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Editors:
Caue Ribeiro
Odílio Benedito Garrido de Assis
Luiz Henrique Capparelli Mattoso
Sergio Mascarenhas

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Influence of the temperature on $Sn_{0.75}Ti_{0.25}O_2$ samples used in dye photodegradation

D. Berger[(1)*], J.A. Varela[(1)], S.M. Tebcherani[(2)] , S. de Lazaro[(2)] , C. R. Oliveira[(3)] and T.R. Giraldi[(3)]

(1) Universidade Estadual Paulista Julio de Mesquita Filho, Araraquara, São Paulo, Brazil. e-mail: Berger.d@iq.unesp.br
(2) Universidade Estadual de Ponta Grossa, Av. Gen. Carlos Cavalcanti, 4748, Ponta Grossa, Paraná, Brazil. Zip code: 84050-300. e-mail: srlazaro@uepg.br
(3) Embrapa Instrumentação Agropecuária, São Carlos, SP, Brasil.

Abstract –The present work shows an investigation about catalytic properties of the $Sn_{0.75}Ti_{0.25}O_2$ system with structure type rutile synthesized by Pechini process. Temperatures of calcination used were 500°C, 700°C, 800°C and 950°C. X- ray diffraction and dye Rhodamine B photodegradation were applied to observe structure and application of this system, respectively. Dye Rhodamine B photodegradation through $Sn_{0.75}Ti_{0.25}O_2$ samples showed intermediate catalytic activity between TiO_2 and SnO_2 materials.

Advances ceramics based on SnO_2-TiO_2 (STO) system are important due to catalytic properties yield for ultraviolet radiation (UV). This property is of great interest due to environmental applications and breaking of carbon chains. However, behavior of spinodal decomposition and formation of SnO_2 nanoislands are reported in literature as factor of influence in results catalytic [1,2].

$Sn_{0.75}Ti_{0.25}O_2$ samples at several temperatures was obtained via Pechini method. This method consist in a polymeric resin aqueous obtained from $SnCl_2.2H_2O$ (98.0%) and citric acid anhydrous (99.5%) followed by polymerization against ethylene glycol (99.99%) at 80°C until clearing one. The obtained polymeric resins were added to obtain dispersions containing 0.75% in weight of SnO_2 per weight of TiO_2. The samples were pre-calcined at 450°C for 3h and thereafter calcined at different heat-treatment temperature 500°C, 700°C, 800°C and 950°C. Photodegradation process in colloidal dispersions were prepared using 50.0mL dye Rhodamine B (RhB) in aqueous solution (2.5 $mg.L^{-1}$) adding 2.5 mg of SnO_2 powder, STO75 powder, and TiO_2 powder, respectively. The dispersions were kept under constant air-equilibrated conditions and the analysis irradiating in time intervals of 30 minutes. Samples of 5.0 mL of the dye RhB solution were collected and analyzed by UV–visible spectroscopy (Shimadzu model MultiSpec1501) to monitor temporal dye photodegradation. Dye RhB concentration in each time was determined for the law Lamber-Beer on absorbance at 554 nm. Characterization of the STO using x-ray diffraction (XRD) 6000 Shimadzu model with scanning degree between 5° - 90°, interval of $2°.min^{-1}$ and Cuk_α radiation.

XRD results are showed in the Figure 1. It is observed that STO75 at 950°C presents rutile and cassiterite phases. In the Figure 2 is showed the photodegradation of Rhodamine B catalyzed through SnO_2, TiO_2 and STO75 samples at different temperatures. These results show that STO75 samples have intermediate photodegradation between TiO_2 and SnO_2 structures.

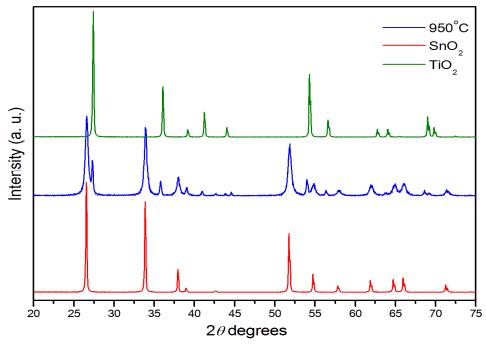

Figure 1: Results XRD for SnO2, TiO2 and STO75 samples synthesized at 950°C.

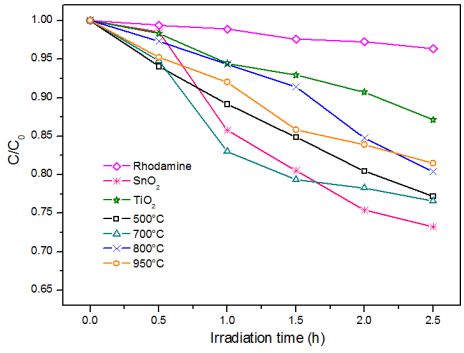

Figure 2: Photodegradation of rhodamine B catalyzed by STO75 at different temperatures.

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