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Abstract
Nano-grade silica hollow sphere were synthesized by the hard template method and the soft template method, respectively. Nano-grade polycyclic acid - chitosan (PAA-CS) particles were used as the hard template in this study. Colloidal silica was added for shell which was absorbed on the surface of PAA-CS particle to form the core-shell structure at room temperature. The core material PAA-CS particle was removed by only adjusting pH to $<$ 1 to form the hollow silica sphere. The PAA-CS powder and hollow silica sphere were changed by the change of the molecular weight of chitosan. The formed hollow silica sphere had a small particles size with a large specific area.

In another part of this study, the soft template, the porous Al (OH)3 was adopted to synthesize the nano grade hollow silica sphere. Colloidal silica was mixed with the aged precipitate of Al(OH)3. During adjusting the solution to pH=1 with 1 M HNO3 , the precipitate of Al(OH)3 was dissolved and the colloidal silica would trap the nano bubble to form the hollow silica sphere.The pH value of solution were the important parameter for controlling the particle size of hollow silica sphere. According to the experimental results, the aged at pH=5 of Al(OH)3 precipitate was the best condition to synthesize the small and uniform hollow silica sphere. In addition, the product of hollow silica sphere could be separated from the aluminum ion solution by using vinyltrimethoxysilane (VTMO) to modify the particle surface and gel the precipitate in the mixing solvent of ethanol and butanol thereafter. The composition of the precipitate was only silica was detected by EDS analysis.
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