



### Edward T. Yu

Guest Editor for this issue of *MRS Bulletin*  
Microelectronics Research Center, University of Texas at Austin, 10100 Burnet Rd., Bldg. 160, Austin, TX 78758, USA; tel. 512-232-5167; and email [ety@ece.utexas.edu](mailto:ety@ece.utexas.edu).

Yu is a professor of electrical engineering and holds the Judson S. Swearingen Regents Chair in Engineering at The University of Texas at Austin. He received his AB (summa cum laude) and AM degrees in physics from Harvard University in 1986, and his PhD degree in applied physics from the California Institute of Technology in 1991. From 1992 to 2009, he served on the faculty of the University of California, San Diego. Yu's research is directed broadly toward the characterization, understanding, and application of physical phenomena and of material and device properties at nanometer to atomic length scales. His current interests include photovoltaics and other technologies for energy generation; scanning probe microscopy; plasmonic and related nanophotonic structures; and solid-state nanoscience and nanotechnology generally. He has been the recipient of a National Science Foundation CAREER Award, the Office of Naval Research Young Investigator Award, the Alfred P. Sloan Research Fellowship, and the University of California, San Diego, Electrical and Computer Engineering Graduate Teaching Award. He currently serves as a member and Associate Chair of the Defense Advanced Research Projects Agency (DARPA) Defense Sciences Research Council.



### Jao van de Lagemaat

Guest Editor for this issue of *MRS Bulletin*

Chemical and Materials Sciences Center, National Renewable Energy Laboratory, 1617 Cole Blvd., Golden, CO 80401, USA; tel. 303-384-6143; and email [jao.vandelagemaat@nrel.gov](mailto:jao.vandelagemaat@nrel.gov).

Van de Lagemaat is a senior scientist and group manager at the National Renewable Energy Laboratory (NREL), as well as a fellow of the Renewable and Sustainable Energy Institute at University of Colorado Boulder. He received his PhD degree in physical chemistry in 1998 from the University of Utrecht. He focused on the exciton dynamics and charge transport and transfer properties at interfaces of large bandgap semiconductors. From 1998 to 2001, he worked on charge transport and recombination in dye-sensitized solar cells as a postdoctoral researcher at NREL. He has been a scientific staff member at NREL since 2001. Van de Lagemaat's research interests include energy and charge transport in single semiconductor nanoparticles (quantum dots) and arrays of nanoparticles, exciton/plasmon coupling in nanostructured materials, as well as the use of plasmonic-enhancement effects in solar energy conversion.



### Mukul Agrawal

Applied Materials, Santa Clara, CA; and email [mukul\\_agrawal@amat.com](mailto:mukul_agrawal@amat.com).

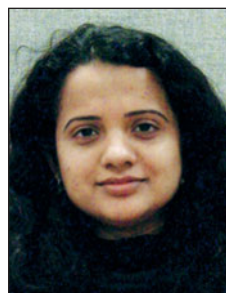
Agrawal is a photovoltaics developer at Applied Materials in Santa Clara, CA. He received his BTech degree in electronics engineering from the Institute of Technology, Banaras Hindu University, India in 2000. He received his MS and PhD degrees in electrical engineering from Stanford University in 2003 and 2008, respectively. Agrawal's research interests include physics of nanoscale materials and devices, energy efficient solid-state devices, and computational electromagnetism.



### Angelika Basch

Institute of Physics, University of Graz, Universitätsplatz 5, 8010 Graz, Austria; tel. 43-664-1773316; and email [angelika@basch.at](mailto:angelika@basch.at).

Basch is a professor at the Upper Austrian University of Applied Sciences and is currently a visiting fellow at the Australian National University, Australia, and the University of Graz, Austria. She earned her master's degree in chemistry from the University of Graz and her PhD degree from the Graz University of Technology, Austria, followed by two years in the semiconductor industry participating in the Christian Doppler Laboratory "Application of Sulfosalts for Energy Conversion" at the University of Salzburg. Her research interests cover thin-film photovoltaics, surface, colloid and solid-state science, and Li-ion batteries.



### Shrestha Basu Mallick

Applied Physics Department, Stanford University; and email [sbasumal@stanford.edu](mailto:sbasumal@stanford.edu).

