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Universal Curve of Ionic Conductivities in Binary Alkali Tellurite Glasses
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Abstract

The main objective of this work is to present an analysis and brief discussion of experimental ionic conductivity s data in the binary alkali tellurite system, including on 47 glasses that extend the ionic conductivity range by more than 14 orders of magnitude in a wide compositional range. A 'universal' behavior is obtained, using log sigma or log sigmaT vs. E A/kB T, where E A is the activation enthalpy for conduction, kB is the Boltzmann constant and T is the absolute temperature. This finding further indicates the importance of a scaling factor F recently proposed, that is correlated to the free volume of glass composition. For a given value of E A/kB T, the difference between large and small values of sigma is only one order of magnitude in 87% of these glass systems. The influence of alkali content and temperature was minor on the pre-exponential terms, considering both expressions log10sigma and log10sigmaT. Indeed, the pre-exponential term sigma0 varies around an average value of 50 omega-1cm-1 considering different compositions in this system. The fact that s lies on these single 'universal' curves for so many ion-conducting binary tellurite glasses means that sigma is governed mainly by E A. The composition dependence of the activation enthalpy is explained in the context of the Anderson-Stuart theory.

Keywords

Glass, Electrical properties, Ionic conduction