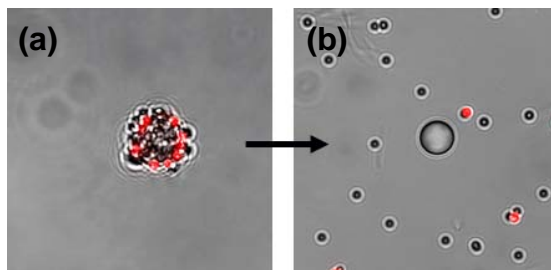


DNA as a reversible materials assembly tool



Micrographs of a) DNA-mediated assembly between a large bead and several complementary microspheres and b) DNA-mediated disassembly of particles following competitive hybridization events.

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Abstract

Recent interest in bio-inspired materials assembly has motivated studies based on recognition events between matching or complementary biological macromolecules immobilized on materials surfaces. DNA is a biological macromolecule in which complementary oligonucleotide strands associate or hybridize to form helical duplexes. Since the affinity between any two matching strands depends on strand length and composition, DNA is a unique assembly tool for tuning the degree of attraction between DNA-functionalized surfaces. To date, studies have also indicated that duplex formation can be reversed by thermal denaturation or “melting” at elevated temperatures. Here, an alternative reversible assembly approach at a fixed temperature is explored using competitive hybridization events between immobilized and soluble oligonucleotide strands. We believe this work presents an important first step towards extending DNA as a reversible assembly tool in physiological systems in which elevated temperatures would compromise cellular function and viability.

Biosketch

Valeria Tohver Milam received her B.S. in Materials Science and Engineering with Honors from the University of Florida in 1993. She specialized in metallurgy and also received a minor in Portuguese. For her master’s degree in MSE at the University of Illinois, Urbana-Champaign, she investigated the properties of semiconductor colloids templated in a surfactant mesophase. As an intern at Sandia National Laboratories in 1997, she formulated ZnO pastes for solid freeform fabrication, specifically, micropen printing. She then completed her doctoral work at UIUC studying the phase behavior, structure and properties of nanoparticle-microsphere suspensions. After finishing her Ph.D. in 2001, she investigated DNA-mediated colloidal assembly at the University of Pennsylvania as a postdoctoral associate. Valeria Milam joined the School of Materials Science & Engineering as an assistant professor at Georgia Tech in 2004. Her current research interests focus on designing and characterizing colloids functionalized with biologically-relevant macromolecules such as oligonucleotides for applications ranging from stimuli-responsive hybrid materials to therapeutic delivery vehicles.