Tuesday, October 8, 2019, 12:30 pm
Verna and Peter Dauterive Hall - VPD 105

Professor Dmitri V. Talapin

Department of Chemistry
University of Chicago

Engineering functionality in colloidal semiconductor nanomaterials

The synthesis of inorganic nanomaterials has seen impressive developments, both in the fundamental understanding of nucleation, growth and surface chemistry of inorganic phases, and in the ability to prepare functional materials with precisely engineered optical and electronic properties. However, the lack of atomic precision restricts our ability to harness all the power of the broad and diverse world of functional nanomaterials. I will discuss a new approach for colloidal synthesis of nanomaterials with minimal, ideally no, size distribution. The concept is inspired by gas-phase atomic layer deposition (ALD) widely used in microelectronics. Our studies show that the ALD concept can be implemented in solution for layer-by-layer growth of crystalline lattices with close-to-atomic precision.

I will also discuss recent advances in the surface chemistry of semiconductor nanostructures. Molecular inorganic species can be designed to electronically couple individual nanostructures into nanocomposite materials with high charge mobility. By making surface ligands photochemically active, we introduce a general approach for photoresist-free, direct optical lithography of functional inorganic nanomaterials (DOLFIN). Examples of patterned materials include metals, semiconductors, oxides, and magnetic and rare earth compositions. The resolution of the patterned layers is about 30 nm in lateral dimensions and sub-10 nm in the vertical direction. No organic impurities are present in the patterned layers, which helps achieve good electronic and optical properties. The ability to directly pattern all-inorganic layers using a light exposure dose comparable to that of organic photoresists opens up a host of new opportunities for colloidal nanocrystals in additive nanomanufacturing.

Hosted by Professor Michael Inkpen

The scientific community is invited

USC Department of Chemistry
chem.usc.edu