Investigation of Physical properties for a New Type Molten $ZnCl_2$-$DMSO_2$ Electrolytes

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Abstract

For the purpose of understanding the transport properties of ionic electrolytes, for the present work the phase diagram, the electric conductivity and the density were measured. The phase diagram of binary $ZnCl_2$-$DMSO_2$ melts was determined by DSC and TGA. The electric conductivity of molten $ZnCl_2$-$DMSO_2$ mixtures was measured using a direct-current computerized method. The conductivities of all the melts studied increased with the increasing of temperature and $DMSO_2$ component. There were a maximum of the conductivity at 40 mole% $ZnCl_2$ (conductivity is 0.00423 S/cm at 110 ^{o}C). The density was measured using the Archimedean technique. The densities of all the melts studied decreased with the increasing of temperature and $DMSO_2$. The equivalent conductivities for binary melts is given by $\Lambda=\kappa M_{mix}/\rho$, where M_{mix} is mean equivalent weight of the molten binary melts. These equivalent conductivities were fitted by the Arrhenius equation ($\Lambda=\Lambda_o \exp(-E_\Lambda/RT)$), the activation energies (E_Λ) of molten binary mixtures with the component of 40、50、60、70 mole% $ZnCl_2$ were 25.275、34.639、44.586、53.980 KJ/mole, respectively.

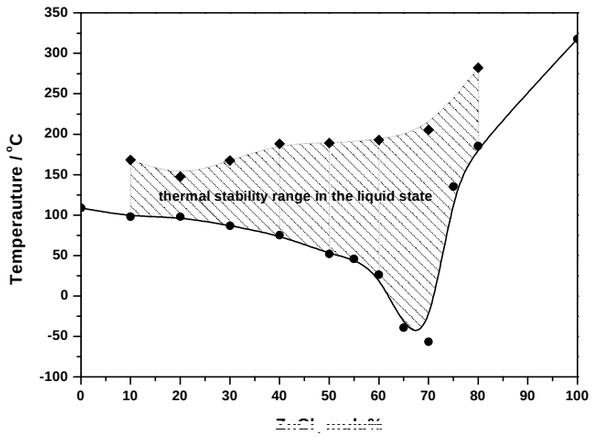

Fig. 1. Stability range of the mixture $ZnCl_2$-$DMSO_2$ in the liquid state.

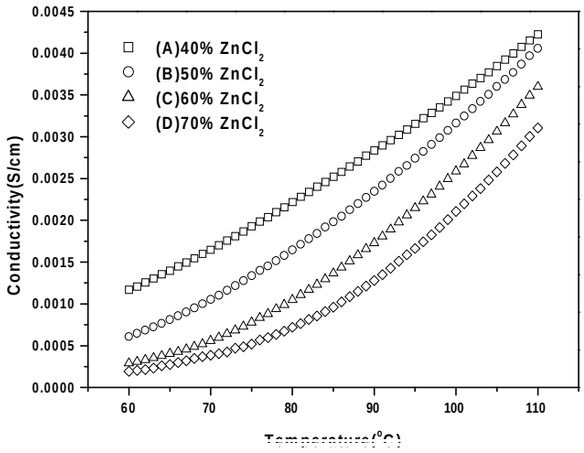

Fig. 2. The electrical conductivity of the molten binary $ZnCl_2$-$DMSO_2$ system as a function of temperature at various composition. (A), 40 mole% $ZnCl_2$; (B), 50 mole% $ZnCl_2$; (C), 60 mole% $ZnCl_2$; (D), 70 mole% $ZnCl_2$.

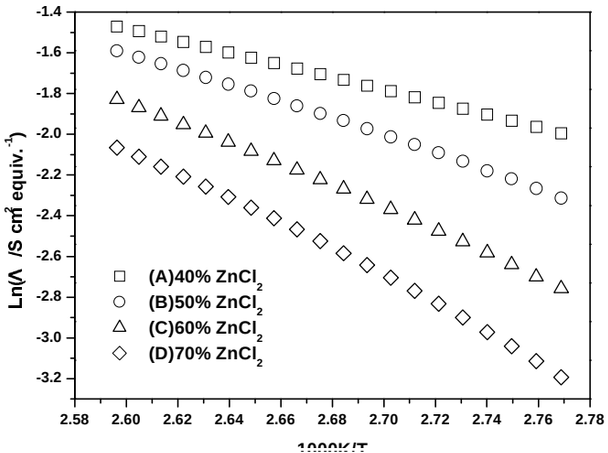

Fig. 3. Arrhenius plots of the electric conductivity for mixtures of $ZnCl_2$-$DMSO_2$. Composition in mole%: (A), 40 mole% $ZnCl_2$; (B), 50 mole% $ZnCl_2$; (C), 60 mole% $ZnCl_2$; (D), 70 mole% $ZnCl_2$.