Photocatalytic Activity of Doped and Undoped Titanium Dioxide Nanoparticles Synthesised by Flame Spray Pyrolysis Platinum-doped TiO2 composites show improved activity compared to commercially available product

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Abstract

The photocatalytic activities of a series of titanium dioxide (TiO2) based nanoparticles, synthesised via flame spray pyrolysis (FSP), have been investigated and compared with the commercially available Evonik Aeroxide (R) TiO2 P 25 (P 25). The effects of metal ions aluminium, tin and platinum, respectively, on the physical and chemical properties of the TiO2 nanoparticles are reported. The set of six samples were characterised by X-ray powder diffraction (XRD), transmission electron microscopy (TEM), inductively coupled plasma-mass spectrometry (ICP-MS) and ultraviolet-visible (UV-vis) diffuse reflectance spectroscopy. Specific surface areas were determined using nitrogen adsorption and desorption measurements. Subsequent photocatalytic studies of the degradation of methyl orange (MO) dye under UV irradiation demonstrated that addition of Al and Sn had a negative effect on catalytic performance, whereas the addition of <= 0.7 at% Pt to each sample enhanced photocatalytic activity. Most interestingly, the Pt-doped composite samples (TiO2-Sn/Pt and TiO2-Al/Pt) both showed a significantly higher rate of degradation of MO, when compared to P 25. All Pt-doped samples show an increased visible photon absorption capacity. The relationships between the physical and chemical characteristics are discussed in relation to photocatalytic performance.

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