Study of thermal and optical properties of composites made of silver iodomercurate (Ag_2HgI_4) in a polymeric matrix

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During the last years, the study of thermochromic materials has increased notably due to their numerous applications as temperature sensors, smart windows, logic gates, among many others [1-4]. Thermochromic materials are characterized by a reversible color change produced by an increase in temperature [5]. Another important characteristic observed in these materials is the variation in their structural, optical, thermal and electrical properties [4,6-9]. This variation occurs in a continuously or discontinuously way, depending on the material [10-11]. Silver iodomercurate (Ag_2HgI_4) is a thermochromic material that exhibits a discontinuous change in their properties [6]. At room temperature, this material is in the stable β phase with a tetragonal crystal lattice structure and the samples exhibit a yellow color [12]; above 323 K the material changes to the disordered α phase with a cubic crystal lattice structure and the samples exhibit an orange color [13]. Ag_2HgI_4 is a superionic conductor because its electrical conductivity is similar to the one of molten salts at the high temperature α phase [13]. In this work, a composite made of Ag_2HgI_4 powder, synthesized by the co-precipitation method, embedded in a polyester resin matrix, is reported

The concentration of Ag_2HgI_4 was varied from 1 to 5 wt%. The hysteresis loop of the thermal diffusivity was measured, in a temperature range from 20 to 70 °C, using the modified Angstrom method. During the heating and cooling processes it can be observed how the reversible phase transition occurs gradually. Thermal diffusivity decreases by 50% on average during the phase transition, whose minimum values are found at 56 and 57.6 °C when heating and cooling respectively. In order to complement our studies, the emissivity of the samples as a function of temperature, was measured using photothermal radiometry. Additionally, the shift of the band gap, due to the phase transition, was determined by UV-Vis spectroscopy.

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