Mallick is a doctoral candidate in the Applied Physics Department at Stanford University under the supervision of Peter Peumans and Mark Brongersma. She holds an MS degree in physics from Purdue University and a BSc degree in physics from Presidency College, Calcutta, India. Her research focuses on using various approaches such as photonic crystals and plasmonics to increase light trapping in thin silicon solar cells. Mallick has previously worked on various applications of photonic crystals to microelectromechanical systems (MEMS).



### Fiona Jean Beck

Institut de Ciències Fotòniques, Mediterranean Technology Park, Av. Canal Olímpic, s/n, 08860 Castelldefeld, Barcelona, Spain; tel. 34-935534181; and email [fiona.beck@icfo.es](mailto:fiona.beck@icfo.es).

Beck is a postdoctoral researcher at the Institut de Ciències Fotòniques. She completed her PhD degree studies in plasmonics for photovoltaic applications at The Australian National University in late 2010, and received an MSci degree in Physics at the University of Glasgow in 2006, where she was awarded the Eve and Ravenscroft prize for the most distinguished graduate from the Faculty of The Physical Sciences. Her research interests include the design of nanophotonic structures for opto-electronic devices as well as novel architectures for photovoltaics.



### Kylie Catchpole

Australian National University, Centre for Sustainable Energy Systems, Canberra ACT 0200, Australia; tel. 61-2-6125-8299; and email [kylie.catchpole@anu.edu.au](mailto:kylie.catchpole@anu.edu.au).

Catchpole is a Research Fellow and leads the nanophotonics group in the Centre for Sustainable Energy Systems at the Australian National University (ANU). She has a physics degree from ANU, winning a University Medal, and also earned her PhD degree from ANU. Catchpole was a postdoctoral fellow at the University of New South Wales and the FOM Institute for Atomic and Molecular Physics, Amsterdam. She has published more than 50 papers, and her work has been featured in the news section of *Science* magazine, *The Economist*, and the Massachusetts Institute of Technology's *Technology Review*.



**Jaehee Cho**  
Rensselaer Polytechnic Institute, 110 Eighth St., Troy, NY 12180, USA; tel. 518-276-6151; and email [choj6@rpi.edu](mailto:choj6@rpi.edu).  
Cho is a senior research scientist in the Future Chips Constellation at Rensselaer Polytechnic Institute (RPI). He earned his PhD degree in materials science and engineering from the Seoul National University, Korea, in 2009. He worked as a senior research scientist at the Samsung Advanced Institute of Technology, Korea, for 10 years until he joined RPI in 2008.

Cho's research interests have been in the areas of device fabrication and optical/electrical analysis of light-emitting diodes, laser diodes, and photovoltaics. He has authored or co-authored more than 60 scientific publications and is an inventor of 22 issued U.S. patents.



**Arthur J. Frank**  
National Renewable Energy Laboratory, Golden, CO 80401, USA; tel. 303-384-6262; and email [Arthur.frank@nrel.gov](mailto:Arthur.frank@nrel.gov).  
Frank is a principal scientist at the National Renewable Energy Laboratory (NREL). He received his BA degree from the University of Colorado at Boulder and his PhD degree from the University of Florida. He was a postdoctoral fellow at the University of California at Berkeley (1976–1978), and the Hahn-Meitner Institute in Berlin (1995–1996), where he worked in the field of molecular and colloidal solar photochemistry. His current

research interests include developing ordered and disordered mesoporous films for sensitized solar cells, photolysis of water, Li-ion batteries and super capacitors and understanding the relationship of film structure to the energetics/kinetics of charge transport and recombination and light management.



**Yong Sung Kim**  
Rensselaer Polytechnic Institute, 110 Eighth St., Troy, NY 12180, USA; tel. 518-231-5229; and email [kimy10@rpi.edu](mailto:kimy10@rpi.edu).  
Kim is currently a research associate in the Future Chips Constellation and the Department of Physics, Applied Physics and Astronomy at the Rensselaer Polytechnic Institute in Troy, NY. He received his BS degree from Seoul National University, Seoul, Korea, his MS degree in physics from Western Illinois University, Macomb, IL, and his PhD degree in physics from Iowa State University, Ames, IA.



**Mei-Ling Kuo**  
Rensselaer Polytechnic Institute, 110 Eighth St., Troy, NY 12180, USA; and email [kuom@rpi.edu](mailto:kuom@rpi.edu).  
Kuo is currently working toward her PhD degree with Professor S. Lin in the Physics Department and Future Chips Constellation of the Rensselaer Polytechnic Institute in Troy, NY. She received her BS degree in physics from the National Taiwan Normal University, Taiwan, in 2001. Her current research interests include optics measurement and nanofabrication.



