Effect of the thickness of TiO_2 films on the photodegration of methyl orange dye

Bianca Alves Marcello[1], Olandir Vercino Correa[2], Rodrigo Teixeira Bento[3], Marina Fuser Pillis[3]

[1]Instituto de Pesquisas Energeticas e Nucleares (*SECTM*) , [2]Instituto de Pesquisas Energeticas e Nucleares, [3]Instituto de Pesquisas Energeticas e Nucleares (*CCTM*)

e-mail: bianca_marcello@hotmail.com

The increase of the disposed of azo dyes such as methyl orange (MO) by textile and allied industries in the wastewater results in a significant increase of pollutants, which requires the development of new degradation materials and techniques to purify the effluents [1]. Heterogeneous photocatalysis using titanium dioxide (TiO_2) films is a highly efficient oxidative process for water treatment [2]. The TiO_2 films were grown on borosilicate substrates by metalorganic chemical vapor deposition (MOCVD) at 500°C, and the growth time was controlled in order to obtain films with the thickness of 400, 600 1100 and 2100 nm. MO dye degradation was evaluated by using anatase-TiO_2 as photocatalyst under UV light. The pH of the solutions was set on 2. The TiO_2 films presented uniform thickness and well-defined columnar structure that grow perpendicular to the substrate surface. The increasing of the growth time increases both the thickness and the mean grain size of the films. All the films presented the formation of anatase-TiO_2 crystalline phase grown preferentially oriented at (112). The results showed that the photocatalytic behavior of the films decreased with increasing the film thickness. The photocatalytic efficiency for the 400, 600, 1100 and 2100 nm films tested at pH 2 are respectively 39.2%, 30.2 %, 24.4 % and 12.2 %. When the thickness of the films augments, the mobility of the electrons is impaired due to the increase of the film opacity, which limits the light penetration through the catalyst, and difficults the diffusion of charge carriers required to activate the semiconductor surface. TiO_2 catalysts grown by MOCVD technique is a practical promising application for the water treatment.