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Formation of Giant Meso-Polymers from Magnetic Nanoparticles Using Fossilized Liquid Assembly JASON BENKOSKI, NIST, Polymers Division, STEVEN BOWLES, University of Arizona, Chemistry Dept., RONALD JONES, JACK DOUGLAS, NIST, Polymers Division, JEFFREY PYUN, University of Arizona, Chemistry Dept., ALAMGIR KARIM, NIST, Polymers Division
— We report the ability to directly image the self-organization of polymer-coated ferromagnetic nanoparticles into one-dimensional mesostructures at a liquid-liquid interface. When polystyrene-coated Co nanoparticles (15 nm) are deposited at an oil/water interface under zero-field conditions, long ($\sim$ 5 μm) chain-like assemblies spontaneously form, where the precise morphology depends upon particle concentration, temperature, and assembly time. The assembly process was examined using "Fossilized Liquid Assembly," a recently developed platform consisting of a biphasic oil/water system in which the oil phase can be flash-cured upon ultraviolet light exposure. The nanoparticle assemblies embedded in the crosslinked phase were then imaged using atomic force microscopy. Noting the dependence of chain length on the assembly conditions, we observed striking similarities between nanoparticle self-assembly and polymer synthesis. Previous reports on the mechanism and kinetics of equilibrium polymerization provide a useful framework for performing quantitative image analysis on the AFM-visualized mesostructures.

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