Fiber drawing region investigation and structural characterization of Ge-S-I chalcohalide glasses

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Abstract

In the aim to produce new multimaterial fibers, we investigate Ge-S-I glass properties as they present a wide transparency from the visible to the infrared as well as good chemical and thermal stability which is needed for fiber production. Ge-S-I glass samples with 5, 10 and 15% of iodine and a concentration of germanium varying between 25 and 35% were produced and their physical properties such as Tg, density, visible and infrared light absorption were investigated [1]. From this study, we were able to show the impact of iodine as modifier with the observation of important change in Tg and Band-gap. We established that these change follow the (GeS2)X-(GeI4)1-X composition line and we proposed an equation of composition that take into account the effect of iodine on the glass properties. According to these results we conduct a study of their drawing ability using the preform-to-fiber drawing technic. This enabled us to draw a fiber drawing region in the Ge-S-I ternary diagram. We then carried out a structural analysis on the samples. A novel approach [2] based on a simultaneous desumation of IR and polarized Raman spectra (RS-VV and RS-HV) has been applied on Ge-S-I chalcohalide glasses. By a careful analysis of the multipolar activities between 180 and 280 cm-1 and a comparison of these results with DFT calculation made on Ge-S-I clusters, we proposed a new attributions of the bands in this region. Four peaks between 230 and 280 cm-1, were assigned to symmetric and anti-symmetric GeI2 vibrations in corner-sharing and edge-sharing tetrahedral, while two normal modes at 190 and 210 cm-1 were attributed to I2 in a molecular form, trap in the glass network. This permit us to underline a correlation between the structure and the physical properties of Ge-S-I glasses.

Keywords: Chalcohalide glasses, Raman spectroscopy, Strucural characterization

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