Self-assembly of microparticles at an interface

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Self-assembly is a process that lowers the Gibbs free energy of a system, leading to the spontaneous organization of matter to attain an equilibrium state. It is a promising route for the fabrication of novel functional materials and architectures across multiple length scales. There has been substantial progress in the development of approaches to self-assemble micro/nanoscale materials into macroscopic suprastructures. The self-assembly of colloidal particles, for example, has led to the formation of suprastructures that exhibit unique organization and functionality. We present the directed self-assembly of anisotropic particles into a macroscopic array. Specifically, this study reveals that solely controlling the shape of the particles may not be sufficient to induce desired assemblies; instead, the precise control of both the shape and patchiness is necessary to achieve the large-scale assembly of particles. Our results provide important design criteria for directing and programming the assembly of particles to create suprastructures with desired properties and functionalities.