Influence of the heat treatment on the photodegradation efficiency of the supported TiO_2 catalysts obtained by a facile airbrush spray-coating

Tatyana Christina Faccin borazanian[1], Olandir Vercino Correa[2], Rodrigo Teixeira Bento[1], Marina Fuser Pillis[1]

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

e-mail: tatyana.borazanian@usp.br

One of the main topics of thin films processing routes based on sol-gel is the need for low-cost and simple techniques [1]. Airbrush spray-coating method has been applied to coat materials, due to its cost-effective, large area and versatile characteristics [2]. However, this technique is not yet sufficiently explored for supported catalysts employed on the water treatment. In this work, titanium dioxide (TiO_2) films were successfully deposited on borosilicate substrates by a facile airbrush spray-coating technique, at room temperature, from a solution of titanium (IV) isopropoxide diluted in isopropanol. The angle of the cold spray was fixed in 45°, and the feed rate was 17 $mm.s^{-1}$. The coated specimens were dried at 100 °C for 60 min, and then heat treated at 300, 450 and 500 °C for 30 min to evaluate the influence of the temperature process on the methyl orange dye degradation under UV light. The catalysts obtained showed a great surface covering, highly porous surface, and good adherence to substrate. The films presented the formation of TiO_2-anatase phase. Methyl orange dye degradation experimental results indicated that the TiO_2 film heat treated at 500 °C presented a higher photocatalytic behavior, that exhibited 68.3 % of the dye degradation for 300 minutes under UV radiation – around 18.5 % more efficient than the supported catalysts prepared at 300 and 450 °C, with a photocatalytic efficiency of 31.6 % and 57.7 %, respectively. The study of the influence of heat treatment on the photocatalytic activity suggests the existence of an ideal temperature in which the photocatalyst exhibits the better photodegradation performance. The results suggest that the supported TiO_2 catalysts deposited by the airbrush spray-coating method have a promising practical application for the green treatment of organic pollutants.

References:

[1] M. Salah et al., Journal of Materials Science 30, 1767-1785 (2019).

[2] M.F. Pillis et al., Materials Research 19, 611-617 (2016).