"Reactivity in Ionic Liquids: Radiation Chemistry and Electron Transfer"

Abstract: Ionic liquids (ILs) can make major contributions to the establishment of a sustainable energy economy through their use in sophisticated technologies for the production, storage and efficient consumption of energy. For this to happen, we have to understand how ionic liquids affect energy capture, conversion and storage reactions. This is a complex set of problems because ionic liquids are a very diverse class of materials and there are significant dynamic and structural differences between ionic liquids and conventional molecular solvents. Our group takes multiple approaches to address these problems. We use radiation chemistry and pulse radiolysis to initiate and follow the reactions of energetic transient species, including the solvation dynamics of the excess electron in ILs and its reactivity with scavengers, and radicals detected by EPR in collaboration with Ilya Shkrob of ANL. This allows us to use pulse radiolysis as a tool to examine general issues of reactivity in ILs and to understand how to increase their stability when exposed to ionizing radiation or extremes of electrochemical potential. This is important for potential nuclear, space and energy storage applications of ionic liquids. Electron transfer (ET) reactions are essential steps in many processes for the capture, storage and utilization of energy, as well as in the operation of many advanced devices. We use photoinduced and radiolytic techniques to study how the unique environment of ionic liquids affects charge transfer processes. Examples will be given of bridged donor-acceptor ET systems used to explore the effects of the slow dynamical relaxation of ILs on intramolecular ET reactions and the effects of IL structure and diffusion phenomena on bimolecular ET reactions of reactants with varying charge types. Due to the glassy nature of ionic liquids, we observe that ET processes on the nanoseconds scale are distributed rather than uniform. It is important to understand the consequences of this phenomenon on the performance of devices that depend on fast charge transfer, such as ionic liquid solar photochemical cells.

Host: Professor Ed Castner

~ Coffee/tea will be served prior to lecture ~

Anyone wishing to meet with Dr. Wishart, please contact Kristin Render at 848-445-8602 or Kristin.render@rutgers.edu to set up an appointment