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

Formation Study of Ag/TiO_2 Thin Films Deposited in Stainless Steel by Sol-Gel Process

N.D.S. Mohallem[(1)*], M.M.Viana[(1)], S.I.Sobrinho[(2)], S. L. B. Lana[(2)] and E. Silva-Pinto[(3)]

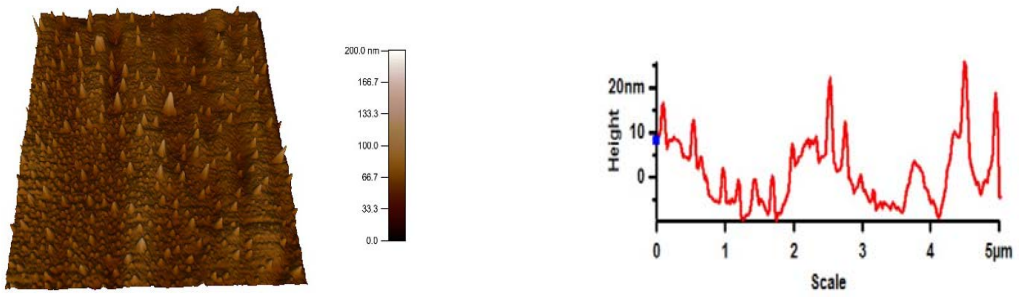
(1) Nanostructured Materials Laboratory, Chemistry Department, UFMG, B. H., Brazil
(2) REDEMAT, MG, Brazil
(3) Centro de Microscopia, UFMG – B. H., MG, Brazil
* nelcy@ufmg.br

Abstract – Ag/TiO_2 thin films deposited in stainless steel by sol-gel process were characterized by atomic force microscopy, scanning electron microscopy and electronic microprobe. The formation of the films was studied in function of Ag amount and heating temperature. It was observed Ag nanostructures growing inside TiO_2 matrix.

Nanocomposites prepared by dispersing finely divided metal in an oxide matrix can be peculiar characteristics due to interactions in nanoparticle/matrix interfaces. Recently, finely divided silver metallic dispersed in TiO_2 matrix have been very studied due to properties such as photocatalysis, photoelectron chemical activity, selective optical absorption and reflection, antibacterial, among others [1,2].

In this work, Ag/TiO_2 thin films were prepared by sol-gel process from alcoholic starting solution containing tetraisopropyl orthotitanate and silver nitrate dissolved in a mixture of isopropyl alcohol and hydrochloric acid. The solutions were prepared with atomic ratio Ag:Ti ranging from 1:6 to 1:20. The solutions were conditioned in a chamber and submitted to stirring and irradiation by ultraviolet UV-C (254 nm) for 12 hours, using two fluorescent light bulbs of mercury (Girardi RSE20B) of 15 W each one, to produce metallic Ag by reduction of Ag^+. The films were dip-coated onto clean stainless steel substrates, dried in air for 30 min and heated for 1 hour at 300 and 400 °C. The films were characterized by X-ray diffractometry, scanning electron microscopy, atomic force microscopy and electronic microprobe.

The formed thin films are free of cracks, show homogeneous nanostructure, and present crystalline Ag phase dispersed in anatase matrix. Figure 1 shows dot formation that suggests the growth of Ag in the anatase film. This result is confirmed by electronic microprobe. The average size of these particles is about 10 nm when the atomic ratio is 1:6 and decreases when the Ag amount diminishes.



(a) **(b)**

Figure 1: (a) AFM of Ag/TiO_2 thin films with Ag:Ti equal to 1:6, (b) section analysis.

References

[1] T. Huakawa, P. V. Kamat, Langmuir 20 (2004) 5645.
[2] E. Traversa, M. L. Vona, P. Nunziante, S. Licoccia, T. Sasaki and N. Koshizaki, J. Sol-Gel Sci. Techn. 19, 1-3 (2000) 733.