Viscosity of Ionic Liquids and Diffusion-Controlled Reaction Rate Constants

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Room temperature ionic liquids generally are more viscous than water and common organic solvents. The high viscosity limits the rate of diffusion of solute molecules, and thus, may limit the rate constants of bimolecular chemical reactions. Diffusion of solute molecules, however, may have a different behavior in ionic liquids than in molecular solvents because of the microheterogeneity in ionic liquids and because of specific interactions between the solute molecule and each of the solvent ions. The aim of this study is to examine whether the correlation between solvent viscosity and diffusion-controlled rate constants is the same in ionic liquids as in classical solvents. The viscosity of several ionic liquids and reaction mixtures are measured and the rate constants for diffusion-controlled reactions in these mixtures are determined. Electron transfer reactions, which are known to be diffusion-controlled in other solvents, are chosen for this purpose. The rate constants are determined by the pulse radiolysis technique in several ionic liquids and in other solvents. The correlation between these rate constants and the solvent viscosity is being examined.