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Dynamically Tunable 3D Nanosystems: From Structural to Optical Switching[1] OLEG GANG, MATHEW MAYE, HUIMING XIONG, DMYTRO NYKYPANCHUK, MUDALIGE THILAK KUMARA, WILLIAM SHERMAN, MATTHEW SFEIR, Brookhaven National Laboratory — The structural plasticity of biomolecules and the reversibility of their interactions can be exploited for creation of nano-systems that are dynamic, reconfigurable and responsive. Here we report a study on 3D nanoparticle systems with discrete and continuous structural tunability endowed by DNA motifs. In the first example we demonstrate an assembly of nanoparticles in 3D superlattices, incorporating a reconfigurable DNA device. The interparticle distances in the superlattices have been modified by adding molecular stimuli, DNA strands. The superlattices were found to switch between two discrete rigid states, whilst a transition to a flexible device configuration showed a significant hysteresis, attributed to molecular trapping within the superlattice. In the second example, we present the successful realization of multi-component superlattices that incorporate metallic nanoparticles and chromophores interconnected by DNA. As the distances between the nano-components were regulated continuously, we have quantified, using small angle x-ray scattering and time-resolved microscopy, the relationship between in-situ determined superlattice structure and fluorescence lifetime.

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