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Formation of colloidal-particle "tails" at oil/water interfaces[1]
KAN DU, Univ. Massachusetts Amherst, Dept. of Physics, T. EMRICK, T.P. RUSSELL, Univ. Massachusetts Amherst, Dept. of Polymer Sci. Eng., A.D. DINSMORE, Univ. Massachusetts Amherst, Dept. of Physics — The spontaneous assembly of microparticles at liquid interfaces is a well known and commonly observed process. Here we report a surprising phenomenon that occurs when the interfacial microparticles are displaced by nanoparticles. We used 2.1-um-diameter polystyrene particles, functionalized with amidine, which assemble at the surface of a fluorohexane droplet in water. The particles are strongly bound, with an adsorption energy of 0.9×10^6 k_BT per particle. Then, 4.5-nm-diameter gold nanoparticles, stabilized with (1-mercaptoundec-11-yl)tetra(ethylene glycol) ligand are added to the suspension. The nanoparticles assemble at the interface, lowering the interfacial tension and displacing the microparticles. As the microparticles desorb, they flow along the droplet's surface and form a tail-like structure that flows into the solution. The tails are a few microns in diameter and flow a distance of several cm before disappearing from view. We discuss the desorption of the microparticles and the role of hydrodynamic flow and particle interactions in the formation and stability of the tails.

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