

Observation of formation pathway for large hollow sphere mesoporous silica using O/W emulsion system and phase separation

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In this study, we propose a formation pathway for large hollow sphere mesoporous silica (HSMS) prepared by a double emulsion system formed by phase separation. The formation of HSMS is influenced by phase separation within the oil-in-water emulsion, which is generated between an aqueous template solution containing Pluronic P123 and HCl, and a silica source solution containing TEOS and butanol. It is found that P123 acts as an emulsion stabilizer by acting on the emulsion, and phase separation caused by hydrolysis of TEOS occurs subsequently after the formation of O/W emulsion. While hydrolyzed TEOS interacts with P123 to form a silicate complex, butanol moves to the center of the emulsion, which forms a double emulsion-like form. As a result, the P123-silicate complex becomes an outer shell having mesopores, and the droplet of butanol at the center of emulsion forms a cavity. The formation pathway and textural properties of HSMS are confirmed by using optical microscopy, SEM, SAXS, BET, and TEM analysis.