Physics Colloquium

Michigan Technological University

Thursday, October 18, 2007 at 4:00 pm

Room 139, Fisher Hall

Near-field Spectral Imaging of Solar Cell Materials

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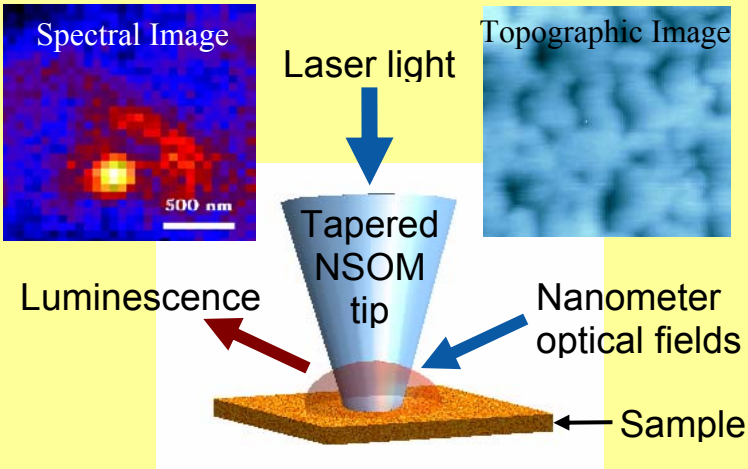

Figure 1: Laser light is confined spatially by a tapered optical fiber (typically 50 to 100nm in diameter), allowing highly localized illumination of solar cell materials. Luminescence from the semiconductor is then analyzed, and the relation between the material's electronic properties and nano-scale structure is thereby revealed.

Abstract: Abbe's classical diffraction limit dictates the smallest feature resolvable by an optical microscope, dictated by the wavelength of light (roughly λ/2, or about 250nm for visible light). Near-field optics is a method for exceeding this limit, allowing imaging and spectroscopy with a resolution which in principle can be pushed to the molecular level. I will discuss the use of near-field optics to analyze the electronic properties of important solar energy materials. As described in the figure above, this work combines low-temperature spectroscopy with near-field optics to map the electronic properties of these materials on a sub-wavelength scale. In so doing, the electronic properties of grain boundaries, composition modulation and spontaneous ordering in compound semiconductors and their alloys are revealed. These experiments have bearing on the improvement of current solar energy technologies, and on the development of so-called "3rd generation" solar cell materials, for more efficient and lower cost solar cells.

Biography: Steve Smith received the BS in Mechanical Engineering from Michigan Tech in 1989 (double major in Physics), and the MS and PhD in Applied Physics from the University of Michigan in 1992, and 1996. He was a postdoctoral fellow and Senior Scientist at the National Renewable Energy Laboratory in Golden, Colorado from 1996-2005. He is currently Associate Professor and Program Director for the Nano- Science and Engineering PhD Program at the South Dakota School of Mines and Technology. His research interests center on nano-scale spectroscopic imaging and nanophotonics, utilizing near-field optics, single molecule methods, and ultrafast laser spectroscopy.

[†]Some work performed while at NREL, Golden, CO 80401