Formulating nanocrystal inks for additive nanomanufacturing at fluid interfaces
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The overarching goal of the proposed project is to develop spearheading nanomanufacturing capabilities that enable the production of materials and devices with precisely programmed structure, composition, and function across six orders of magnitude in length scale. The vision driving the proposed research is that combined control over individual nanostructures (at atomistic length scales), programmable molecular assembly of micrometer superstructures and advanced manufacturing methods (spanning micrometer to meter) presents an exciting, unprecedented and immensely fertile opportunity space to create a new class of materials and devices. The innovative claim of the proposed additive nanomanufacturing at fluid interfaces derives from the synergistic integration of recent advances in directed self-assembly and 3D printing to bridge the manufacturing length scale gap.
The specific objective of this project is to apply recent advances in the formulation of photoresist-free nanoparticle ink formulations to enable nanofabrication at fluid interfaces. Students working on this project should grain proficiency in synthesis of colloidal nanocrystals and functional ligands and nanofabrication in a custom-made 3D printer. Students will also gain expertise in the following characterization techniques: small- and wide-angle x-ray diffraction, scanning electron microscopy (SEM), energy dispersive spectroscopy (EDX), transmission electron microscopy (TEM), and Fourier transform infrared spectroscopy (FTIR).