Fe-doped TiO2 Nanoparticles Produced via MOCVD: Synthesis, Characterization, and Photocatalytic Activity.

ABSTRACT

Iron (Fe)-doped titanium dioxide (TiO2) nanoparticles were produced via the metallorganic chemical vapour deposition (MOCVD) method at 700∘C. Different amounts of ferrocene as the Fe dopant source (0.001–0.05 g) were introduced inside the reactor together with the titanium precursor in order to synthesize different Fe dopant concentrations of TiO2 nanoparticles. Nitrogen (N2) adsorption results showed that increasing the Fe dopant concentration caused a slight increase in the surface area of the nanoparticles due to the decrease in nanoparticle size. The UV-diffuse reflectance spectra demonstrated an absorption shift in Fe-doped TiO2 nanoparticles to longer wavelengths, thus showing an enhancement of the absorption in the visible spectrum. Bandgap energy values determined from the UV-diffuse reflectance spectra data decreased with an increase in the Fe dopant concentrations. The photocatalytic activity of Fe-doped TiO2 nanoparticles was investigated via degradation of methylene blue under UV and fluorescent light. It was found that Fe doping reduced the photocatalytic activity of the samples. Based on X-ray photoelectron spectroscopy (XPS) results, it is believed that this is due to the unfavourable location of Fe3+ inside the interior matrix of the TiO2 nanoparticles rather than on the exterior surface, which would affect photocatalytic behaviour.

Keyword: Iron (Fe)-doped titanium dioxide (TiO2); Metallorganic chemical vapour deposition (MOCVD)