

Fabrication of monodisperse polymeric microspheres coated with silica nanoparticles

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The synthesis of organic-inorganic hybrid particles with highly controlled particle sizes in the micrometer range is a major challenge in many areas of research. In this study, we present a microfluidic method for the preparation of organic-inorganic hybrid microparticles with poly(1,10-decanediol dimethacrylate-co-trimethoxysilyl propyl methacrylate) (PDDMA-co-TPM) as the core and silica nanoparticles as the shell. In this approach, the droplet-based microfluidic method combined with in situ photopolymerization produces highly monodisperse organic microparticles of PDDMA-co-TPM in a simple manner, and the silica nanoparticles gradually grow on the surface of the microparticles prepared via hydrolysis and condensation of tetraethoxysilane (TEOS) in a basic ammonium hydroxide medium without additional surface treatment. This approach leads to a reduction in the number of processes and allows drastically improved size uniformity compared to conventional methods. Finally, we experimentally describe the formation mechanism of a silica-coating layer on the organic surface of polymeric core particles.