

Debra J. Lightly Mascaro

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Education

MASSACHUSETTS INSTITUTE OF TECHNOLOGY Cambridge, MA
Ph.D. in Materials Science and Engineering, *June 2004*
Field of Study: Electronic, Photonic and Magnetic Materials
IBM Research Fellow, 1999-2000
National Science Foundation Graduate Fellow, 1996-1999

GUSTAVUS ADOLPHUS COLLEGE Saint Peter, MN
B.A. in Physics, Summa Cum Laude, *May 1995*
Barry M. Goldwater Scholar, 1993-1995
National Merit Scholar, 1991-1995
First Decade Award, October 2006
(presented by the Gustavus Adolphus College Alumni Association to one male and one female graduate of the 10th anniversary class in recognition of early professional achievement)

Work Experience

UNIVERSITY OF UTAH Salt Lake City, UT
Associate Professor (Lecturer), Dept. of Mechanical Engineering July 2017-present
Assistant Professor (Lecturer), Dept. of Mechanical Engineering October 2013-June 2017
Director of Undergraduate Studies, Mechanical Engineering October 2008-present

- Teach freshman-level courses and coordinate the junior seminar (see Teaching Experience)
- Oversee advising of Mechanical Engineering undergraduate students
- Oversee admissions into the Mechanical Engineering Undergraduate Program
- Oversee implementation of electronic filing system in the Undergraduate Advising Office
- Coordinate class schedules, curriculum changes, course fees, articulation, etc.
- Serve on several committees related to curriculum, ABET, scholarships, etc. (see Service)

Research Experience

UNIVERSITY OF UTAH Salt Lake City, UT
Research Assistant Professor, Department of Mechanical Engineering 2005-2013
Joint appointment in the Department of Electrical & Computer Engineering

- Materials processing of molecular and polymeric organic materials for electronic and photonic device applications.
- Experimental investigation of the physical mechanisms driving organic crystal formation on a substrate during exposure to solvent vapor.
- Experimental investigation of the effect of spin $\frac{1}{2}$ radicals on the device performance of organic solar cells.
- Investigation of novel fabrication methods for stretchable circuits (wearable sensor and electronics applications).
- Experimental investigation of self-healing electroactive polymer actuator systems.

NDSU CENTER FOR NANOSCALE SCIENCE AND ENGINEERING Fargo, ND
Research Scientist January-December 2004

- Sensor development and microfabrication related to microsensor systems. Miniaturization of chemiresistive sensors used for the detection of explosives and chemical warfare agents.
- Characterization of novel polymeric materials for spintronics device applications.

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MIT LAB OF ORGANIC OPTICS AND ELECTRONICS

Cambridge, MA

Graduate Research Assistant

1997-2004

Thesis on "Formation of In-Plane Crystals of Molecular Organic Semiconductors" under Professor V. Bulović, Department of Electrical Engineering, and Professor T. M. Swager, Department of Chemistry

- Developed methods for generating ordered films of crystalline organic materials over large area substrates with the aim of using the films in practical device applications. Introduced solvent vapor annealing as a means to facilitate the formation of oriented crystalline needles from amorphous organic films grown on nano-patterned substrates.
- Developed large area nano-structures that enabled: (1) the demonstration of organic photonic band gap thin films, presently being used to improve outcoupling from organic LEDs and to develop organic super-prisms, waveguides, and optical filters, and (2) the deposition of nano-structured polymer monolayers by soft lithography and nano-scale molding/embossing of organic thin film structures.
- Investigated analyte-activated photoconductivity in conjugated polymers as a potential sensing mechanism for TNT and other explosives.
- Explored ways to electrochemically embed conducting polymers within hydrogels in order to transduce mechanical swelling into an electrical signal.

IBM T. J. WATSON RESEARCH CENTER

Yorktown Heights, NY

Research Intern, Physical Sciences Department

Summer 2000, Summer 1999

- Investigated the effects of various substrate treatments on the morphology and device performance of pentacene field-effect transistors.
- Fabricated and characterized electrical properties of polymer and small molecule OFETs.

