

Jeffrey J. Urban

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Education

Ph.D. in Physical Chemistry, Harvard University, November 2004
M.A. in Physical Chemistry, Harvard University, 2000
B.S. with Honors in Biochemistry and Molecular Biology, The Pennsylvania State University, 1998

Professional Background

- Deputy Director, Inorganic Materials Facility, Lawrence Berkeley National Laboratory (2010-present)
- Staff Scientist, Inorganic Materials Facility, Lawrence Berkeley National Laboratory (2007-present)
- Postdoctoral Studies in Synthesis and Measurements of Nanocrystal Transistors, Thermoelectrics, and Photovoltaics with Professor Christopher B. Murray, University of Pennsylvania (2004-2007)
- Graduate Studies in Synthesis and Physical Characterization of Transition Metal Oxide Nanostructures with Professor Hongkun Park, Harvard University (1999-2004)
- Graduate Studies in Bio-organic Synthesis of Peptidomimetic Libraries with Professor Gregory L. Verdine, Harvard University (1998-1999)
- Undergraduate Research in Protein Folding Biophysics with Professor C. R. Matthews, Pennsylvania State University (1996-1998)

Teaching Experience

Guest Lecturer:

Chemistry and Materials Science and Engineering, University of California, Berkeley, Spring 2011
Chemistry and Materials Science and Engineering, University of California, Berkeley, Spring 2010
Materials Science and Engineering, University of California, Berkeley, Spring 2010
Physics and Nanoscale Science and Engineering, University of California, Berkeley, Spring 2010
Chemistry and Materials Science and Engineering, University of California, Berkeley, Spring 2009

Teaching Fellow:

Materials Chemistry and Physics, Harvard University, Fall 2002 (Head Teaching Fellow)
Graduate Quantum Mechanics, Harvard University, Fall 2001 (Head Teaching Fellow)
Advanced Physical Organic Chemistry, Harvard University, Spring 1999
Introductory Organic Chemistry, Harvard University, Fall 1998

Presentations (past 2 years)

June 2011—IEEE Nano Symposium, Santa Clara, CA (Invited Talk)
November 2010—Hydrogen Storage and Production Conference, Netherlands (Invited Talk)
August 2010—MSD Program Review, CCS EFRC
July 2010—Gordon Research Seminar, Tilton, NH (Invited Lecture)
June 2010—ONR Program Review, San Diego, CA
May 2010—Condensed Matter Physics Seminar, UC Davis (Invited Talk)
April 2010—LBL MSD Molecular Foundry Transport Workshop, Berkeley, CA (Invited Talk)
Jan 2010—DOE Review: Nanostructured Thermoelectrics, Berkeley, CA
Nov 2009—NSF/DOE Nanoscience Workshop, Saclay, France (Invited Talk)

Nov 2009—Optics Seminar in Electrical Engineering, UC Berkeley, Berkeley, CA (Invited Talk)
Sept 2009—Nanoscale Informal Science Education (NISE) Lecture, San Francisco, CA (Invited Talk)
Aug 2009—LBL MSD Program Review for Thermoelectrics, Napa Valley, CA
May 2009—ONR Hybrid Photovoltaics Review, National Harbor, MD
April 2009—Greenpower Conferences, Solar Power Generation, San Francisco, CA (Invited Talk)
April 2009—Electronic Materials Symposium, Santa Clara, CA (Invited)

Peer-Reviewed Publications

(star indicates contact author(s), gray text clarifies role in contributing-author-only work)

