Structural, Morphological and Electrochemical Impedance Study of CS:LiTf based Solid Polymer Electrolyte: Reformulated Arrhenius Equation for Ion Transport Study

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This paper discusses ion conduction mechanism in terms of reformulated Arrhenius equation. Understanding the fundamental concepts of Li ion transport is crucial for Li battery technology. Structural and morphological investigations are significant to understand the structure-properties relationships. The broadening of X-ray peaks of chitosan upon the addition of LiTf salt reveals that the crystalline domains are reduced. The SEM micrographs reveal that the samples have a smooth surface. Electrochemical impedance spectroscopy (EIS) was used to obtain the electrical and dielectric parameters. The dielectric constant and DC ionic conductivity follows the same trend with salt concentration. The behavior of Arrhenius and modified Arrhenius equations versus temperature are clarified. The influence of dielectric constant on DC conductivity experimentally achieved. The

reformulated Arrhenius equation ($\sigma_{(\epsilon',T)} = \sigma_o \exp\left(-\frac{E_a}{K_B \epsilon' T}\right)$) exhibited more linearity between the DC conductivity and $1000/(\epsilon' \times T)$. The shortcoming of Arrhenius equation can be understood from the less linear behavior of DC conductivity versus $1000/T$. The pre-exponential factor is almost constant at different temperature and independent on dielectric constant. The calculated activation energy from the reformulated Arrhenius equation is greater than that obtained from Arrhenius equation.

Keywords: Polymer electrolyte; XRD and SEM analysis; Dielectric constant and DC conductivity; reformulated Arrhenius equation.

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