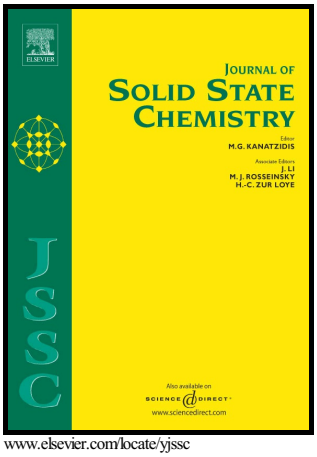

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Solvent effects on microstructures and properties of three-dimensional hierarchical TiO_2 microsphere structures synthesized via solvothermal approach

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Abstract

One-step solvothermal method has been proved to be a simple and efficient route to synthesize three-dimensional (3D) hierarchical TiO_2 microsphere structures, but discrepant properties of the solvent media had been claimed as the major factors determining microstructures and properties of the final products. In this study, several typical solvents, including alkane, aromatic hydrocarbons, halohydrocarbon, ketone, organic acid, mono- and dihydric alcohols, were selected to comprehensively investigate the effect of solvents on the morphology, crystal structure, specific surface area, porous property and light harvesting capability of the final products. According to the experimental results, a good interface separating titanium precursor with aqueous phase in the reaction solution, created by non-polar solvents, or polar solvents which are immiscible with titanium precursor, was the decisive factor for the formation of quasi-3D urchin-like TiO_2 microspheres self-assembled from one-dimensional (1D) nanostructures, and concentrated H^+ induced by organic acid medium was also helpful. Meanwhile, without the liquid-liquid interface or extremely low solution pH, anatase TiO_2 sphere structures with big specific surface area comprising of nanoparticles or nanosheets would be formed, and performed well in photodegradation of pollutants in water.