Teaching Experience

UNIVERSITY OF UTAH

Salt Lake City, UT

Instructor for ME EN 1000 (*Fall 2009, 2010, 2011, 2012*) and ME EN 1010 (*Spring semesters 2010-2021; Fall semesters 2014-2020*). Involved in implementation of SPIRAL ME curriculum, including the development of new lectures, demos, active-learning exercises, labs and homework and project assignments. These efforts resulted in two ASEE Best Paper Awards and one Honorable Mention. Co-developed lectures, labs and project for revised version of ME EN 1010 (new title "Computer-Based Problem Solving for Engineering Systems.")

Coordinator for ME EN 3900 Professionalism and Ethics Seminar. *Fall semesters 2009-2016*.

Coordinator for ME EN 5910 Cooperative Education. *Spring 2009-present (Fall, Spring, Summer)*.

Instructor for ME EN 5620/6620 Introduction to Microscale Engineering. *Fall 2006, 2008*.

Instructor for ME EN 5960/6960 Organic Electronic and Photonics: Materials and Devices (Special Topics). Cross-listed as ECE 6961 and MSE 5050/6050.

Developed course content which includes:

- the physical origin of optical and electronic processes in organic molecules and polymers
- the fundamental benefits and limitations of organic materials in device applications
- device architecture and theory of operation of organic LEDs, solar cells and transistors
- the use of organic materials in xerography, holographic data storage and non-linear optics
- materials processing and device fabrication techniques

Responsible for all aspects of the course, including lectures, homework assignments, exams, and grading. Designed team projects to promote interdisciplinary interaction between students from different departments. Received a University Individual Teaching Grant to develop a laboratory project (OLED fabrication/testing). *Spring 2006, 2007, 2008*.

