

Hierarchically porous aluminosilicate substrates as a promising carriers for photocatalytic nanoparticles

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Abstract:

Recently, wastewater treatment has become a critical issue due to particular concerns for sustainable environment, climate change and industrial growth. There has been a need for readily available and inexpensive solutions between research and industry. Porous aluminosilicate materials based on geopolymer systems have proven their effectiveness as adsorbents, ion-exchangers, membranes, anti-microbial filters, pH buffers and stabilizers for water treatment residues. Furthermore, catalysts and/or catalyst supports for pollutant degradation in liquid phase reactions have been studied. High permeability, surface area, chemical resistance and mechanical strength are essential for these applications. Here we present a facile synthesis routes based on replica technique and sol-gel pipetting of highly porous substrates with open cells and water-floatable spherical beads with closed porosity. Characterization of prepared structures was performed with respect to their porous architecture, surface properties and mechanical integrity. Scanning electron microscopy (SEM) and micro-computed tomography (micro CT) revealed the relationship between the inner/outer structure and the open/closed porosity ratio. Thermal behavior was studied by thermogravimetric (TGA) and differential thermal analysis (DTA) up to 1000 °C and 1300 °C, respectively. In addition, mechanical stability was determined and a procedure for coating nanoparticles with respect to their photocatalytic activities was proposed.

Key words:

Porosity, carriers, photocatalysis