

Rational design of functional nanostructures based on patchy building blocks

Motivated by the need to fabricate next-generation functional materials without human intervention, intensive research focused on the self-assembly of colloidal building units has been conducted for two decades with the aim of reproducing the hierarchical assembly of biomolecular building units into living systems. It remains a great challenge to realize the self-assembly of particles into arbitrary structures of targeted size and composition with the versatility similar to that of 3D printing. Indeed, the formation of complex assemblies, which span length scales orders of magnitude greater than the feature sizes of their constituting building blocks, requires that each subunit carries the information about its precise final location in the structure through the design of its interaction rules. An efficient strategy that emerged recently to confer particles predetermined “instructions” for assembly is to decorate the surface of the particles with patches.

In this talk, I will describe some examples of nanostructure synthesis based on the use of patchy nanoparticles as building units. The fabrication of colloidal molecules, colloidal polymers, plasmonic clusters and plasmonic nanocages will be presented.