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Publications

- Brown, N. N., Velarde, J., and Mascaro, D. J., "Using Peer Mentoring to Enhance Student Experience and Increase Retention in Mechanical Engineering," *Proc. of the 2016 ASEE Annual Conference and Exposition*.
- Brown, N. N., Velarde, J., and Mascaro, D. J., "Using Peer Mentoring to Enhance Transfer Student Experience and Increase Student Success in Mechanical Engineering," *Proc. of the 2016 ASEE Annual Conference and Exposition*.
- Mascaro, D. J. and Mascaro S., 2016, "An Integrated Project-Driven Course in Computer Programming for Mechanical Engineering Students," *ASEE Computers in Education Journal*, Vol. 7, 2016, pp. 58-72.
- Zhang, Y., Gautamb, B. R., Basel, T. P., Mascaro, D. J., and Vardeny, Z. V., "Organic Bulk Heterojunction Solar Cells Enhanced by Spin Interaction," *Synthetic Metals*, Vol. 173, 2013, pp. 2-9.
- Sorenson, K. and Mascaro D. J., "Active Learning and Increased Faculty Involvement to Improve Design Instruction and Retention in a First-Year Introductory Engineering Design Course," *Proc. of the 5th Annual First Year Engineering Experience Conference* (2013).
- Zhang, Y., Basel, T. P., Gautam, B. R., Yang, X., Mascaro, D. J., Liu, F. and Vardeny, Z. V., "Spin-enhanced Organic Bulk Heterojunction Photovoltaic Solar Cells," *Nature Communications*, Vol. 3, 2012, DOI: 10.1038/ncomms2057.
- Vogt, A. P., Roemer, R., Bamberg, S. and Mascaro, D. J., "A Manufacturing Curriculum Using a Student-driven Pedagogy of Integrated, Reinforced, Active Learning (SPIRAL) Approach," *Proc. of the 2012 ASEE Annual Conference and Exposition*.
- Jeong, J., Mascaro, D. and Blair, S., "Precise Pixel Patterning of Small Molecule Organic Light-Emitting Devices by Spin Casting," *Organic Electronics*, Vol. 12, 2011, pp. 2095-2102.
- Mascaro, D. J., Bamberg, S. J .M. and Roemer, R., "SPIRAL Design-Oriented Laboratories in the First-Year Mechanical Engineering Curriculum," *Proc. of the 2011 ASEE Annual Conference and Exposition*.
- Roemer, R., Mascaro, D. J., Pardyjak, E. R. and Bamberg, S. J .M., "A SPIRAL Learning Curriculum for Second Year Students in Mechanical Engineering," *Proc. of the 2011 ASEE Annual Conference and Exposition*.
- Mascaro, D. J., Bamberg, S. J .M. and Roemer, R., "Integration and Reinforcement of Engineering Skills Beginning in the First-Year Design Experience," *Proc. of the 2010 ASEE Annual Conference and Exposition*.
- Bamberg, S. J .M., Mascaro, D. J. and Roemer, R., "Interactive Learning Using a SPIRAL Approach in a Large Required First-Year Mechanical Engineering Class," *Proc. of the 2010 ASEE Annual Conference and Exposition*.
- Roemer, R., Mascaro, D. J. and Bamberg, S. J .M., "A SPIRAL Learning Curriculum in Mechanical Engineering," *Proc. of the 2010 ASEE Annual Conference and Exposition*.
- Zhang, Y., Hukic-Markosian, G., Mascaro, D. J. and Vardeny, Z. V., "Enhanced Performance of P3HT/PCBM Bulk Heterojunction Photovoltaic Devices by Adding Spin $\frac{1}{2}$ Radicals," *Synthetic Metals*, Vol. 160, 2010, pp. 262-265.
- Mascaro, D. J., Baxter, J. C., Halvorsen, A., White, K., Scholz, B. and Schulz, D. L., "ChemiBlock Transducers," *Sensors and Actuators B: Chemical*, Vol. 120, 2007, pp. 353-361.
- Mascaro, D. J., Thompson, M. E., Smith, H. I., and Bulović, V., "Forming Oriented Alq₃ Crystals from Amorphous Thin Films on Patterned Substrates via Solvent-Vapor Annealing," *Organic Electronics*, Vol. 6, 2005, pp. 211-220.

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Mascaro, D. J. and Bulović, V., "Supramolecular Assembly of In-Plane Organic Crystals via Solvent-Vapor Exposure," *Proc. of the 8th Joint Conference on Information Sciences* (2005).

Dimitrakopoulos, C. D. and Mascaro, D. J., "Organic Thin-Film Transistors: A Review of Recent Advances," *IBM Journal of Research and Development*, Vol. 45, 2001, pp. 11-27.

Kosbar, L. L., Dimitrakopoulos, C. D., Mascaro, D. J., "The Effect of Surface Preparation on the Structure and Electrical Transport in an Organic Semiconductor," *Proc. of the Materials Research Society Spring Meeting* (2001).

Presentations

Zhang, Y., Hukic-Markosian, G., Mascaro, D., and Vardeny, Z. V., "Effect of Doping Spin 1/2 Radical Impurities on the Performance of Polymer/Fullerene Bulk Heterojunction Solar Cell Devices," American Physical Society March Meeting, March 2010, Portland, OR.

Zhang, Y., Singh, S., Hukic-Markosian, G., Mascaro, D. and Vardeny, Z. V., "Enhanced Performance of Polymer/Fullerene Photovoltaic Devices with Spin 1/2 Radical Doping," SPINOS 2009 Meeting, February 2009, Salt Lake City, UT.

Park, J. W., Mascaro S. A., and Mascaro D. J., "2-D Stretchable Electronics with Compliantly Embedded Rigid Components," Materials Research Society Spring Meeting, April 2009, San Francisco, CA.

Jeong, J., and Mascaro, D. J., "Precise Pixel Patterning and Fabrication of High-Resolution OLEDs via Spin Casting," Materials Research Society (MRS) Fall Meeting, November 2007, Boston, MA.

