11th International Conference on Advanced Materials
Rio de Janeiro Brazil
September 20 - 25
ICAM2009

# Development of nanostructured photocatalysts and thin films for environmental application

I. T. Weber[(1)], G. H. T. C. Albuquerque[(1)]

(1) DQF, Fundamental Chemistry Department, Federal University of Pernambuco, e-mail: Ingrid@ufpe.br

**Abstract** – Zinc oxide was obtained by the polymeric precursors route (Pechini's method), and the photocatalystic ativity was compared to the ZnO Vetec®. The doping effect by addition of silver nitrate was analyzed through the addition of silver nitrate to the polymeric resin (Pechini) and in addition in ultrasonic bath (Vetec). It was observed that the effect of the addition of the dopant caused low modification to the photocatalytic performance of ZnO Vetec®, but the photocatalytic activity increase of ZnO Pechini was considerable, even with the surface area decrease. This fact can be useful in the deposition of thin films and environmental application with easy recuperation of the catalysts.

Zinc oxide is a semiconductor widely studied and applied in the purification of water that belongs to a kind of advanced oxidation processes. But its oxidant power, price relatively low and wide bandgap make him an ideal catalyst [1] turning possible its application in large scale under solar radiation with excellents results.

The Remazol Red is an azo dye [2], which is an effluent rejected by laundries on rivers of Toritama municipality (PE-Brazil). In this work we employed two metodologies to analyse the fading of the dye. The first consists in the uso of ZnO Vetec® pure and doped with $AgNO_3$ by ultrasonic bath and the second, ZnO pure and doped with $AgNO_3$, both synthesized by Pechini´s method. The dopant concentrations used were 1, 3 and 5 % (mol/mol). The polymeric resin was obtained from zinc acetate (precursor of zinc), nitric acid and ethylene glycol [3]. Samples of constant concentration (100 ppm) were submitted to UV-C radiation for two hours and the fading was analyzed.

The best fading power was found to the samples containing 3% of silver. As shown in Figure 1, adding dopant increases the photocatalytic activity of the ZnO obtained by Pechini´s method, but the same behavior was not observed for ZnO Vetec® samples. For that samples, the photocatalytic activity was not influenciated by dopant presence or radiation exposition time.

Although the lower surface area of the samples obtained by Pechini´s method (Table 1), the use of Ag as dopant increases the fading of the dye for that samples and that method allows a homogeneous distribution of the dopant in the resin and, consequently, allows a high control of viscosity. All theses characteristics are favorable to the development of thin films by the deposition of the resin and its environmental application could promote the regional sustainable development.

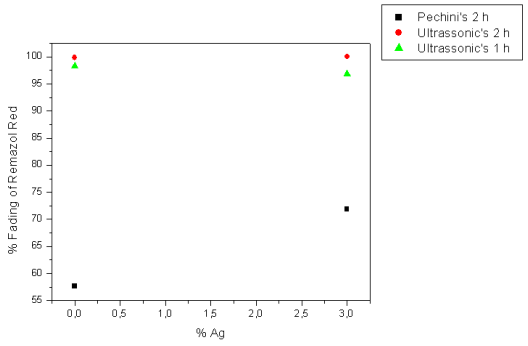


**Figure 1:** Fading of Remazol Red after 1 and 2 hours of photocatalyst activity in presence of ZnO Vetec, doped by ultrasonic bath, and 2 hours for the ZnO obtained by Pechini's method. Both doped with 3% Ag and pure.

| Catalyst | Method | % Ag | Surface area by BET ($m^2/g$) |
|---|---|---|---|
| ZnO | Pechini | 0 | 6,50 |
| ZnO | Vetec | 0 | 22,70 |

**Table 1:** Surface area of ZnO (Pechini's/Vetec)

[1] J. Liqiang, W. Dejun, W. Baiqi and L. Shudan." Effects of noble metal modification on surface oxygen composition, charge separation and photocatalytic activity of ZnO nanoparticles". Journal of molecular catalysis, 2006, vol. 244, n°1-2, pp. 193-200.
[2] E. Almeida, M. Assalin, M. Rosa and N. Durán."Tratamento de efluentes industriais por processos oxidativos na presença de ozônio" - Química Nova, 2004.
[3] A. Maciel,E. Longo and E. Leite. "Dióxido de estanho nanoestruturado: síntese e crescimento de nanocristais e nanofitas". Quím. Nova, vol.26, n° 6, São Paulo - Nov./Dec. 2003.