10th International Conference on Composite Science and Technology
ICCST/10
A. L. Araújo, J. R. Correia, C. M. Mota Soares, et al. (Editors)
© IDMEC 2015

Abstract ID-157

DEVELOPMENT OF HIGH EMITTING ROSAMINE-TiO2/ SiO2 COMPOSITE THIN FILMS

M. Belén Suárez Jiménez[(1)], María G. Guillén[(1)], Tânia Lópes-Costa[(1)], José M. Pedrosa[(1)], Juan R. Sánchez-Valencia[(2)], Ángel Barranco[(2)], Agustín R. González-Elipe[(2)], Ana M. G. Silva[(3)]

[(1)]Pablo de Olavide University, Spain
mbsuajim@upo.es, mariagonzalez88@gmail.com, tlopcos@upo.es, jmpedpoy@upo.es
[(2)]Instituto de Ciencia de Materiales de Sevilla, Universidad de Sevilla, Spain
[(3)]Universidade do Porto, Portugal

Keywords: Rosamine, Infiltration, TiO2, Optically active composites, Porous thin films

Summary: Incorporation of dye molecules into microstructure porous films has been recently studied [1, 2] leading to interesting applications like optical gas sensing [3, 4]. Rhodamine derivatives are particularly attractive as dye molecules because of their excellent emission properties. However, explotation of such properties, requires the assembly of the fluorescence probe into suitable solid substrate for the design of a practical device.
An innovative aspect of the present work is the incorporation of Rosamines, rhodamine derivatives without 2'-carboxilic group, into transparent and microstructured columnar TiO2 and SiO2 (MO2) thin films prepared by evaporation at glancing angles (GAPVD) resulting new transparent materials with low refractive index, high porosity and controlled thickness.
The anchoring process of the emitting dye has been described by a Langmuir type adsorption isotherm and an Elovich-like kinetics, what implies that these columnar microstructures not only exhibit a very good infiltration capacity, but also an excellent accessibility of the incoming rosamine molecules to the active adsorption sites.
Hybrid composites were prepared by simple immersion of the MO2 films into dicholomethane solutions of the rosamine at different concentrations. The state of anchoring and aggregation of the absorbed molecules, the infiltration efficiency and the adsorption kinetics were studied by UV-Vis adsorption and fluorescence spectroscopies. There is no reabsorption of light and the emitting capacity remains stable over time and has been directly correlated with concentration and time of infiltration. Infiltration into very diluted solutions of rosamine lead to a significant increment of the emission when the time of infiltration increases. On the contrary, when the infiltration occurs from a concentrated solution of the dye, the emission capacity decreases with time because of molecular aggregation.
The dye aggregation phenomena are higher in composite films with TiO2 than in SiO2 and therefore, the emission capacity of the latter films is better. Moreover, it has been investigated the influence of pre-ilumination14 and the pH of infiltrating solution on the emission properties.
Finally, the anchoring mechanism of the rosamine to the MO2 matrix has been revealed by specular reflectance FTIR.