**Jaret Lee**  
Australian National University, Canberra ACT 0200 Australia; and email [jaret.lee@alumni.rice.edu](mailto:jaret.lee@alumni.rice.edu).  
Lee is a PhD degree student at the Australian National University. He holds BS and MS degrees, both in electrical engineering, from Rice University and the University of California, Santa Barbara, respectively. Lee was a former recipient of the National Science Foundation-Partnerships for International Research and Education NanoJapan fellowship. His research interests include the fabrication and character-

ization of novel photovoltaic devices.



**Jung-Yong Lee**  
Korea Advanced Institute of Science and Technology; and email [jungyong.lee@kaist.ac.kr](mailto:jungyong.lee@kaist.ac.kr).  
Lee is an assistant professor at the Korea Advanced Institute of Science and Technology (KAIST). He received his BS and MS degrees in electrical engineering from Seoul National University in 2000 and 2002, respectively, and his PhD degree in electrical engineering from Stanford University in 2009. Prior to joining KAIST in 2010, Lee was a postdoctoral researcher at Stanford University. His research interests include highly efficient photovoltaic cells and

various renewable energy technologies.



**Shawn-Yu Lin**  
Rensselaer Polytechnic Institute, 110 Eighth St., Troy, NY 12180, USA; tel. 518-320-0870; and email [sylin@rpi.edu](mailto:sylin@rpi.edu).  
Lin has been a distinguished professor for the Future-Chips Constellation and the Department of Physics at Rensselaer Polytechnic Institute in Troy, NY, since the summer of 2004. He received his bachelor's degree from the National Taiwan University, Taiwan, his master's degree from the University of North Carolina-Chapel Hill, and his PhD degree from Princeton University, Princeton, NJ. In 1992, Lin joined the IBM

T.J. Watson Research Center, first working on the wave-function symmetry of high-temperature superconductors and then on ultrafast photo-conductive switches. In 1994, he joined Sandia National Laboratory and led its efforts in developing photonic-crystal devices for communication, defense, and energy applications. His current research interest is in active photonic crystal structures for sensing, beam steering, solid-state lighting, photon recycling, and solar energy applications.



**Eric Mazur**  
29 Oxford St., Pierce 233, Cambridge, MA 02138, USA; tel. 617-495-8729; and email [mazur@physics.harvard.edu](mailto:mazur@physics.harvard.edu).  
Mazur is the Balkanski Professor of Physics and Applied Physics and dean of Applied Physics at Harvard University. He obtained his PhD degree in experimental physics at the University of Leiden in the Netherlands in 1981 and joined the Harvard faculty in 1984. His work includes spectroscopy, light scattering, and studies of electronic and structural events in solids that occur on the femtosecond time scale. He also

is interested in education, science policy, outreach, and the public perception of science.



#### Arnold McKinley

Australian National University, Centre for Sustainable Energy Systems, Canberra ACT 0200, Australia; and email [arni.mckinley@anu.edu.au](mailto:arni.mckinley@anu.edu.au).

McKinley is a PhD degree student at the Australian National University. He holds a master's degree in electrical engineering and a master's degree in engineering-economic systems, both from Stanford University. His PhD degree studies focused on nano-antennas. For many years, he developed software for various educational and technological solutions at research labs in

California. Most recently, McKinley led the development of a web-based energy-monitoring system for renewable resources.



#### Sudha Mokkaapati

Australian National University, Centre for Sustainable Energy Systems, Canberra ACT 0200, Australia; tel. 61-2-6125-8299; and email [sudha.mokkaapati@anu.edu.au](mailto:sudha.mokkaapati@anu.edu.au).

Mokkaapati is a postdoctoral fellow working in the nanophotonics research group of the Center for Sustainable Energy Systems at the Australian National University (ANU). She earned her MSc degree in physics from the University of Hyderabad, India, her MTech degree in materials science from the Indian Institute of Technology, Kanpur, India, and her PhD degree in

physics from ANU. Mokkaapati's research interests include quantum-dot lasers and nanophotonics for solar cell applications. She has published 22 refereed journal articles, four book chapters, and several conference papers.



