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Effect of the Oxygen/Halogen Ratio on the Physical Properties of Some Sodium-Boro-Vanadate Glasses

Ahmed Gamal El-Din MOSTAFA
Phys. Dept., Faculty of Science, Al-Azhar Univ. (11884),
Nasr City, Cairo-EGYPT
e-mail: dr$_a$hmedgamal@hotmail.com

Keywords
Authors

phys@tubitak.gov.tr

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Abstract: Four different glass systems of the sodium boro-vanadate type containing halogen ions, were prepared by melting at 1000°C for three hours and annealed at 300°C. These glasses were investigated using dc conductivity, density, molar volume and magnetic susceptibility measurements. It was found that the activation energy shows a decrease as the halogen ions were increased, which was attributed to the increase in the mobility of sodium ions and the gradual formation of some terminal non-bridging halogens, in addition to the electron hopping between the different oxidation states of vanadium. The activation energy values for glasses containing iodine ions was less then the activation energy for glasses containing fluorine ions, a function that can be ascribed to the ionic radii of the respective halogen ions. The decrease in activation energy in turn is due to the increase in the interstitial vacancies in the same sequence. This was confirmed by the density and the molar volume results. It was supposed that the decrease in the paramagenetic properties of these glasses with the increase of the halogen ions content may be due to the formation of VXO_3 groups. Also, the magnetic properties was found to decrease as the ionic radius of the introduced halogen ions increased, which was attributed to the increase in the internal vacancies inside the network. An attempt is made to correlate the experimentally obtained values of both the activation energy and the. magnetic susceptibility with the calculated molar volume values of these glasses.

Key Words: Physical Properties of glass, Glass containing halogen ions, Glass structure.

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