

Electrochemical Characterization of Poly(ethylene oxide)-Zinc Chloride System and its Application in Rechargeable Batteries

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The system $\text{PEO}_n\text{ZnCl}_2$ with $n=4-16$ was studied in view of its potential application in a solid state rechargeable zinc battery. A.c. conductivity and cationic transference number measurements, in the temperature range 20-150°C, were performed and the electrochemical stability window was established for the polymer electrolyte with $n=4$ composition. The ionic conductivity, σ , of this film, follows a VTF behaviour, with an activation energy of $3.3 \pm 0.2 \text{ kJ mol}^{-1}$ and σ values were found between $2.50 \times 10^{-7} \text{ S cm}^{-1}$ at 24°C and $4.81 \times 10^{-4} \text{ S cm}^{-1}$ at 145°C. Acceptable zinc ion transference numbers of 0.36 (medium value) and decomposition voltage values between 3.19V (20°C) and 1.44V (150°C) were estimated. Cyclic voltammetric studies using $\text{Zn}/\text{PEO}_4\text{ZnCl}_2/\text{Zn}$ cell indicated reversibility of the Zn/Zn^{2+} couple at the electrode/electrolyte interface. Several cells $\text{Zn}(-)/\text{PEO}_4\text{ZnCl}_2/\text{Nb}_2\text{O}_5(+)$ were assembled and studied at 55°C, with several discharge current densities. Results of cell's discharge profiles, capacity values, charge-discharge cycles behaviour and stability are reported.