

Synthesis and Characterization by XRD and TEM of photochromic films doped with nanoparticles of Ormosils

Lidiane Patricia Gonçalves^{1*}, Luciana Valgas de Souza, Ubirajara Pereira Rodrigues Filho
¹University of São Paulo, Institute of São Carlos, SP, Brazil

Organic-inorganic hybrid materials are composite materials of great interest in various technological applications in molecular electronics, electro-optical devices and catalysis [1], since they have chemical, mechanical, optical and thermal properties that are more advantageous than the isolated components in addition to possessing the necessary porosity to occlusion of enzymes, catalysts, drugs, and photochromic compounds) [2-4]. This work studied photochromic materials of the class of Ormosil (organically modified silicates) containing photochromic pigment as phosphotungstic acid (HPW) - $[PW_{12}O_{40}]^{3-}$. This pigment is 10-12Å in diameter and to be subjected to radiation Ultra-Violet (UV) or X-rays, it becomes bluish. The incorporation of HPW in ormosil prepared by the sol-gel allows the systematic study of the photochromic properties of HPW as a function of organic functional groups. The films containing ormosil HPW were prepared by dip-coating and casting on glass substrates and had their behavior assessed on Photochromic content of TiO₂ nanoparticles (NP). Silanes used in this work were 4-butyronitrile, triethoxysilane (BNTES), (3-Glycidyloxypropyl), trimethoxysilane (GLYMO), tetraethyl orthosilicate (TEOS). NP of TiO₂ (anatase and rutile mixture) were added in the form of suspension 10% (ρ: V) in water. Solutions were prepared with different volumes of the suspension of TiO₂ NP. The films were characterized by X Ray Difraccion (XRD) and transmission electron microscopy (TEM) to evaluate the crystallinity and dispersion through the films. With the technique DRX noted that the films exhibit semi-crystalline halos with the largest centered at 25.4 and that the resulting structure is not the same feature of the NP nor the HPW. Analyzing the halos found, we observed that the ormosils have different nanostructures. TEM analysis was performed using the solution drip ormosil carbon copper grids and can be seen that the NP is spherical, isolated or grouped, by varying the size reaching up to 50 nm show. Through the infrared data can be proved that there is an interaction of nanoparticles with ormosil because displacement occurs when added nanoparticles, peaks appear in the analysis of the infrared regions at 819, 892 and 980, after adding there was a displacement of the peaks in + 7cm, 6cm + and +5 cm.

Keywords: ormosils, hybrid materials, sol-gel, phosphotungstic acid .

[1] KATSOULIS, D.E. Chemical Reviews, v.98, p.359-388, 1998.

[2] SANCHEZ C.; LEBEAU, B.; CHAPUTT, F.; BOILOT, J.P.; Advanced Materials vol. 15, p.1969-1994, 2003.

[3] BLUM, J.; ROSENFELD, A.; POLAK, N.; ISRAELSON, O.; SCHUMANN, H.; AVNIR, D. Journal of Molecular Catalysis A: Chemical vol.107 p.217-223, 1996.

[4] KURUSU, Y.; NECKERS, D.C.; Journal of Organic Chemistry vol.56 p.1981-1983, 1991.

Email: lidyzinha@usp.br