Temperature Dependent Optical and Electrical Properties of Heavy Metal Oxide Glasses

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Abstract

Tellurite and antimonite based heavy metal oxide (HMO) glasses are considered as promising amorphous semiconducting materials due to their medium optical band gap energy values that are comparable with conventional semiconductors. Therefore, these glasses are studied for different potential applications in non-linear optical devices such as ultra-fast switches, power limiters and broad band optical amplifiers. It is well known that the addition of transition metal oxides to HMO glasses improves non-linear optical properties, enhances electrical conductivity, increases refractive index and expands the transmission range up to the middle infrared region of the electromagnetic spectrum. In the present work, MoO3 and WO3 were included in TeO2 and Sb2O3 glass network in different concentrations since these transition metal oxides have the potential to improve optical and electrical properties of glasses and enhance their optical sensitivity and non-linear optical features due to their different oxidation states in the glass network. Accordingly, a series of glasses were synthesized in the WO3-MoO3-TeO2 and WO3-MoO3-Sb2O3 ternary systems using conventional melt-quenching technique. Optical and electrical properties of these glasses were investigated as a function of temperature using in-situ UV-Vis spectroscopy and electrical conductivity measurement setup. The authors of this study gratefully acknowledge The Scientific & Technological Research Council of Turkey (TUBITAK) for the financial support under the project numbered 116M210.

Keywords: Heavy metal oxide glasses, TeO2, Sb2O3, optical properties, electrical properties

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