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Directed self-assembly of nanoscale building blocks through coded bonding potentials JASON J. BENKOSKI, RONALD L. JONES, JACK F. DOUGLAS, ALAMGIR KARIM, National Institute of Standards and Technology — Herein we investigate the competition among the forces that drive the assembly of nanoscale building blocks, the results of which lay the groundwork for complex, hierarchical topologies like those seen in Nature. We observed the self assembly of various nanoscale building blocks at the interface between water and a photocrosslinkable oil (dodecanediol dimethacrylate, DMA). While both liquids have a low viscosity at room temperature, DMA can be flash cured with UV light in the presence of a photoinitiator to produce a solid in less than 1 s. Such crosslinking allows one to obtain a “snapshot” of the self-assembly process for particles that segregate to the oil/water interface. Among the particles investigated were 400 nm PMMA latex spheres, 10 nm quantum dots, multi-walled carbon nanotubes, and colloidosomes. Micrographs of each experiment were then captured using either an atomic force microscope (AFM) or light optical microscope (LOM). The agglomerates formed by this process were typically either globular or fractal-like in appearance. By comparing with theory and simulation, we argue that the geometry of the aggregates is coded directly in the particles through the symmetry of the bonding potentials.

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