HETEROSTRUCTURED OPTICAL NANOMATERIALS FROM THE INSIDE OUT

PRESENTED BY:

Jennifer A Hollingsworth

Center for Integrated Nanotechnologies

Los Alamos National Laboratory

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The synthetically accessible “structural toolbox” available for tuning photophysical properties of semiconductor nanocrystals has been dramatically expanded in recent years. Once largely dependent on size or quantum-confinement effects for the direct manipulation of properties like the color of light emitted by a quantum dot (QD), synthetic tuning of shape and compositional complexity has afforded access to additional variables and, thereby, opportunities for exquisite refinement of photophysical properties, as well as for introduction of new and emergent phenomena, such as two-color blinking-suppressed photoluminescence. Here, I will describe examples where advances in properties optimization and discovery have been enabled by establishment of deep synthesis-structure-function correlations, as well as new synthetic protocol and synthesis and characterization methods, including, for example, automation and single-nanocrystal “stress tests,” respectively. Lastly, I will describe our efforts to assemble semiconductor nanocrystals with sub-wavelength nanophotonic structures, such as optical nanoantenna and nanoscale resonators, toward the ultimate in extrinsic manipulation and enhancement of light emission properties.

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