THE ELECTRICAL PROPERTIES OF THE $Sb_xAs_{37-x}S_{48}I_{15}$ GLASS SYSTEM IMPORTANT FOR EFFICIENT ENERGY USAGE

Goran Štrbac[1], Ondrej Bošák[2], Dragana Štrbac[3], Marian Kubliha[2]

[1]*University of Novi Sad, Faculty of Sciences, Trg Dositeja Obradovića 4, Novi Sad, Serbia*
[2]*Faculty of Materials Science and Technology, Slovak University of Technology, Bottova 25, 91724 Trnava, Slovakia*
[3]*University of Novi Sad, Faculty of Technical Sciences, Trg Dositeja Obradovića 6, Novi Sad, Serbia*
e-mail: draganastrbac@uns.ac.rs

Abstract

This work presents the results of measuring the electrical conductivity parameters of glasses from the $Sb_xAs_{37-x}S_{48}I_{15}$ system, carried out in both DC and AC regimes. Measurements were performed on both amorphous and annealed samples, in which the crystallization of SbSI and Sb_2S_3 structural units was induced. It was shown that the conductivity of the annealed samples is several tens of times higher compared to the amorphous samples. The temperature dependence of conductivity follows Arrhenius behavior. The values of the activation energy ΔE_{DC} obtained by fitting the DC component of the conductivity as a function of temperature and the decreasing character of this quantity with an increase in the proportion of antimony was determined. The results of the conductivity tests as a function of frequency showed that conductivity increases with rising temperature, antimony proportion, and frequency. Measurements were made in the frequency range of 0 to 10^5 Hz and the temperature range from room temperature to 398 K. ΔE_{AC} values at 100 Hz and 1000 Hz were determined. In this regime, the activation energies showed complex relaxation mechanisms. Impedance spectra were analyzed using an equivalent-circuit model, through relaxation time values and the activation energies of the relaxation process were determined. The presence of a temperature-dependent electrical relaxation phenomenon of the non-Debye type was confirmed. Additionally, effect of frequency and temperature on the loss factor (ε'') within the measured frequency range was analyzed.