#### Frank W. Mont

8 Lillian Ln., Troy, NY 12180, USA; tel. 845-325-0936; and email [montf@raydextech.com](mailto:montf@raydextech.com).

Mont is currently the chief technical officer of Raydex Technology, Inc. He received his BS degree (2005), MS degree (2007), and PhD degree (2011) in electrical engineering from the Rensselaer Polytechnic Institute. He served as a National Science Foundation graduate research fellow from 2006 to 2009. Mont's current interests include developing photonic-based devices and optical components for intelligent optical systems. While at RPI, he developed GaN LEDs

and thin-film optical coatings. He has co-authored more than 20 publications.



#### Peter Peumans

Stanford University, Stanford, CA 94305, USA; and email [ppeumans@stanford.edu](mailto:ppeumans@stanford.edu).

Peumans is an assistant professor of electrical engineering at Stanford University and deputy director of the Center for Advanced Molecular Photovoltaics. He is interested in low-cost photovoltaics, light management in solar cells, solar thermal systems, large-area electronics, and biomedical electronics. Peumans also is the recipient of a National Science Foundation CAREER award.

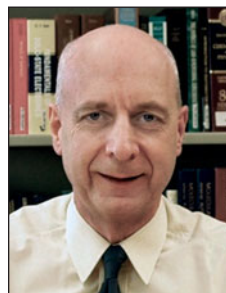


#### David J. Poxson

Rensselaer Polytechnic Institute, 110 Eighth St., Troy, NY 12180, USA; tel. 518-276-3392; and email [poxsod@rpi.edu](mailto:poxsod@rpi.edu).

Poxson is a PhD degree student in the multi-disciplinary program at Rensselaer Polytechnic Institute (RPI) and a member of the Future Chips Constellation. He attended Michigan State University, where he earned his BS degree in physics in fall 2005. He earned his MS degree in physics at RPI in 2008, based partly on his work involving nanoporous thin films with tailored- and low-refractive indices. Poxson's

current research interests include optimized antireflection coatings for solar cell devices, as well as nanoporous materials fabricated on flexible or moldable substrates.



#### E. Fred Schubert

Rensselaer Polytechnic Institute, 110 Eighth St., Troy, NY 12180, USA; tel. 518-271-2044; and email [efschubert@rpi.edu](mailto:efschubert@rpi.edu).

Schubert is the Wellfleet Senior Constellation Professor at the Rensselaer Polytechnic Institute. He earned his PhD degree in 1986 and has made pioneering contributions to the field of compound semiconductors. Schubert is the co-inventor of more than 30 U.S. patents and has co-authored more than 275 publications. He authored the books *Doping in III-V Semiconductors* (1992), *Delta Doping of Semiconductors* (1996), and *Light-Emitting Diodes* (1st edition 2003 and 2nd edition 2006).

He also is a fellow of the American Physical Society, IEEE, the Optical Society of America, SPIE, and has received several awards.



#### Nicholas Sergeant

Stanford University, Stanford, CA 94305, USA; and email [Nicholas.p.sergeant@gmail.com](mailto:Nicholas.p.sergeant@gmail.com).

Sergeant is a doctoral candidate in electrical engineering at Stanford University under the supervision of Shanhui Fan and Peter Peumans. He holds MS and BS degrees in electrical engineering from the Katholieke Universiteit Leuven and received another MS degree in nanotechnology from Chalmers University of Technology in 2007. His current research focuses on novel transparent electrodes for organic solar cells that can enhance absorption by coherent

light trapping. Sergeant is a Franquii fellow of the Belgian American Educational Foundation.



#### Meng-Ju Sher

9 Oxford St., McKay 321, Cambridge, MA 02138, USA; tel. 617-495-9616; and email [sher@physics.harvard.edu](mailto:sher@physics.harvard.edu).

Sher is a PhD degree candidate in the physics department at Harvard University and a member of the Mazur Group. She received her BA degree in physics from Wesleyan University in 2007 and her AM degree in physics from Harvard University in 2009. Sher also is part of the Harvard Graduate Consortium on Energy and Environment. Her research projects are fabricating and studying femtosecond-laser hyper-

doped silicon for photovoltaic applications.



**Ashok K. Sood**

Magnolia Solar Corporation and Magnolia Optical Technologies, Woburn, MA 01801, USA; and email at [aksood@magnoliasolar.com](mailto:aksood@magnoliasolar.com). Sood is president and chief executive officer of Magnolia Solar Corporation and Magnolia Optical Technologies Inc. He received his MS and PhD degrees in electrical engineering from the University of Pennsylvania. He also received BS and MS degree honors in physics from Delhi University in India. He has extensive experience in working with EO/IR technologies for multi-band detector arrays and systems applications

using GaN/AlGaIn, CdTe/CdS/HgCdTe, Si, SiGe, CNT, and ZnO nanostructure materials for a variety of defense systems applications. Sood also has more than 75 publications, several chapters, and numerous invited talks at various meetings.



