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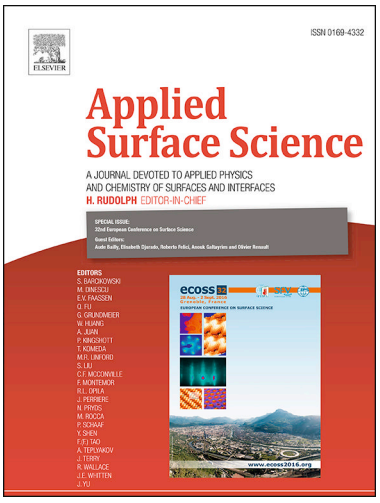

Full Length Article

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Development of SiO_2@TiO_2 core-shell nanospheres for catalytic applications

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Abstract

Silica-titania core-shell nanospheres, CSNp, were prepared via a simple and environmentally friendly two step route. First, silica cores were prepared through the hydrolysis-condensation reaction of silicic acid in the presence of hyperbranched poly(ethylene)imine (HBPEI) followed by repeating washing, centrifugation and, finally, calcination steps. To create the core-shell structure, various amounts of titanium isopropoxide were added to the cores and after that a HBPEI-water solution was added to hydrolyze the titanium precursor. Washing with ethanol and heat treatment followed. The optimization of processing parameters led to well-developed core-shell structures bearing a homogeneous nanocrystalline anatase coating over each silica core. The photocatalytic activity for NO was examined in a continuous flux photocatalytic reactor under real environmental conditions. The results revealed a very potent photocatalyst as the degradation percentage reached 84.27 % for the core-shell material compared to the 82 % of pure titania with the photodecomposition rates measured at 0.62 and 0.55 $\mu g \cdot m^{-2} \cdot s^{-1}$, respectively. In addition, catalytic activities of the CSNp and pure titania were investigated by monitoring the reduction of 4-nitrophenol to 4-aminophenol by an excess of $NaBH_4$. Both materials exhibited excellent catalytic activity (100 %), making the core-shell material a promising alternative catalyst to pure titania for various applications.

Keywords: Core-shell; Titanium dioxide; Silicon dioxide; Nitrogen oxides; 4-nitrophenol