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Programming Assembly and Transformation of Nanoscale Materials

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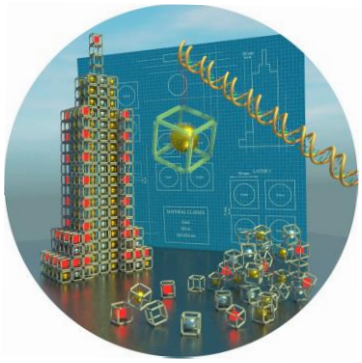

Abstract: The ability to organize diverse types of functional nanocomponents into the targeted 3D architectures can enable a broad range of nanotechnological applications, from new classes of engineered biomaterials to photonic devices. However, the current top-down methods are limited in their ability to create 3D nanostructures with prescribed architectures and an integration of different types of nanocomponents, while the typical bottom-up methods do not provide a flexibility of a system design. The talk will present our progress in establishing a self-assembly platform for the fabrication of designed large-scale and finite-size nano-architectures from diverse inorganic and biomolecular nanocomponents through the DNA-programmable assembly. The recent advances in creating periodic and hierarchical organizations from inorganic nanoparticles and proteins will be presented. The formed nanostructures can be farther transformed into fully inorganic 3D replica of different materials via nano-templating. The developed assembly approaches were applied to demonstrate a fabrication of functional nanomaterials with nano-optical, electrical, mechanical, and biochemical functions. Finally, the progress and outlook for creating reconfigurable nanomaterials with well-defined switchable states will be discussed.