33. “Heat transport in ultrafine grained CdSe nanoparticles”, Joseph P. Feser, Kedar Hippalgaonkar, Arun Majumdar, Rachel A. Segalman and ***Jeffrey J. Urban**, *submitted* (2011).
32. “Tip-enhanced Raman spectroscopy with bowtie-antenna-based scan probes”, Alexander Weber-Bargioni, Adam Schwartzberg, Ariel Ismach, Jeffrey J. Urban, Paul Ashby, D. Frank Ogletree, *Stefano Cabrini, and *P. James Schuck, *submitted* (2011).
Role in work: Contributed to development of tip-based optical probes featured here.
31. “Air-stable metal hydride nanocomposites: a platform for engineering lightweight, high-energy density, cyclable storage materials”, Anne M. Ruminski, Rizia Bardhan, Alyssa Brand, and ***Jeffrey J. Urban**, *invited article, Energy & Environmental Science* (2011).
30. “Scanning confocal Raman crystallography”, Adam M. Schwartzberg, Shaul Aloni, and ***Jeffrey J. Urban**, *submitted* (2011).
29. “Size-dependent critical nuclei formation energies for nanocrystal-gas equilibria”, Rizia Bardhan, Cary L. Pint, Lester Hedges, Steve Whitelam, Ali Javey, and ***Jeffrey J. Urban**, *submitted* (2011).
28. “Mixing behavior of the thermoelectric properties of conducting polymer/nanocrystal composites”, Nelson E. Coates, Shannon K. Yee, Kevin C. See, *Rachel A. Segalman, and, ***Jeffrey J. Urban**, *submitted* (2011).
27. “One-step, gram-scale synthesis of highly fluorescent, spectrally-responsive carbogenic nanoparticles”, Hoi Ri Moon, Rizia Bardhan, Anne M. Ruminski, Ki-Joon Jeon, and ***Jeffrey J. Urban**, *submitted* (2011).
26. “Vertical alignment of nanorods in polymer thin films”, Miguel A. Modestino, Jeffrey J. Urban, and *Rachel A. Segalman, *submitted* (2011).
Role in work: Contributed to experimental design and materials synthesis.
25. “Optically- and thermally-responsive programmable materials based on carbon nanotube-hydrogel polymer composites”, Xiaobo Zhang, Cary L. Pint, Min Hyung Lee, Bryan Edward Schubert, Arash Jamshidi, Kuniharu Takei, Hyunhyub Ko, Andrew Gillies, Rizia Bardhan, Jeffrey J. Urban, Ming Wu, Ronald Fearing, and *Ali Javey, *submitted* (2011).
Role in work: Contributed to optical microscopy and light scattering experiments.
24. “Pd nanoparticle decorated p-InP nanopillars for efficient water reduction”, Jaehyun Moon, Cary L. Pint, Kuniharu Takei, Min Hyung Lee, Rizia Bardhan, Jeffrey J. Urban, Arash Jamshid, Ming Wu, and *Ali Javey, *submitted* (2011).
Role in work: Contributed the Pd nanocrystals used in this work.

23. “Size- and surface-dependent CO₂ capture in chemically synthesized magnesium oxide nanocrystals”, Anne M. Ruminski, Ki-Joon Jeon, and, ***Jeffrey J. Urban**, invited article in *J. Mater. Chem.*, special themed issue on “Chemical transformations of nanoparticles”, *under review* (2011).
22. “Optical cavity characterization in nanowires via self-generated broad-band emission”, Adam M. Schwartzberg, Shaul Aloni, Tevye Kuykendall, P. James Schuck, and ***Jeffrey J. Urban**, *in press*, *Optics Express*, (2011).
21. “Hyperspectral nanoscale imaging on dielectric substrates with coaxial optical antenna scan probes”, Alexander Weber-Bargioni, Adam M. Schwartzburg, Matteo Cornaglia, Ariel Ismach, **Jeffrey J. Urban**, YuanJie Pang, Reuven Gordon, Jeffrey Bokor, Miquel Salmeron, D. Frank Ogletree, *Stefano Cabrini, and *P. James Schuck, *Nano Lett.*, **11(3)**, 1201-1207 (2011).
Role in work: Contributed to development of tip-based optical probes featured here.
20. “Interface segregating fluoroalkyl-modified polymers enable high fidelity block copolymer nanoimprint lithography with PS-b-PDMS”, Vincent Voet, Teresa E. Pick, Sang-Min Park, Manuel Moritz, Aaron T. Hammack, **Jeffrey J. Urban**, D. Frank Ogletree, *Deirdre L. Olynick, and *Brett A. Helms, *J. Amer. Chem. Soc.*, **133(9)**, 2812-2815 (2011).
Role in work: Contributed to surface chemical analysis via XPS spectroscopy.
19. “Air-stable magnesium nanocomposites provide rapid and high-capacity hydrogen storage without using heavy-metal catalysts”, Ki-Joon Jeon, Hoi Ri Moon, Anne M. Ruminski, Bin Jiang, Christian Kisielowski, and ***Jeffrey J. Urban**, *Nature Materials*, **10(4)**, 286-290 (2011).
Work highlighted in *Nature Materials*, News & Views (pg. 265-266).
Work highlighted in *Nature Nanotechnology*, April, 2011
Work highlighted in CNN interview (“The Big Innovation”), March 22, 2011
18. “Size-dependent polar ordering in colloidal GeTe nanocrystals”, Mark J. Polking, **Jeffrey J. Urban**, Delia J. Milliron, Haimei Zheng, Emory Chan, Marissa A. Caldwell, Simone Raoux, Christian F. Kisielowski, Joel W. Ager III, *Ramamoorthy Ramesh, and *A.P. Alivisatos, *Nano Lett.*, **11(3)**, 1147-1152 (2011).
Role in work: Contributed to analysis of size-dependent phase transition and synthesis.
17. “Water-processable polymer-nanocrystal hybrids for thermoelectrics”, Kevin C. See, Joseph P. Feser, Cynthia E. Chen, Arun Majumdar, ***Jeffrey J. Urban**, and *Rachel A. Segalman, *Nano Lett.*, **10(11)**, 4664-4667 (2010).
Work highlighted in *MRS Bulletin*, December 2010.
16. “Spectroscopic evidence for exceptional thermal contribution to electron-beam induced fragmentation”, Marissa A. Caldwell, Ben Haynor, Shaul Aloni, D. Frank Ogletree, H.-S. Philip Wong, ***Jeffrey J. Urban**, and *Delia J. Milliron, *J. Phys. Chem. C*, **114**, 22064-22068 (2010).
15. “Universal and solution-processable precursor to bismuth chalcogenide thermoelectrics”, Robert Y. Wang, Joseph P. Feser, Xun Gu, Kin Man Yu, Rachel A. Segalman, Arun Majumdar, *Delia J. Milliron, and ***Jeffrey J. Urban**, *Chem. Mater.*, **22(6)**, 1943-1945 (2010).
14. “Carrier distribution and dynamics of nanocrystal solids doped with artificial atoms”, Dong-Kyun Ko, **Jeffrey J. Urban**, and *Christopher B. Murray, *Nano. Lett.*, **10(5)**, 1842-1847 (2010).
Role in work: Contributed to thermoelectric measurements and data analysis.

