Effect of Acetyl Acetone on Property of TiO_2 Thin Film for Photocatalytic Reduction of Chromium(VI) from Aqueous Solution

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ABSTRACT

In this research, a sol-gel technique with dip coating method was used to prepare photocatalytic TiO_2 thin films immobilized on glass plates. Titanium(IV) butoxide was used as initial substrate. The solvent was ethanol and the additive substrate was acetyl acetone. Molar ratios of TiO_2 to acetyl acetone were varied as studied parameters. This study was aimed to investigate the effect of acetyl acetone on TiO_2 thin film properties that are adherence and corrosive property, surface morphology of thin film, TiO_2 molecular structure and photoactivity. It was found that acetyl acetone played an important role on TiO_2 thin film properties. It significantly enhanced the adherence property and provided the smooth surface of TiO_2 thin film. On the contrary, acetyl acetone exerted less effect on the crystal structure of TiO_2 film and increased nanoparticle size of TiO_2, which results in the decreasing of photocatalytic activity of the film. Findings from this research can be beneficial for the developments of thin film TiO_2 preparation for environmental application.

Key words: Thin films, TiO_2, Acetyl acetone, Photocatalytic activity

INTRODUCTION

In recent years, the emission of hazardous pollutants has become a very serious problem and caused different degrees of hazard to human health and environment. In order to eliminate their presence in the environment, much attention has been paid to find practical ways to introduce efficient remedial technologies.

Photocatalysis process using titanium dioxide, TiO_2, as a catalyst is emerging as one of the more promising candidates for the elimination of hazardous substances in polluted air and wastewater (Linsebigler et al., 1995; Ollis, 2000). Under favorable conditions, a wide range of organic and inorganic compounds can be mineralized to mineral acids, carbon dioxide and water or transformed into harmless species (Huang et al., 1993; Litter, 1999). TiO_2 as used in the photocatalysis process always exists in two forms, one is the suspended form of fine particles dispersed in a liquid medium, and the other is the immobilized form as thin films. Although the suspended TiO_2 can be used without any preparation techniques, it is associated with the difficult problem of powder separation and the catalyst recycle after use. For this reason, several techniques have been developed to immobilize TiO_2 on different substrates with suitable properties to offer a highly-active surface area, photoactivity and