

DR. RAJIV GIRIDHARAGOPAL

University of Washington
Department of Chemistry
Box 351700
Seattle, WA 98195
rgiri@uw.edu

Education

- Rice University** Houston, TX
Ph.D. in Electrical and Computer Engineering January 2010.
Thesis: *Scanning Probe Analysis of Polydiacetylene Nanowires and Poly(3-Hexylthiophene) Thin Films*
Advisor: Prof. Kevin F. Kelly
M.S. in Electrical and Computer Engineering January 2007.
- The University of Texas at Austin** Austin, TX
B.S. in Electrical Engineering with High Honors May 2004.

Research Interests

Organic and inorganic photovoltaic systems • organic and molecular electronic devices • interface engineering • self-assembled structures and molecular ordering • polymer physics of dilute solutions • optical nanomaterials (quantum dots, plasmonic structures) • scanning probe microscopy and spectroscopy (AFM, STM, EFM) instrumentation development

Research Experience

- Postdoctoral Research Associate with Prof. David S. Ginger** 2009 – present
University of Washington, Department of Chemistry, Seattle, WA
- Developed sub-microsecond time-resolved electrostatic force microscopy (trEFM) technique for analyzing organic and inorganic photovoltaic materials
 - Characterized polymer nanowire-fullerene blends and inverted solar cell architectures using photoconductive atomic force microscopy and trEFM
 - Studied processing variations in quantum dot/polymer and CIGS/CZTS devices
 - Measured photocurrent behavior in mesostructured metal oxide photoanode substrates
- Graduate Researcher with Prof. Kevin F. Kelly** 2004 – 2009
Rice University, Department of Electrical and Computer Engineering, Houston, TX
- Used using ambient and ultrahigh vacuum scanning tunneling microscopy and spectroscopy to study conducting polymer nanostructures, individual polymer nanowires, mono/bilayer conducting polymer films, and organic photovoltaic systems
 - Built microwave frequency STM system to measure capacitance information on organic semiconductor films/nanowires with atomic-scale spatial resolution in UHV
 - Probed polymer-fullerene solar cell materials using optical methods (confocal microscopy, Raman spectroscopy) correlated with atomic force microscopy
- Honors Scholar Undergraduate Researcher with Dr. Robert L. Rogers** 2003 – 2004
Applied Research Labs, Austin, TX
- Simulated and fabricated microstrip/coplanar waveguide microwave devices
 - Analyzed microwave devices and antennas via spectrum/network analysis
- Undergraduate Researcher with Prof. Anvar Zakhidov** 2002 (summer)
University of Texas at Dallas, Department of Physics
- Researched inkjet printing of conducting polymers and inverse opal fabrication

Honors and Awards

- CISSEM Innovative Research Seed Award (collaborative with U-Arizona, 2011)
- National Science Foundation Graduate Research Fellowship (2005-2008)
- Shell Presentation Award, Rice Quantum Institute Colloquium (2008)
- Micron Technology Presentation Award, Rice Quantum Institute Colloquium (2005)
- Honors Scholar Award from Applied Research Labs (2003-2004)
- Ernest J. Cockrell Scholarship in Engineering (2000-2004)
- National Merit Finalist and Scholarship Recipient (2000-2004)

