Effects of Nb doping on microstructure and photocatalytic properties of TiO$_2$ thin film

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ABSTRACT

Pure TiO$_2$ and Nb-doped TiO$_2$ thin films deposited on quartz glass substrate were prepared by the sol-gel method. The morphologies, microstructure and spectral absorption properties of the as-prepared TiO$_2$ thin films were investigated by scanning electron microscope (SEM), atomic force microscope (AFM) and UV–VIS absorption spectra (UV–VIS). The photocatalytic activity of the TiO$_2$ thin films was evaluated by the degradation of methyl orange under ultraviolet illumination. The results showed that after Nb-doping the grain size of Nb-doped TiO$_2$ particles was decreased to some extent and the pore size distribution was affected, but the morphology was changed negligibly. Moreover, the Nb-doping could produce a blue shift in the optical absorption edge compared to that of the pure TiO$_2$ thin film. The Nb-doped TiO$_2$ film showed lower photocatalytic activity for the degradation of methyl orange. We also investigated the effect of the number of layers on methyl orange degradation. The more the coating amount, the thicker the TiO$_2$ thin film and the higher photocatalytic efficiency.

Keywords: TiO$_2$ thin film; Nb-doping; Microstructure; Photocatalytic activity; Methyl Orange