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I-CReST 2025:128-092 – Ionic Conductivity and Temperature Dependence Studies of PVC Complexes Modified with Doping Salt and Additives

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ABSTRACT

The ionic conductivity of PVC-$NH_4CF_3SO_3$ system, PVC-$NH_4CF_3SO_3$-EC system and PVC-$NH_4CF_3SO_3$-Bu_3MeNTf_2N system has been presented. The highest conductivity for the salted system at room temperature is found to be 2.50×10^{-7} S cm^{-1} at 30 wt.% $NH_4CF_3SO_3$ (A4) concentration. Addition of EC increased the ionic conductivity value of the highest-conducting sample in the salted system. The plasticized sample at room temperature with 5 wt.% EC (B1) concentration is found to have a maximum value of 3.06 × 10-5 S cm^{-1}, whereas 15 wt.% Bu_3MeNTf_2N (C3) gave ionic conductivity value of 1.56 × 10-4 S cm^{-1} at room temperature, which is the highest among the samples studied in this work. In temperature dependence-ionic conductivity study, all systems exhibited Arrhenius type of behaviour within the temperature regime studied and favored the ion hopping mechanism at elevated temperatures. The dielectric constant, ε_r studies were observed to follow the trend of the conductivity studies for all systems. The sample with the highest conductivity value possessed the highest value of dielectric constant. Analysis of the experimental conductivity data showed that the correlated barrier hopping (CBH) model is the most applicable conduction mechanism for PVC-$NH_4CF_3SO_3$ and PVC-$NH_4CF_3SO_3$-EC system, whereas the conduction mechanism in PVC-$NH_4CF_3SO_3$-Bu_3MeNTf_2N system can be best represented by the overlapping large polaron tunneling (OLPT) model.

Keywords: Conductivity; Dielectric; Arrhenius; CBH Model; OLPT Model