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**Preliminary results of photocatalytic Cr(VI) reduction using TiO2 films grown by cathodic arc deposition: effect of the film thickness and the N-doping**

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***Abstract***

TiO2 is the most studied photocatalyst for the treatment of pollutants; however, its rather large band gap and the need for a removal step when used as a suspension hinder the wide application of this technology. Immobilized TiO2 films grown by cathodic arc deposition (CAD) have shown superior adhesion to the substrate and activities similar to that of P-25 TiO2 films, the reference photocatalyst, but they still require UV light to be excited [1]. N-doping is a strategy frequently used to extend the TiO2 band gap to the visible range [2], but it has a scarce application on CAD-grown films. In this work, TiO2 CAD films, with and without N-doping, were prepared and tested on the photocatalytic removal of Cr(VI), a priority water pollutant, in the presence of ethylenediaminetetraacetic acid (EDTA) as an organic donor.

TiO2 films of different thicknesses: (290 ± 40 nm), (440 ± 40) nm, and (850 ± 70) nm, were deposited by CAD according to a reported method [1]. The doping of the films was performed by plasma immersion ion implantation in a N2 environment. For comparison, P-25 TiO2 films of (280 ± 20) nm and (480 ± 30) nm thicknesses were prepared by dip-coating; thicker P-25 films were not stable. All films were grown over a borosilicate glass substrate. Photocatalytic experiments were performed in thermostatted cylindrical glass cells (*T* = 25 °C) magnetically stirred and irradiated from the top with a HPA 400S lamp (*λ* > 320 nm, mean UV irradiance 28 W m-2), equipped with an IR filter. 10 mL of a 0.8 mM Cr(VI) and 1 mM EDTA solution at pH 2 (HClO4) were poured into each cell, and 0.25 mL samples were periodically taken for Cr(VI) quantification by the diphenylcarbazide method; at the end of the experiments, a Cr(III)-EDTA complex in solution was determined by direct spectrophotometry [1].

After 5 h of irradiation, Cr(VI) removals of 58% and 85% were obtained with pure and N-doped 290 nm CADfilms, respectively, while for pure and N-doped 440 nm CAD films the corresponding removals were 70% and 85%; with the 280 nm and 480 nm P-25 films, Cr(VI) removals were 81% and 88%, respectively. Although thicker CAD films were more efficient (99% of Cr(VI) removal with 850 nm films), no difference could be appreciated between N-doped and undoped films. Cr(VI) evolution could be adjusted to a pseudo-first-order kinetics. In all cases, Cr(III)-EDTA represented 75% of the reduced Cr(VI), the remaining Cr(III) being retained on the TiO2 surface, [1].

The photocatalytic efficiency increased with the thickness of the films. Although P-25 films showed a higher photoactivity than the CAD films of similar thickness, thicker and more active CAD films can be surely obtained in future works. N-doping increased slightly the photocatalytic activity of the thinnest films.

***References***

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