SUB-NANOMETER IMAGING OF ELECTRONICALLY EXCITED QUANTUM DOTS: STARK EFFECT, ORIENTATION DEPENDENCE AND ENERGY TRANSFER

DUC NGUYEN, *Chemistry, University of Illinois at Urbana-Champaign, URBANA-CHAMPAIGN, IL, USA*; MARTIN GRUEBELE, *Department of Chemistry, University of Illinois at Urbana-Champaign, Urbana, IL, USA*; JOSEPH LYDING, *Department of Electrical and Computer Engineering, University of Illinois at Urbana-Champaign, Urbana-Champaign, IL, USA*.

Single-molecule adsorption scanning tunneling microscopy (SMA-STM) is a powerful spectroscopy method capable of imaging absorption at sub-nanometer spatial resolution. Herein, we use SMA-STM to investigate electronically excited quantum dots (QDs). Absorption images of individual QDs vary significantly from dot-to-dot, resulting from heterogeneity and defects. Single QD absorption is strongly dependent on the applied electric field, reflecting different excited states being probed. Details on the three-dimensional geometry of the QD excited states are obtained by using the STM tip to nudge and roll the QDs on the surfaces, then image at different angles. Orientation-dependent imaging, in combination with density functional theory calculations of a model QD, reveals presence of surface localized defects. Finally, the energy transfer in arrays of QDs is imaged and manipulated in real space at individual dot level. This study establishes SMA-STM as a powerful method to study electronically excited nanostructures and energy transfer at sub-nm spatial resolution.