Publications

- **R. Giridharagopal**, G. E. Rayermann, G. Shao, D. T. Moore, O. G. Reid, A. F. Tillack, D.J. Masiello, and D. S. Ginger. "Sub-Microsecond Time Resolution Atomic Force Microscopy for Probing Nanoscale Dynamics." *Nano Letters* **12**, 893-898 (2012)
- **R. Giridharagopal**, J. Zhang, and K. F. Kelly. "Antenna-Based Ultrahigh Vacuum Microwave Frequency Alternating Current Scanning Tunneling Microscopy System." *Review of Scientific Instruments* **82**, 053710 (2011) [cover article]
- A. H. Rice, **R. Giridharagopal**, S. X. Zheng, F. S. Ohuchi, D. S. Ginger, C. K. Luscombe. "Controlling Vertical Morphology Within the Active Layer of Organic Photovoltaics Using Poly(3-Hexylthiophene) Nanowires and Phenyl-C₆₁-Butyric Acid Methyl Ester." *ACS Nano* **5**, 3132-3140 (2011)
- **R. Giridharagopal** and D. S. Ginger. "Characterizing Morphology in Bulk Heterojunction Organic Photovoltaic Systems." *Journal of Physical Chemistry Letters* **1**, 1160-1169 (2010) [invited review, cover article]
- **R. Giridharagopal**, G. Shao, C. Groves, and D. S. Ginger. "New SPM Techniques for Analyzing OPV Materials." *Materials Today* **19**, 50-56 (2010) [invited review]
- J. H. Worne, **R. Giridharagopal**, K. F. Kelly, and D. Natelson. "Interfacial Charge Transfer in Nanoscale Polymer Transistors." *Nano Research* **1**, 341-350 (2008)
- **R. Giridharagopal** and K. F. Kelly. "Substrate-Dependent Properties of Polydiacetylene Nanowires on Graphite and MoS₂." *ACS Nano* **2**, 1571-1580 (2008)
- **R. Giridharagopal** and K. F. Kelly. "Atomic-Scale Analysis of Polydiacetylene Nanowires by Scanning Tunneling Microscopy", IEEE International Conference on Nanotechnology, Hong Kong, 1002-1006 (2007) [refereed conference proceeding]
- **R. Giridharagopal** and K. F. Kelly. "STM-Induced Desorption of Polydiacetylene Nanowires and Reordering Via Molecular Cascades." *Journal of Physical Chemistry C* **111**, 6161-6166 (2007)
- P. Landon, J. Gutierrez, J. Ferraris, I. Martinez, **R. Giridharagopal**, et al. "Inverse Gold Photonic Crystals and Conjugated Polymer Coated Opals for Functional Materials." *Physica B: Condensed Matter* **338**, 165-170 (2003)

Teaching/Education Experience

University of Washington

- Guest lectured in MSE 333 (Materials Characterization) on scanning probe techniques
- "Plastic Solar Cells?" presentation to undergraduate summer research students

Rice University

- Teaching Assistant, ELEC 571 (Nanoscale Imaging), ELEC 461 (Electronic Circuits for Non-Majors), and ELEC 261 (Electronic Materials)
- Held office hours and tutorial sessions for ELEC 571
- Graded homework/exams
- Guest lectured in ELEC 261 several times
- Performed in-class scanning probe demos for ELEC 261

Academic and University Service

- Peer-reviewer for *J. Phys. Chem. Lett.*, *J. Phys. Chem. C*, *J. App. Phys.*, *Small*, *ACS Nano*, *Nano Letters*
- Co-organizer of UW Postdoctoral Research Symposium (2010, 2011)
- Officer (2010-2011) and Treasurer (2010), University of Washington Post-Doc Association
- Electrical Engineering Graduate Mentor, Rice University (2009)
- Officer of Rice ECE Graduate Student Council (2004-2006)
- Member of APS, ACS, MRS, IEEE

Public Outreach

- Shoreline SolarFest (2011)
- Organizer and volunteer, No Limits Science Festival, Rice University (2009)
- Volunteer, Children's Museum of Houston (2009)
- Student Engineers Educating Kids (SEEK), Rice University (2009)

Patent Application

"Sub-Microsecond-Resolution Time-Domain Time-Resolved Electrostatic Force Microscopy." D. S. Ginger, **R. Giridharagopal**, D. T. Moore, O. G. Reid, G. E. Rayermann. Patent Application 61/382,804 [filed]