13. "Block copolymers for organic electronics", *Rachel A. Segalman, Bryan McCulloch, Saar Kirmayer, and Jeffrey J. Urban, *Macromolecules*, **42(23)**, 9205-9216 (2009).
Role in work: Contributed both to optical and electronic characterization sections.
Article selected for cover art, December 8, 2009.
12. "Size-controlled synthesis and optical properties of monodisperse colloidal magnesium oxide nanocrystals", Hoi Ri Moon, Jeffrey J. Urban, and *Delia J. Milliron, *Angewandte Chemie*, **48(34)**, 6278-6281 (2009).
Role in work: Contributed both to nanocrystal synthesis and optical properties characterization.
Work selected as "hot paper" by editor.
Work highlighted in *Photonics Spectra* (Nov. 2009)
Work highlighted in Reuters press coverage (Nov. 2009)
11. "Label-free in situ imaging of lignification in the cell wall of low lignin transgenic *Populus trichocarpa*," Martin Schmidt, Adam M. Schwartzberg, Pradeep N. Perera, Alex Weber-Bargioni, Andrew Carroll, Purbasha Sarkar, Elena Bosneaga, Jeffrey J. Urban, Jingyuan Song, Mikhail Y. Balakshin, Ewellyn A. Capanema, Manfred Auer, Paul D. Adams, Vincent L. Chiang, and *P. James Schuck, *Planta*, **230**, 589-597 (2009).
Role in work: Contributed to development of confocal Raman microscopy tools used here.

Moved to LBNL (December 2007)

