Probing Heterogeneous Electron Transfer Processes in Next-Generation Photovoltaics using Single-Molecule Spectroscopy

Kristin L. Wustholz, The College of William and Mary, kwustholz@wm.edu

Dye-sensitized solar cells (DSSCs) are relatively inexpensive and easily-fabricated solar cells. However, despite intensive research efforts, the efficiencies of DSSCs have only modestly increased since their discovery. We use single-molecule spectroscopy to probe the distributions of electron transfer dynamics in DSSCs. Another strategy to improve the performance of DSSCs is to enhance dye absorption by the incorporation of metal nanoparticles. We have synthesized model dye-sensitized silica-coated silver nanoparticles and characterized the properties of dyes in proximity to individual nanoparticles.

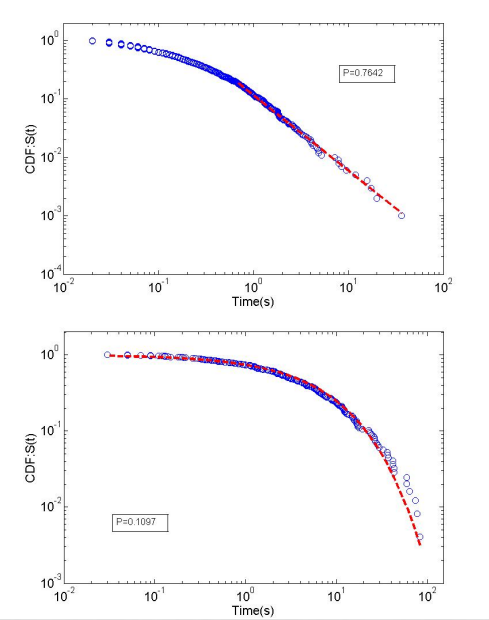

Figure 1. Complex emissive (top) and non-emissive (bottom) single-molecule event distributions in DSSCs

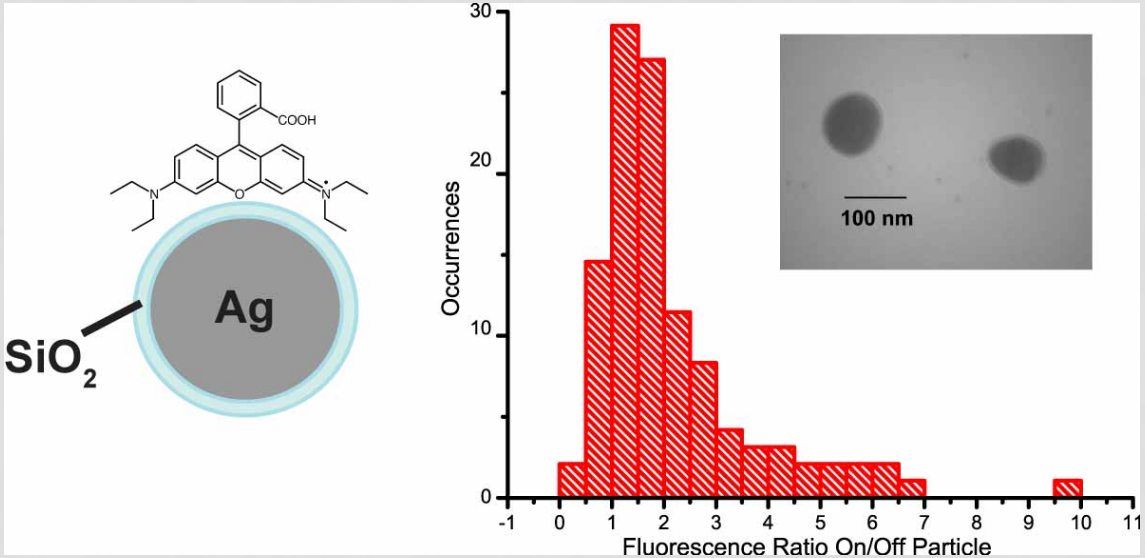

Figure 2. Model dye-sensitized silica-coated silver nanoparticles with corresponding TEM image and distribution of fluorescent enhancements for 108 individual nanoparticles.