**Er-Chien (Eric) Wang**

Australian National University, Centre for Sustainable Energy Systems, Canberra ACT 0200, Australia; tel. 61-2-6125-8299; and email [er-chien.wang@anu.edu.au](mailto:er-chien.wang@anu.edu.au).

Wang is completing his PhD degree studies on nanoimprint lithography and its applications at the Centre for Sustainable Energy Systems at the Australian National University. He received his bachelor's degree in electrical and electronics engineering in 2008 from the University of Canterbury. During his bachelor's degree studies, Wang developed his research interests in

nanotechnology, specifically in the area of nanostructure surface treatment.



**Roger E. Welser**

Magnolia Solar, Inc.; and email [rwelser@magnoliasolar.com](mailto:rwelser@magnoliasolar.com).

Welser is the chief technology officer at Magnolia Solar, Inc., where he is responsible for leading the development of next-generation solar cells employing advanced nanostructured materials and coatings. Welser received his PhD degree in applied physics from Yale University in 1995 and an undergraduate degree with honors in physics from Swarthmore College in 1989. Prior to joining Magnolia in 2009, he served as director of technology and new

product development in III-V materials at Kopin Corporation.



**Mark Winkler**

77 Massachusetts Ave., 35-135A, Cambridge, MA 02139, USA; and email [mwinkler@mit.edu](mailto:mwinkler@mit.edu).

Winkler is a postdoctoral fellow at the Massachusetts Institute of Technology, where he works in Professor Tonio Buonassisi's Laboratory for Photovoltaics. He received his PhD degree in physics from Harvard University, where he studied laser-doped silicon with Professor Eric Mazur. While at Harvard, Winkler also led the Harvard Energy Journal Club for two years, serving as its president. He continues to study hyperdoped materials as candidates for

intermediate band photovoltaic devices, and is generally interested in the technical challenges of realizing a carbon-neutral energy economy.



**Xing Yan**

CII 6129 Rensselaer Polytechnic Institute, 110 Eighth St., Troy, NY 12180, USA; tel. 518-276-3392; and email [yanx@rpi.edu](mailto:yanx@rpi.edu).

Yan is a PhD degree student in the Department of Physics, Applied Physics, and Astronomy and a member of Future Chips Constellation at Rensselaer Polytechnic Institute. He received his MS degree in physics from RPI in 2010. His current research topic is algorithmic design for multilayer optical thin-film optimization. His research interests also include modeling, design, fabrication, and characterization of

multilayer optical thin-film coatings.



**Kai Zhu**

National Renewable Energy Laboratory; and email [Kai\\_Zhu@nrel.gov](mailto:Kai_Zhu@nrel.gov).

Zhu is a senior scientist in the Chemical and Materials Science Center at the National Renewable Energy Laboratory. He received his BE (1995) and MS (1998) degrees in modern physics from the University of Science and Technology of China, and his PhD degree in physics from Syracuse University in 2003. Zhu's research interests have included characterization and modeling of thin-film solar cells based on hydrogenated amorphous silicon,

characterization of optoelectronic properties of III-Nitride wide-bandgap semiconductors for high-power blue and UV light-emitting diodes, fabrication of oriented TiO<sub>2</sub> nanotube arrays and fundamental investigations of charge transport and recombination processes in dye-sensitized photoelectrochemical cells, and development and basic studies of ordered nanostructured electrodes for Li-ion batteries and supercapacitors.

# JANIS

## Cryostats for FTIR Spectroscopy



- Low vibration closed cycle cryostat mounts directly on the spectrometer
- Open cycle 4 K and 77 K cryostats
- Sample in vacuum or exchange gas
- Interfaces exist for many commercial spectrometers
- Multiple-position sample holders for easy movement between reference and sample

**Janis Research Company**  
 2 Jewel Drive Wilmington, MA 01887 USA  
 TEL +1 978 657-8750 FAX +1 978 658-0349 [sales@janis.com](mailto:sales@janis.com)  
 Visit our website at [www.janis.com](http://www.janis.com)