10. "Synergism in binary nanocrystal superlattices leads to enhanced *p*-type conductivity in self-assembled PbTe/Ag₂Te thin films," *Jeffrey J. Urban, Dmitri V. Talapin, Elena V. Shevchenko, Cherie R. Kagan, and *C.B. Murray, *Nature Materials* **6(2)** 115-121 (2007).
Work highlighted in Nature 445 492-493 (2007).
9. "Magnetic switching of phase-slip dissipation in NbSe₂ nanobelts" Abram Falk, Mandar M. Deshmukh, Amy L. Prieto, Jeffrey J. Urban, Andrea Jonas, and *Hongkun Park, *Phys. Rev. B.* **75** 020501(R) (2007)
8. "Observation of optical nonlinearities in strongly quantum confined PbS nanocrystals for all-optical tunable nanophotonics," Charlton J. Chen, J.I. Dadap Jr., Jeffrey J. Urban, C.B. Murray, and *C.W. Wong, *Proc. of Optics East* (2006).
7. "Self-assembly of PbTe quantum dots into nanocrystal superlattices and glassy films," *Jeffrey J. Urban, Dmitri V. Talapin, Elena V. Shevchenko, and *C.B. Murray, *J. Am. Chem. Soc.* **128(10)**, 3248-3255 (2006).
Work highlighted in Photonics Spectra, April 2006
6. "Ferroelectric phase transitions in individual single-crystalline BaTiO₃ nanowires," Jonathan E. Spanier, Alexie M. Kolpak, Jeffrey J. Urban, Ilya Grinberg, Wan Soo Yun, Lian Ouyang, Andrew M. Rappe, and *Hongkun Park, *Nano Lett.* **6**, 735-739 (2006).
5. "Synthesis of single-crystalline La_{1-x}Ba_xMnO₃ nanocubes with adjustable doping," Jeffrey J. Urban, Lian Ouyang, Moon-Ho Jo, Dina S. Wang and *Hongkun Park, *Nano Lett.* **4**, 1547-1550 (2004).

4. "Single-Crystalline Barium Titanate Nanowires," Jeffrey J. Urban, Jonathan, E. Spanier, Lian Ouyang, Wan Soo Yun, and *Hongkun Park, *Adv. Mater.* **15**, 423-426 (2003).
3. "Ferroelectric properties of individual barium titanate nanowires investigated by scanned probe microscopy," Wan Soo Yun, Jeffrey J. Urban, Qian Gu and *Hongkun Park, *Nano Lett.* **2**, 447-450 (2002).

Work highlighted in Chemical and Engineering News, March 4, 2002.

2. "Synthesis of single-crystalline perovskite nanowires composed of barium titanate and strontium titanate," Jeffrey J. Urban, Wan Soo Yun, Qian Gu and *Hongkun Park, *J. Am. Chem. Soc.* **124**, 1186 (2002).

Work highlighted in Chemical and Engineering News, March 4, 2002.

1. "A Modular Synthetic Approach Toward Exhaustively Stereodiversified Ligand Libraries," Tiffany M. Gierasch, Milan Chytil, Mary T. Didiuk, Julie Y. Park, Jeffrey J. Urban, Steven P. Nolan, *Gregory L. Verdine, *Org. Lett.* **2**, 3999-4002 (2000).

Book Chapters and Invited Review Articles

1. "Future prospects for hydrogen as a competitive energy carrier", Anne M. Ruminski, Rizia Bardhan, Alyssa Brand, and ***Jeffrey J. Urban**, *invited editorial, Biofuels* (2011).
2. "The Physics and Chemistry of Quantum-Dot Based Photovoltaics," Delia J. Milliron and **Jeffrey J. Urban**, invited book chapter appearing in *Colloidal Quantum Dot Devices: Sensors, Sources, and Solar Cells* (Cambridge University Press, 2011).
3. "Integrated Miniaturized Materials—From Self-Assembly to Device Integration," **Jeffrey J. Urban** et al., invited book chapter appearing in *Materials Research Society Symposium Proceedings, Spring 2010, Volume 1272* (Materials Research Society Press, 2011).
4. "Ferroelectric Nanowires," Jonathan E. Spanier, Jeffrey J. Urban, Lian Ouyang, Wan Soo Yun, and Hongkun Park, invited book chapter appearing in *Nanowire Materials* (Kluwer, Netherlands, 2002).

Patents

1. "Transition metal oxide nanowires and devices incorporating them," Hongkun Park, Jeffrey J. Urban, Wan Soo Yun, Qian Gu, US Patent 7,918,935 B2 (Filed, 2007).
2. "Solution Processable Conducting Polymer/Inorganic Nanostructured Composites for Thermoelectric Applications," Kevin C. See, Rachel A. Segalman, and Jeffrey J. Urban, LBNL Disclosure IB-2859 (2011).
3. "Gallium nitride nanowires as a low-power directional nanoscale light source", Adam M. Schwartzberg and Jeffrey J. Urban, LBNL Disclosure IB-2860 (2011).
4. "Composites of air-stable magnesium nanoparticles and gas-selective polymer for hydrogen storage", Ki-Joon Jeon, Hoi Ri Moon, Anne M. Ruminski, and Jeffrey J. Urban, US Patent Application Number 61/437,456, LBNL Disclosure IB-2918 (2011).

