

A novel poly(vinyl alcohol) post-precipitation template synthesis and property tuning of photoactive mesoporous nano-TiO₂

ABSTRACT

For the first time, a facile method is introduced to obtain ultrathin, mesoporous TiO₂ nanosheets by the alkali precipitation of aqueous TiCl₃ in the presence of NH₄OH, and in-situ templating with polyvinyl alcohol (PVA). The synthesized titania have been characterized by N₂ adsorption-desorption measurements, x-ray diffraction (XRD), scanning electron microscopy (SEM), transmission electron microscopy (TEM), thermo-gravimetric analysis (TGA) and ultraviolet-visible (UV-vis) spectroscopy. The obtained titania were hexagonal-like, detached, non-agglomerated, polydispersed, sub-20 nm nanodiscs. Unlike in doping methods, their surface area and pore volumes can easily be tailored devoid of any wavelength shift, by simply tuning the amount of the template. Accordingly, their aggregation as microspheres can successfully be controlled by the templating step. The remarkable photoactivity of these nanoscopic materials has been confirmed by the degradation of aqueous methyl orange.

Keyword: Anatase; Mesoporous; TiO₂; Template; Photocatalysis; Precipitation