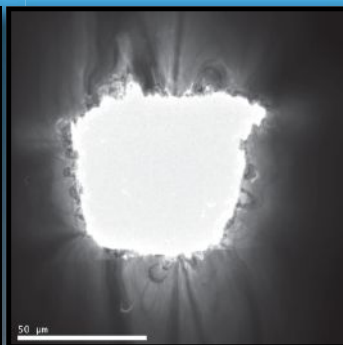
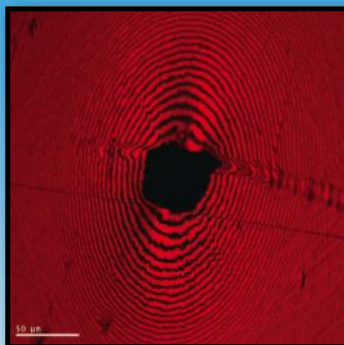
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