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Understanding the impact of nanoscale aggregation on charge transport and structural dynamics in room temperature ionic liquids PHILIP GRIFFIN, University of Pennsylvania, ADAM HOLT, University of Tennessee, YANGYANG WANG, Oak Ridge National Lab, ALEXEI SOKOLOV, University of Tennessee — Amphiphilic room temperature ionic liquids (ILs) segregate on the nanoscale, forming intricate networks of charge-rich ionic domains intercalated with charge-poor aliphatic domains. While this structural phenomenon has been well established through x-ray diffraction studies and atomistic MD simulations, the precise effects of nanophase segregation on ion transport and structural dynamics in ILs remains poorly understood. Using a combination of broadband dielectric spectroscopy, light scattering spectroscopy, and rheology, we have characterized the ionic conductivity, structural dynamics, and shear viscosity of a homologous series of quaternary ammonium ionic liquids over a wide temperature range. Upon increasing the length and volume fraction of the alkyl side chains of these quaternary ammonium ILs, ionic conductivity decreases precipitously, although no corresponding slowing of the structural dynamics is observed. Instead, we identify the dynamical signature of supramolecular aggregates. Our results directly demonstrate the role that chemical structure and ionic aggregation plays in determining the charge transport properties of amphiphilic ILs.

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