Optical and photocatalytic properties of noble-metal-doped TiO_2 thin films prepared by photodeposition method

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Metallization of sol-gel-derived TiO_2 films on quartz substrates were performed by photodepostion method. The prepared M/TiO_2 (M= Pd, Pt) films had high optical and photocatalytic properties. The size of the metal clusters formed by the photochemical method is smaller than what is obtained in the impregnation method. The primary role of metal is to act as an electron sink and enhance the photocatalytic efficiency. Photodeposition of metal on TiO_2 films very slightly reduced the transmittance of TiO_2 films. 90% of benzene is decomposed in the presence of M/TiO_2 films after UV illumination for 60 min. There exists an optimum metal content where the photoactivity becomes the maximum. Beyond the optimum metal content the decline of in activity is due to metal agglomeration and shading of the photosensitive surface of TiO2. In the case of UV illumination, the effect of recombination retardation of electron-hole pairs seems to be more important than the shading effect of TiO_2 surface by metal particles. On the other hand, in the case of fluorescent illumination, the shading effect prevails because the amount of electron-hole pairs is relatively small.