

Electrical Conductivity and Glass Formation of Nitrile-Functionalized Pyrrolidinium Bis(Trifluoromethylsulfonyl)Imide Ionic Liquids

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A series of 1-cyanoalkyl-1-methylpyrrolidinium bis(trifluoromethylsulfonyl)imide ionic liquids, aimed at the solubilization of metals in catalytic or electrochemical applications, has recently been synthesized [1]. The physical and chemical properties of these nitrile-functionalized ionic liquids were found to be influenced by the length of the alkyl spacer separating the nitrile group from the pyrrolidinium ring. The electrical conductivities of seven ionic liquids of this nitrile-functionalized series, with alkyl chain lengths 1, 2, 3, 4, 5, 7 and 10, were obtained in a temperature range 173 K to 393 K from complex electric impedance measurement with a Novocontrol Alpha dielectric analyzer in the frequency range from 0.1 Hz to 10 MHz. The glass transition temperature T_g was determined by differential scanning calorimetry (DSC) measurements. Superposed on the expected chain length dependence [2], properties characterizing the glass formation such as the fragility and the activation energy showed a clear odd-even effect, which was also reflected in other physical properties. This dependence could be explained in terms of changing intermolecular interactions due to increasing molecular size and changing charge distribution on the cyanoalkyl chain being interpreted in the potential energy landscape picture of the glass transition [3,4,5,6].

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