Microfluidic Fabrication of Janus Colloidal Particles

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Recently, there has been great interest in developing new synthetic routes to fabricate Janus colloidal particles due to their high desorption energy at the water/oil interfaces, enabling long-term stability of emulsions. However, conventional methods lack the ability to precisely and independently tune the physicochemical properties of each compartment within the particle. In this work, we first present a facile route in which a cationic surfactant, Didodecyldimethylammonium bromide (DDAB) was utilized to modulate the geometry of the particles. The concentration of the DDAB surfactants in the solution containing molten wax and silica nanoparticle affects the net charge density of the silica nanoparticles and thus the extent of penetration depth at the wax-water interface. Upon freezing of the dispersed wax phase and subsequent selective functionalization of the exposed surfaces, we show that Janus colloidal particles with tunable geometry as well as functionality can be prepared. We further demonstrate that by combining this approach with droplet microfluidics, monodisperse wax colloidosomes and well-controllable Janus colloidal particles can be prepared in a continuous fashion.