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Effects of hydrophobic aggregation on the charge transport mechanism of quaternary ammonium ionic liquids PHILIP GRIFFIN, ADAM HOLT, University of Tennessee Dept. of Physics, YANGYANG WANG, ORNL Chemical Sciences Division, VLADIMIR NOVIKOV, University of Tennessee Dept. of Chemistry, JOSHUA SANGORO, University of Tennessee Dept. of Chemical Engineering, ALEXEI SOKOLOV, ORNL Chemical Sciences Division and University of Tennessee Dept. of Chemistry — Aprotic quaternary ammonium ionic liquids (ILs) are an important class of ILs due to their large electrochemical window and hydrophobicity. However, many of these ILs suffer from relatively low conductivity at room temperature which limits their use in electrochemical applications. In order to understand the nature of this low conductivity and its relation to the chemical structure of the alkyl ammonium cation, we have measured the charge transport properties and structural dynamics of the room temperature ionic liquid methyltrioctylammonium bistriflimide [m3oa][ntf2] over a broad temperature range using dielectric spectroscopy, dynamic light scattering, rheology, and pulsed field gradient nuclear magnetic resonance. We demonstrate that the low values of dc conductivity are due to the combined effects of significantly reduced ion mobility as well as reduced free ion concentration relative to other types of ILs. Secondly we find evidence for a mesoscopic scale structural relaxation process that we attribute to the reorientational motion of nanometer sized alkyl nanodomains. These two findings indicate that hydrophobic aggregation plays an important role in the charge transport mechanism of aprotic ammonium ionic liquids with long aliphatic side chains.

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