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Stabilization of molecular TiO_4 species on the pore surface of mesoporous silica and its photocatalytic properties

Although molecular tetrahedral Ti-oxo species exhibit unique electronic and photochemical properties due to their discrete energy levels,[1] which are different from those of anatase and rutile, such Ti-oxo species are generally unstable and readily transformed to amorphous/crystalline TiO_2 (bulk phases, nanoparticles, and clusters) via hydrolysis and condensation. Here, molecular Ti-oxo species were immobilized on the pore surface of mesoporous silica SBA-15 by grafting titanium(IV) oxyacetylacetonate using the surface silanol groups of SBA-15 as a scaffold, followed by chemical etching with dilute hydrochloric acid to form molecular TiO_4 species.[2] These Ti species mainly exist as isolated tetrahedrally coordinated structures, as was confirmed by diffuse reflectance UV−vis and Raman spectroscopy. The SBA-15-immobilized molecular TiO_4 exhibited higher photocatalytic activity than the reference photocatalysts (P25 and Ti-MCM-41) for both H_2 production from methanol solution and CO_2 reduction to C_2 products such as ethanol and acetic acid.

References:

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