Professional Service (Past Year and Future Commitments)

Co-organizer, APS, 2012, Thermoelectric Materials Physics
Co-Organizer, EMS, April 2011, Electronic Materials Symposium
Session Chair, ASHRAE, February 2011, Low-GWP Refrigerants
Session Chair, Gordon Research Conference, July 2010, Nanofabrication: Self-Assembly
Co-Organizer, EMS, April 2010, Electronic Materials Symposium
Co-Organizer, MRS, April 2010, Directed Assembly and Self-Assembly
Session Chair, MRS, April 2010, Directed Assembly and Self-Assembly: Device Applications
Session Chair, MRS, April 2010, Thermoelectric Materials
Co-Organizer, LBL, April 2010, Nanoscale Transport Phenomena
Session Chair, APS, March 2009, Photoexcited Charge Transport at Interfaces
Session Chair, APS, March 2009, Organic Electronics and Photovoltaics
Co-Organizer, EMS, April 2009, Electronic Materials Symposium
Co-Organizer, LBL, October 2009, Nanostructured Materials for Photovoltaics
Co-Organizer, MRS, March 2010, Directed Self-Assembly and Self-Assembly
Co-Organizer, LBL, April 2010, Transport Phenomena
Co-Organizer, EMS, April 2010, Electronic Materials Symposium

Consulting and Scientific Advising:

Reviewer, FY12 UC Discovery Grants
Reviewer, 2012 LDRD Pool, MSD Submissions for LDRD Funding
Joined Scientific Advisory Board for Clean Tech Institute, Santa Clara, CA, April 2011
Consulting for TPG Capital on Thermoelectrics Startup Company, March 2011
Reviewer (2009-2010) France-Berkeley Fund
Reviewer, 2010 ARPA-E proposals on building thermodevices
Committee Member, 2010, Photovoltaics Installation at ALS Assessment Team
Committee Member, 2010-Present, Heat Island Group
Committee Member, 2009-2010, White Roofs Strategic Planning Initiative
Reviewer for *Nature*, *Nature Materials*, *JACS*, *Nano Letters*

Recent Collaborators (Past Year): R. Segalman (UCB), A. Majumdar (ARPA-E), R. Ramesh (UCB), J. Wu (UCB), J. Long (UCB), A.P. Alivisatos (UCB), D. Milliron (LBL), P.J. Schuck (LBL), C.B. Murray (UPenn), M. Kaviani (U. Mich), L. Loo (Princeton)

Graduate and Postdoctoral Advisees

Dr. Richa Sharma (2010-present), co-advised with Dr. Delia Milliron
Dr. Nelson Coates (2010-present)
Dr. Emory Chan (2010-present)
Dr. Rizia Bardhan (2010-present)
Dr. Aaron Hammack (2010-present), co-advised with Dr. Frank Ogletree
Dr. Rueben Mendelsberg (2010-2011), co-advised with Dr. Andre Anders, Dr. Delia Milliron
Dr. Anne Ruminski (2009-present)
Dr. Ki-Joon Jeon (2008-present), currently an Assistant Professor at XYZ, S. Korea

Dr. Saar Kirmayer (2008-2010), currently a postdoctoral researcher at the Weizmann Institute
Dr. Adam Schwartzberg (2007-2010), currently a staff scientist at Sandia National Lab
Dr. Kevin See (2008-2010), currently with Lux Research
Dr. Hoi Ri Moon, (2008-2010), currently an Assistant Professor at UNIST, S. Korea
Dr. Robert Wang (2008-2011), currently an Assistant Professor at Arizona State University, co-
advised with Dr. Delia Milliron

Alyssa Brand (2010-present)
Shannon Yee (2010-present), co-advised with Prof. Rachel Segalman
Boris Russ (2010-present), co-advised with Prof. Rachel Segalman (NDSEG award winner)
Bryan McCulloch (2008-2010), co-advised with Prof. Rachel Segalman
Joseph P. Feser (2008-2011), currently a postdoctoral researcher with Prof. David Cahill (UIUC),
co-advised with Prof. Rachel Segalman
Wendy X. Gu (2008-2010), currently a graduate student at CalTech (Fulbright and NDSEG award
winner)