

Structure evolution and high photocatalytic activity of Au nanoparticles decorated on TiO₂ anatase sea-urchin-like microspheres for high activity photocatalytic degradation

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Abstract

Au nanoparticles decorated on titanium dioxide sea-urchin-like microspheres (TSUMs) were synthesized by a hydrothermal method. Having the gold nanoparticles well dispersed on the crystalline spines TiO₂ sea-urchin-like microspheres are expected to increase the photocatalytic activity. XAS results indicate that different Au precursor concentration affects the electronic structure of the TSUM spines. The oxygen defects in the local structural symmetry of TiO₆ octahedra are also shown to be strongly correlated with the decoration of Au nanoparticles, as testified by XAS analysis. The oxygen defects and Ti₃₊ in the spines, generated by the decoration of Au nanoparticles, are considered to enhance photocatalytic degradation of paracetamol. Further, in-situ XAS measurements reveal the hot electron transferred from Au to TSUMs assisted by the localized surface plasmon resonance under visible light irradiation. The investigation provides new insights into the active sites, surface's structure, and its electronic properties of a photocatalyst applicable to environmental problems.

Keywords - photocatalyst, Titanium dioxide, XAS; In situ, Degradation of paracetamol