



POLYMER PROGRAM SEMINARS

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Friday, September 27th, 2019

11:10 AM, IMS 20

Directed Self-Assembly and Crystallization of Polymeric Colloids

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The self-assembly and crystallization of colloidal particles into well-defined architectures is of great interest for potential applications in biomaterials, catalysis, and photonics. In contrast to atoms and molecules, the number and symmetry of structures that self-assemble from colloidal particles is restricted by the absence of directional specific bonds. We have introduced a general method for creating the colloidal analogs of atoms with valence: colloidal particles with chemically functionalized patches that can form highly directional specific bonds. The valences of these new “colloidal atoms” possess all the common symmetries characteristic of hybridized atomic orbitals, including sp , sp^2 , sp^3 , sp^3d , sp^3d^2 , and sp^3d^3 . Because the bonds between these new colloidal atoms are highly directional and fully reversible, they open up the possibility of building new low-coordinated open structures, both amorphous and crystalline, which is emerging as a key design feature for assembling colloids with photonic band gaps. The presentation will expand on these results by introducing colloids fabricated from polymers and polymer-inorganic hybrids. It will describe supramolecular assembly routes engineered in our group to drive these colloidal particles into precisely-assembled architectures via the exploitation of directional noncovalent dynamic interactions such as metal coordination, host-guest complexation, and DNA hybridization. The design principles are based upon the engineering of functional colloidal particles bearing surface-exposed functional groups such as amidines, carboxylic acids, and/or azides that undergo programmable click-like conjugation with hydroxylated block copolymers or cyclooctyne-terminated DNA.

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