Charge Traps in Colloidal Quantum Dot Photovoltaic Materials

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Time-resolved infrared spectroscopy: We have developed a novel approach to examine defects at interfaces of nano-crystalline materials based on time-resolved infrared spectroscopy. Our approach permits us to elucidate the interactions of molecular ligands with colloidal quantum dot surfaces through their vibrational spectra and simultaneously establish the corresponding charge trap energies and densities associated with the ligands.

Collaborative Effort Toward High Efficiency Solar Cells: Having developed the technique, we began collaborating with a leader in the colloidal quantum dot solar cell field, Edward H. Sargent, and together have made significant strides toward understanding how molecular interactions of ligands with quantum dot surfaces influence the electronic properties of devices. Our work has led to development of world-record power conversion efficiency colloidal quantum dot solar cells recently reported in *Nature Materials* (2011) and *ACS Nano* (2012).