Highly uniform polyhedral colloids formed by colloidal crystal templating

We seek to create polyhedral solid particles by compressing oil droplets in a colloidal crystal, and polymerizing them in situ, resulting in polyhedral particles containing spherical dimples in an ordered arrangement. Specifically, highly monodisperse, micron-sized droplets of 3-methacryloxypropyl trimethoxysilane (TPM) were first prepared through a poly condensation reaction, following well established methods. The droplets were mixed with an excess of polystyrene(PS) particles (diameter in 2.58 μm), which formed face centered cubic(FCC) colloidal crystals by natural sedimentation and compression under partial drying, with TPM oil droplets trapped into their tetrahedral and octahedral interstitial sites. Depending on the initial particle volume fraction and extent of drying, a high yield of dimpled particles having different shapes including tetrahedrons and cubes were obtained after oil initiated polymerization and dissolution of the host PS particles, as seen under SEM. The effects of particle to droplet size ratio, drying time, and other factors in relation to the yield of tetrahedral and cubic dimpled particles will be presented. Finally, fractionation techniques were used to obtain suspensions of uniform polyhedral particles of high purity.