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Temperature dependent spectral features of room temperature ionic liquids: Aromatic vs. non aromatic

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Ionic liquids (ILs) are liquid state salts at room temperature. ILs possess unique features, such as low melting points, negligible vapor pressure at ambient temperature and pressure, and so on. In fact, such unique properties are largely responsible for their complex intermolecular interactions. Because the intermolecular vibrations probe the microscopic structure and intermolecular interactions in condensed phases, it is essential to study their intermolecular vibrations. Femtosecond Raman-induced Kerr effect spectroscopy (fs-RIKES) observes the molecular motions in the low-frequency region (ca. 0.3–700 cm^{-1}) where the intermolecular vibrational bands in most condensed phases appear. Thus, fs-RIKES is a useful spectroscopic technique to study ILs. So far, we have reported several specific topics on the low-frequency spectral features of ILs: Heavy atom substitution effect, comparison between di-cationic and mono-cationic ILs and; understanding the general spectral features of aromatic cation based ILs on the basis of 40 samples. In this talk, I will show the results of the temperature dependence of the low-frequency spectra of ILs that we are currently studying. Figure 1 shows the low-frequency spectra of bis (trifluoromethylsulfonyl)amide ($[\text{NTf}_2]^-$) salts of (a) 1-butyl-3-methylimidazolium cation ($[\text{C}_4\text{Mim}]^+$) and (b) 1-butyl-1-methylpyrrolidinium cation ($[\text{Pyrr}_{14}]^+$) at various temperatures. We can see the clear difference between the two, and the difference will be discussed in detail.

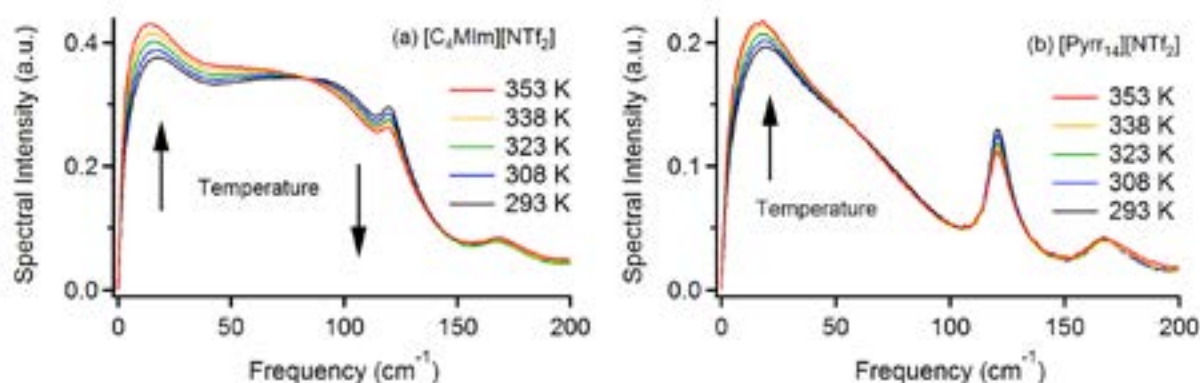


Figure 1: Temperature dependent low-frequency spectra of bis(trifluoromethylsulfonyl)amide ($[\text{NTf}_2]^-$) salts of (a) 1-butyl-3-methylimidazolium cation ($[\text{C}_4\text{Mim}]^+$) and (b) 1-butyl-1-methylpyrrolidinium cation ($[\text{Pyrr}_{14}]^+$).

Biography

Hideaki Shirota received his PhD from Graduate University for Advanced Studies in 1998. His academic career started as a Research Associate at University of Tokyo in 1996. He then worked at State University of New Jersey, Rutgers and University of Tokyo as a Postdoctoral Associate and a Research Associate. In 2006, he joined Chiba University as an Associate Professor of Chemistry. His current research interests include molecular spectroscopy, laser spectroscopy, time-resolved spectroscopy, molecular dynamics in condensed phases, reaction dynamics in solutions, and solution chemistry.

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