Invited Conference Presentations

- **R. Giridharagopal** and D. S. Ginger. "Probing Polymer Photovoltaic Systems: Imaging Optoelectronic Performance at the Nanoscale." *American Chemical Society Northwest Regional Meeting*. Portland, OR (2011)
- **R. Giridharagopal**, G. E. Rayermann, D. T. Moore, O. G. Reid, D. S. Ginger. "Time-Resolved Electrostatic Force Microscopy for Organic Photovoltaics Applications." Presentation to Asylum Research. Santa Barbara, CA (2010)
- **R. Giridharagopal**, L. S. C. Pingree, O. G. Reid, and D. S. Ginger. "Probing Polymer Photocurrents: Imaging Photocurrents in Organic Solar Cells." *Electronics Packaging Symposium at GE Research*, Niskayuna, NY (2010)
- **R. Giridharagopal**, L. S. C. Pingree, O. G. Reid, and D. S. Ginger. "Probing Polymer Photocurrents: Imaging Photocurrents in Organic Solar Cells." *Complex Materials for Energy Applications Workshop*. Michigan State University, Lansing, MI (2010)
- **R. Giridharagopal**, L. S. C. Pingree, O. G. Reid, and D. S. Ginger. "Probing Polymer Photocurrents: Imaging Photocurrents in Organic Solar Cells" *Electrochemical Society Meeting*. Vancouver, Canada (2010)

Selected Contributed Conference Presentations

- **R. Giridharagopal**, G. E. Rayermann, G. Shao, D. T. Moore, O. G. Reid, A. F. Tillack, D.J. Masiello, and D. S. Ginger. "Sub-Microsecond Time-Resolved Electrostatic Force Microscopy: A New Tool for Interface Science." *Center for Interface Science: Solar Electric Materials EFRC Meeting*. Golden, CO (2011) [poster]

- **R. Giridharagopal** and D. S. Ginger. "Single-Microsecond Resolution Time-Resolved Electrostatic Force Microscopy of Nanostructured Organic Photovoltaic Blends." *Materials Research Society Fall Meeting*. Boston, MA (2010) [poster]
- **R. Giridharagopal**, G. E. Rayermann, D. T. Moore, O. G. Reid, A. H. Rice, C. K. Luscombe, and D. S. Ginger. "New Approaches to Mapping Local Electronic Properties in Nanostructured Organic Photovoltaic Blends." *ORCAS 2010: International Conference on Energy Conversion*. Friday Harbor, WA (2010) [poster]
- **R. Giridharagopal** and K. F. Kelly. "Scanning Probe Analysis of Poly(3-Hexylthiophene)." *Materials Research Society Spring Meeting*. San Francisco, CA (2009) [poster]
- **R. Giridharagopal** and K. F. Kelly. "Substrate-Dependent Electronic Behavior of Polydiacetylene Nanowires." *American Physical Society March Meeting*. New Orleans, LA (2008)
- **R. Giridharagopal** and K. F. Kelly. "Alternating Current STM of Polymer Systems." *Second MURI Workshop on Nanoscale Subsurface Spectroscopy and Tomography*. Lenox, MA (2007)
- **R. Giridharagopal** and K. F. Kelly. "STM of Polydiacetylene Nanowires: Electrode Interactions and Stability." *Materials Research Society Spring Meeting*. San Francisco, CA (2007)

References

Kevin F. Kelly

Associate Professor
Department of Electrical and Computer Engineering
Rice University
6100 Main St
MS-378
Houston, TX 77005
Phone: (713) 348-3565
E-mail: kkelly@rice.edu

Douglas Natelson

Professor
Department of Physics and Astronomy
Rice University
6100 Main St
MS-61
Houston, TX 77005
Phone: (713) 348-3214
E-mail: natelson@rice.edu

David S. Ginger

Professor and Lawton Distinguished Scholar in Chemistry
Department of Chemistry
University of Washington
Box 351700
Seattle, WA 98195
Phone: (206) 685-2331
E-mail: ginger@chem.washington.edu