

STUDY OF PHYSICAL – CHEMISTRY PROPERTIES MODIFICATION FOR HYBRID FILMS DOPED WITH CATIONIC DYES

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Incorporation of organic laser dyes in the sol-gel matrix is a useful strategy for preparing wave guides, lasers, sensors, light emitting, diodes and non-linear optical materials. Among these hybrid compounds, silica based materials have several advantages for designing materials for optical applications because: (i) many silane precursors are commercially available or can be easily modified or synthesized, (ii) the control of precursors reactivity can be easily achieved by using acidic or basic or nucleophilic catalysts, (iii) transparent films or monoliths having good mechanical integrity and excellent optical quality can be easily processed. A uniform and extremely fine scale distribution of doped materials in silica network can be achieved by the gel technique. However, the degree of homogeneity and the structure of the dispersed dye phase in gel derived glasses are strongly influenced by the various parameters [1].

In this paper, we study the possibility to prepare hybrid materials by sol-gel process, in the presence of different cross-linking agents, like tetraisopropyl orthotitanate (TIP) or aluminium sec-butoxide (ASB). As starting precursors, different triethoxysilanes (RTES) were chosen: methyltriethoxysilane (MeTES), phenyltriethoxysilane (PTES), octyltriethoxysilane (OTES), vinyltriethoxysilane (VTES) and (3-glycidyloxypropyl)trimethoxysilane (GMPS). Due to the high reactivity of cross-linking agents in sol-gel reactions, maleic anhydride (MA) was added as complexing agent. In all preparations, RTES was prehydrolyzed in acidic conditions with ethanol and water for 2 h under continuous stirring. Then, the cross-linking agent (TIP or ASB) were added to the solution, together with the second portion of water. The mixture was stirred for another 2 h. All hybrid materials were dried at room temperature (25°C). Thermal stabilities of the final hybrid films were evaluated and it was observed that the hybrid films with ASB, present a degradation temperatures (T_{max}) much lower than hybrid films with TIP. This effect is probably due to the presence of AlOH groups, which can play a role of catalyst over organic chains degradation. The morphology of the hybrid films was evaluated by SEM. The surface of the hybrids was found to be homogenous, without any obvious phase separations.

In a previous paper [2, 3], some hybrid materials doped with cationic dyes (methylenblau, rhodamine B, kristallviolett, malachit green), in the presence of tetraisopropyl orthotitanate (TIP), were synthesized by sol-gel process. As a continuation of this study, in this paper we present as well a comparison of the properties of the resulted hybrid materials when aluminium sec-butoxide (ASB) is used a different cross-linking agent. UV-Vis spectra show the polarity modification of the colorant due to its micro-vicinity and to its trapping in matrix structure.

References:

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