



PMSE 353: Architectural core-shell metal catalyst synthesis onto/into clay nanotubes

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Body

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Decreasing the size of transition metal particles to the nanoscale allows for a higher catalytic activity in heterogeneous reactions. These catalysts need a support for preventing aggregation of the highly active nanoparticles. Mesoporous supports supply good diffusion of larger molecules to the active centers and are perfect for the immobilization of metal complexes compared to more common supports such as zeolites. Halloysite clay nanotubes which are natural, available in large quantities (thousands of tons), and mesoporous (with 15 nm lumen) were used as a carrier for metal nanoparticles. Halloysite nanotubes are formed by rolling kaolin aluminosilicate sheets up to 10-15 revolutions. They have a diameter of 50-60 nm, and a length of 500-800 nm. They are environmentally friendly and inexpensive. Metal nanoparticle catalysts (Au, Fe, Co, Ru) were selectively attached to the nanotube outer surface, the inner lumen, or in between the layers resulting in high catalysis yields. Such core-shell metal/ceramic composites could be synthesized on a large scale in industrial reactors, for a number of applications such as Fischer-Tropsch gas-diesel catalysis. In order to enhance metal adherence to halloysite, the nanotubes were intercalated with furfural which was then converted to tetradentate ligands. We applied this complexation agent for Ru, Pt, Pd, Ni, and Cu ions at elevated temperatures. Ligand-metal complex formation followed by reduction resulted in formation of metal particles of 2-5 nm both in the central lumen and in the interlayer spaces of the tube walls. These core-shell nanostructures are efficient catalysts in redox reactions.

Sessions



PMSE: Joint PMSE-POLY Poster Session

Tuesday, Mar 20 6:00 PM

Hall E, Ernest N. Morial Convention Center

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