Evaluation of the photocatalytic activity of TiO_2 films grown by mocvd technique

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The presence of pollutants such as insecticides and antibiotics in wastewaters and drinking water is nowadays one of the major environmental problems. Titanium dioxide has emerged as an excellent photocatalyst for pollutant degradation. In this research TiO_2 films with thicknesses of 184, 395 and 720 nm were grown at 400ºC by metallorganic chemical vapor deposition (MOCVD) on borosilicate substrates. Titanium isopropoxide IV was used both as titanium and oxygen precursors. The films were analyzed by x-ray diffraction and the results suggested that anatase was the only phase formed. The photocatalytic behavior of the TiO_2 films on the degradation of methyl orange dye solution in different values of pH was evaluated by spectrophotometry under UV irradiation. The results of the dye degradation show that the lower the pH of the solution, the higher the efficiency of the TiO_2, independently of the thickness of the film. The best photocatalytic performance was observed for films with 395 nm of thickness at pH 2.00, which showed 65.3% of efficiency in the degradation of the dye. Similar result was obtained by Duminica et al.[1] that grew TiO_2 films by MOCVD and reported the best result for films with approximately 300 nm of thickness. According to these authors, when the film is very thick and dense, most of the pairs electron/hole is generated inside the film, and do not reach the surface, and when the film is very thin, only a small portion of the incident light is absorbed by TiO_2. Thus, there is an optimal thickness to obtain the best results. The findings of the present study permit to conclude that TiO_2 films produced by MOCVD are promising for application as photocatalyst material in the degradation of organic pollutants as methyl orange dye.

References:

[1] Duminica et al. *Surface & Coatings Technology*. 201, 9304-9308 (2007).