

Michael McGehee Named 2007 MRS “Outstanding Young Investigator”

Michael McGehee, assistant professor in the Department of Materials Science and Engineering (MSE) at Stanford University, has been named the 2007 Materials Research Society Outstanding Young Investigator. He is cited for “innovation and application of organic semiconductor in lasers, light-emitting diodes, transistors, and solar cells.” He will deliver an award talk at the 2007 Materials Research Society Spring Meeting in San Francisco on April 12, 2007, 8:15 a.m. in Room 2009 at the Moscone West Convention Center.

Driven by a deep commitment to the global problem of climate change and the need for sources of renewable and environmentally sustainable energy, McGehee has developed a range of interdisciplinary collaborations at Stanford and other academic and industrial research groups to address materials solutions. He is internationally recognized for his work on various nanostructured, conjugated polymers of interest for photovoltaics, organic light-emitting diodes, and transistors.

In the area of photovoltaics (PV), McGehee’s goal was to increase the efficiency and affordability of solar cells by developing methods to fabricate flexible cells in roll-to-roll coating. He chose organic semiconductors because they can be printed at very low cost and he had previous experience using this class of materials in lasers and light-emitting diodes. However, simply blending semiconducting polymers typically produces disordered bulk heterojunction solar cells with efficiencies of only a few percent. McGehee developed innovative self-assembly techniques and produced well-ordered bulk heterojunctions in nanostructured inorganic-organic materials with optimized dimen-



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sions. He employed self-assembled mesoporous titania as an electron acceptor intermixed with polythiophene on the nanometer scale as a means of engineering charge separation and transport. He is responsible for integrating these materials into devices and elucidating their performance as PV cells and thin-film transistors. In the area of semiconducting polymers, McGehee and his students made the crucial discovery that the charge carrier mobility of the most studied semiconducting polymer increases by a factor of 10,000 when the molecular weight is increased by one order of magnitude. McGehee demonstrated that the key to obtaining good charge transport is nucleating crystals off the gate dielectric. Currently, McGehee’s research group is developing other strategies for obtaining ideal semiconducting polymer structures using spin-casting solvents that evaporate slowly, subsequently annealing the films and treating the gate dielectric surface with highly hydrophobic self-assembled monolayers.

In the area of polymer light-emitting diodes (LEDs) and organic lasers, McGehee has been able to increase the efficiency of organic LEDs used to make high-quality flexible displays. Work by his group showed that 25% more light can be extracted if a grating is stamped into the conducting polymer electrode. They have further developed a model for determining how much light naturally escapes an LED, how much is waveguided in the polymer, and how much is waveguided in the substrate.

In addition to his research contributions, McGehee is providing leadership in materials science and engineering (MSE) education. He has initiated a major revision of the Stanford undergraduate and graduate teaching curriculum. He teaches classes in fundamental and applied aspects of organic nanostructured materials, nanoscience, and nanotechnology that attract some of the largest classes in the Stanford MSE department.

McGehee received his PhD degree in materials science from the University of California–Santa Barbara in 1999, then stayed an additional year as a post-doctoral researcher. He joined the faculty at Stanford in 2000. His honors include the Gilbreth Lecturer at the National Academy of Engineering’s National Meeting (2006), NSF CAREER Award (2001), Dupont Young Faculty Award (2001), Dreyfus New Faculty Award (2000), and the MRS Graduate Student Gold Award (1999).

He is a member of the Materials Research Society, the American Chemical Society, and the American Physical Society. He is the author or co-author of over 40 publications.



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