Droplet based microfluidic preparation of highly monodisperse organic-inorganic hybrid particles

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This study presents a microfluidic method for preparation of organic−inorganic hybrid microspheres with poly(Dodecanediolo Dimethacrylate-co-Trimethoxysillyl propyl methacrylate) (P(DDMA-co-MPS)) as the core and silica nanoparticles as the shell. In this process, the monodisperse microspheres of P(DDMA-co-MPS) were first synthesized via microfluidic approach of droplet generation combined with in situ photopolymerization, and nanosilica particles gradually grew on the surface of microsphere via hydrolysis and condensation of tetraethoxysilane (TEOS) in basic ammonium hydroxide medium without additional surface treatment. The morphology, composition, and crystalline structure of the hybrid microspheres were confirmed by scanning electron microscopy, transmission electron microscopy, Fourier transform infrared spectroscopy, EDS, and XPS analysis, respectively. The results indicated that the shell of the complex microspheres consists of SiO_2 microspheres with about 60 nm. Finally, we suggest the coating mechanism of SiO_2 nanoparticles on the polymeric microsphere.