Transforming Colloidal Crystals and Clusters with DNA Handshaking

(Talk #23)

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DNA is a versatile tool for directing the controlled self-assembly of nanoscopic and microscopic objects, but also for subsequently transforming them into new structures. This approach requires detailed knowledge of the interactions between microspheres due to formation of dynamically forming and breaking bridges of DNA, known as handshaking, which have now been measured and modeled in detail [1,2]. Knowledge of the potential, in turn, enables the exploration of the complex phase and processing diagrams in simulation [3]. In experiment, at high densities of long grafted DNA strands, and temperatures where the binding is reversible, these systems readily form colloidal crystals and colloidal clusters having a range of symmetries. For interactions that favor alloying between two same-sized colloidal species, our experimental observations compare favorably to a simulation framework that predicts the equilibrium phase behavior, growth kinetics and solid-solid transitions. We will discuss the crystallography of the novel alloy structures formed and the interesting diffusionless transformations they undergo [4]. Moreover, reprogramming the interactions in these crystals results in the formation of colloidal clusters having several different well-controlled geometries and their own equilibrium structural transformations [5].

References:

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