Controlled 2D and 3D self-assembly of Janus particle via solvent polarity

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Self-assembly is the spontaneous formation of complex structures from single components which is driven by thermodynamic free energy. Especially, self-assembly using colloids, and micro and millimeter particles are promising for generation of ordered structures in micro and mesoscale.
In this work, we demonstrate the effect of solvent polarity on controlled 2D and 3D self-assembly of Janus particle. We synthesize the Janus particle by micromolding and wetting fluid. The assembled structures show that simple 2D dimers to complex 3D structures via changing solvent polarity. To understand the formation of self-assembly, we examine surface free energy of the Janus particles and thermodynamic free energy of adhesion. It is demonstrated that the thermodynamic free energy is highly changed by the solvents. This results imply that the self-assembly of Janus particles are highly affected by solvent polarity. We expect that our results provide fundamental understanding in designing of self-assembly using particles that are potentially applicable for manufacturing process and biological applications.