Jeong, J., and Mascaro, D. J., "Precise Patterning and Single Crystal Formation of Molecular Organic Semiconductors via Spin-Casting and Solvent-Vapor Exposure: Towards Low-Cost, Large-Area OLED and OFET Arrays," MRS Fall Meeting, November 2006, Boston, MA.

Mascaro, D. J., Zartman, J. J., Smith, H. I., and Bulović, V., "Forming Oriented Organic Crystal Needles by Solvent-Vapor Annealing of Amorphous Thin Films on Nano-Patterned Substrates," MRS Spring Meeting, April 2003, San Francisco, CA.

Mascaro, D. J., Swager, T. M., Smith, H. I., and Bulović, V., "Guided Growth of Organic Films on Nano-Patterned Substrates," MRS Spring Meeting, April 2002, San Francisco, CA.

Lightly, D. J., Enoki, T., Tanaka, T., and Swager, T. M., "Polyaniline/NIPA Gel Composite Device for Sensor Applications," MRS Fall Meeting, December 1998, Boston, MA.

Service and Leadership Experience

Member, Senate Advisory Committee on Academic Policy (SACAP) 2019-present
University of Utah

Represent the College of Engineering in discussions of policies for Academic Senate.

Member, Undergraduate Council 2016-2018
University of Utah 2012-2015

Represent the College of Engineering in the discussion of undergraduate issues (e.g., general education requirements, and new/revised majors, minors, certificates and emphases).

Member, Student Course Feedback Oversight Committee 2016-2018
University of Utah

Represent the Undergraduate Council in the discussion of student course feedback processes and policies.

Member, Admissions and Enrollment Committee 2011-2019
Department of Mechanical Engineering, University of Utah

Coordinate the undergraduate admissions process for incoming freshman and transfer students.

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Director of Education and Outreach & Member, Executive Committee 2011-2014
NSF Materials Research Science and Engineering Center (MRSEC), U of U
Oversee the Center's education, outreach and diversity efforts (K-12, undergrad and grad).

Chair, Academic Standards Committee 2010-present
Department of Mechanical Engineering, University of Utah
Responsible for reviewing student petitions to department policies.

Member, ABET Committee 2008-present
Department of Mechanical Engineering, University of Utah (Chair 2013-2014)
Responsible for various aspects of the ABET accreditation process.

Member, Curriculum Committee 2008-present
Department of Mechanical Engineering, University of Utah (Chair 2011-2013)
Discuss program and curriculum changes and new course proposals.
Coordinate logistics of program and curriculum changes in the department.

Member, Executive Committee 2008-present
Department of Mechanical Engineering, University of Utah
Represent the undergraduate program in department planning and discussions.

Member, Scholarship Committee 2008-present
Department of Mechanical Engineering, University of Utah
Review applications and select recipients of departmental scholarships for undergraduates.

Faculty Advisor, Undergraduate Student Advisory Committee (USAC) 2008-present
Department of Mechanical Engineering, University of Utah
Assist USAC officers and members in organizing department service and social activities.

Member, Curriculum Committee 2008-present
College of Engineering, University of Utah
Represent the Department of Mechanical Engineering in the discussion of new/revised courses and program requirements.

Member, Program Advisory Committee 2008-present
Engineering Department, Salt Lake Community College
Communicate curriculum changes and articulation concerns to SLCC engineering faculty

Member, Articulation Committee 2008-present
College of Engineering, University of Utah
Facilitate articulation of engineering courses with other Utah Colleges and Universities.

Member, Graduate Committee 2005-2010
Department of Mechanical Engineering, University of Utah
Responsible for organizing a graduate applicant visitation weekend as a recruitment tool.
Involved in changes to the Mechanical Engineering qualifying exam process.

References

Dr. Vladimir Bulović, Professor
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Dr. Robert Roemer, Emeritus Professor
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