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Electrochemistry

TEMPERATURE AND CONCENTRATION-DEPENDENCE OF TRANSPORT BEHAVIOUR OF GLASS-FORMING MELTS

NURUL ISLAM

Department of Chemistry, Aligarh Muslim University, Aligarh-202 001, India

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Temperature dependence of transport properties Y (A equivalent conductance or, fluidity) of several inherent as well as induced glass-forming melts, was quantitatively explained in terms of equations based on the free-volume, the configurational entropy (CEM), and the environmental relaxation (ERM) models. Concentration dependence of these properties was explained quantitatively by the isothermal equations essentially based on the Vogel-Tammann-Fulcher (VTF) and the CEM equations. The concentration-dependence of the individual parameters of these equations was examined critically and alternative expressions based on the isoenergic and apparently isoentropic conditions have been proposed. Such an examination resulted in the emergence of several physically meaningful linear interdependences of these parameters. The applicability of the proposed equations:

$$Y = (A_{0y} \pm Q_{1y}N) \quad [c\,(T_{0(0)} \pm Q_{2y}N)]^{1/2} \exp\,[-K_y/\{(T_{0(0)} \pm Q_{2y}N)\,(c-1)\}]$$

and

$$Y = (A_{y0} \pm Q_{1y}N) \exp\,[-K_y/\{(T_{0(0)} \pm Q_{2y}N)\,c \ln c)\}]$$

and the linear interdependence of the thermodynamic parameters (the zero mobility temperature and the intrinsic molar volume) to ideal (with respect to volume of mixing) as well as non-ideal melts containing either tetrahedral, T_d or octahedral, O_h complexions have been demonstrated. Such dependences of the Walden products have also been discussed in terms of similar three parameter equations based on the above models. A linear dependence of the energy of activations, E_y on the available (or free) volume has also been demonstrated.

Keywords : Temperature; Concentration; Transport Behaviour; Glass-Forming Melts

Discussion

A. V. GORODYSKY (*Institute of General and Inorganic Chemistry, Ukrainian SSR Academy of Sciences, Kiev, USSR*) : Have you observed any extreme in energy absorption when plotting against composition ?

NURUL ISLAM : Band energies were found to be independent of the solute concentration (Beer's law holds good signifying the presence of same absorbing species in extremely dilute solution as well as in the corresponding glassy material). Thus, an increase in $(MX_4^{2-})/(X^-)$ as well as changes in temperature do not seem to cause any perceptible change in the structure of the absorbing species unlike the effects on equivalent conductances and viscosities.