476f Synthesis and Characterization of Vesicular Nanoparticles Formed by Fluorinated Surfactant Templating

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In the last few years, cationic fluorinated surfactants have been shown to form unusual pore structures when used as pore templates for sol-gel derived silica. Examples include unusually small pores and random mesh phase particles. The latter structure forms because of the stiffness of the fluorocarbon tails, which favors bilayers and disc-shaped micelles. Based on this observation, we expect that fluorinated surfactants should be useful for the formation of templated synthesis of other bilayer-based structures, such as vesicular particles (rigid counterparts of surfactant vesicles). Here, we report the successful synthesis of several materials with vesicular pore structures by using different partially fluorinated cationic surfactants as templates. Vesicular silicas with both unilamellar and multilamellar shells will be introduced. The unilamellar shells are prepared with a shorter, more fully fluorinated surfactant. They differ from the structure of surfactant vesicles because the micelles are organized in a single layer of micelles rather than a bilayer. The multilamellar particles are formed with a longer surfactant with a smaller degree of fluorination. The process to prepare the vesicular silica with multilamellar shells is shown to provide flexibility in the type of material that makes up the shells. For example, organic-inorganic hybrid materials with multilamellar vesicular structures can be prepared. The sensitivity of the synthesis process to the stirring rate and the type of silane precursor (alkoxide group and type of organic) will be discussed.