

JANUS PARTICLES AS SOLID SURFACTANTS

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Janus particles are asymmetric colloids with polar and apolar sides. Their amphiphilicity makes this new class of colloids exhibit behaviors that are similar to those of surfactant molecules. The major goal of our work is to address the following intellectual questions: are Janus particles efficient “solid surfactants” for the stabilization of multiphase fluid mixtures such as emulsions and foams? We are inspired by how the chemical composition and shape of molecules influence the surfactant properties of molecular amphiphiles. In this talk, I will discuss our recent work on the thermodynamics of emulsion stabilization using Janus particles, the emulsion stabilization and phase inversion emulsification using shape-changing/amphiphilicity-reversing Janus particles. Because the attachment energy of Janus particles to fluid-fluid interfaces is significantly larger than that of homogenous particles, it is possible to generate Pickering emulsions that are thermodynamically stable when Janus particles are used as emulsifiers. I will also describe recently developed Janus particles that undergo significant changes in their shape and amphiphilicity in response to changes in the solution pH. We show that it is possible to stabilize different types of emulsions and also induce the phase inversion of emulsions using these stimuli-responsive Janus particles. New synthetic routes that enable the large-scale production of Janus particles of various shape and chemistry will be presented.