

Improvement of catalytic activity in styrene oxidation of carbon-coated titania by formation of porous carbon layer

Abstract

Porous carbon layer has been formed by treating the carbon-coated titania (C@TiO₂) with KOH solution. Carbon-coated titania (C@TiO₂) was obtained by pyrolysis of polystyrene-coated titania (PS@TiO₂), which was produced by in situ polymerization of styrene by using aqueous hydrogen peroxide. The presence of polystyrene and carbon on the surface of titania were confirmed by X-ray photoelectron spectroscopy (XPS) and Fourier transform infrared (FTIR) spectroscopy techniques. Carbon content was about 2.2 wt.% with thickness of carbon layer ca. 5 nm. After treating with KOH solution, PC@TiO₂ with the pore size of ca. 5 nm, total pore volume of 0.05 cm³ g⁻¹ and Brunauer–Emmett–Teller (BET) specific surface area of 46 m² g⁻¹ has been obtained. Catalytic activity results showed that PC@TiO₂ gave a higher activity in styrene oxidation compared to bare TiO₂, and C@TiO₂. The highest catalytic activity was obtained by using PC@TiO₂ that obtained after treating C@TiO₂ with 1.0 M KOH solution with benzaldehyde and phenylacetaldehyde as the main reaction products. At the higher concentration of KOH solution, the catalytic activity decreased when crystallinity of TiO₂ decreased.