

A comparative study on physicochemical properties and photocatalytic behavior of two different nanostructure composite TiO₂ films coated on glass substrate

Mojtaba Nasr-Esfahani^{a*}, Mohammad Hossein Habibi^b

^aDepartment of Materials Science and Engineering, Islamic Azad University, Najafabad Branch, Iran

Tel./Fax: +98 311 253 6771; email: m-nasresfahani@iaun.ac.ir, mnstd@sci.ui.ac.ir

^bDepartment of Chemistry, University of Isfahan, Isfahan, 81746-73441, Iran

Received 30 April 2008; Accepted 27 January 2009

ABSTRACT

Two types of composite films (MPC500SGF-MC and ANPSGF-MC) have been synthesized by a modified sol–gel method using different particle sizes of TiO₂ powder. Methyl cellulose was added as a template to the sol for stress reduction which improved not only the amount of crystalline material immobilized on the support, but also the nanosize of the films calcined at 500°C. The physicochemical properties, including surface morphology, crystal size and adhesion on the glass substrate, were investigated by SEM and XRD. The photocatalytic activities of the films were compared using methyl orange (MO) as a model organic contaminant in water. The results on photocatalytic degradation of MO showed that the increase in photocatalytic activity for Aldrich TiO₂ powder (ANP) calcined at 500°C, compared with that of Millennium PC500 composite film. The optimum degradation conditions of MO solution are determined. This study proves that particle size of starting TiO₂ material is important for the preparation of nanostructured TiO₂ composite film with enhanced photocatalytic activity and excellent adhesion on the glass substrate.

Keywords: Millennium PC500; Aldrich TiO₂ powder; Sol–gel; Methyl orange; Nanostructure; Composite film; Methyl cellulose; Coated on glass

* Corresponding author.