

An ultrafast infrared study of the structure and dynamics of concentrated potassium halide solutions



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Jordyn Nicole Strasberg Smith

Department of Chemistry - PhD Candidate at Stanford University

Solutions of ionic compounds in water have long been studied because of their widespread applications. For instance, they impact the stability of proteins in our bodies, affect processes occurring in the ocean, and represent an emerging option for safer battery electrolytes. Much is known about how the molecules in these solutions are organized and their motions, but questions remain about the specific molecular interactions that explain these behaviors. In this work, a system of lasers is used to generate short and intense pulses of infrared light. These pulses are used in a polarization-dependent experiment to study the behavior of a reporter molecule called selenocyanate (SeCN^-) in the environment of aqueous potassium halide (fluoride, chloride, bromide, iodide) solutions. The measured vibrational lifetime (how long SeCN^- remains in a vibrationally excited state) and rotational anisotropy (how long it takes to reorient in solution) shed light on the dynamics of the surrounding solutions. It appears that while potassium chloride, bromide, and iodide disrupt interactions between SeCN^- and surrounding water molecules, potassium fluoride does not. Interestingly, SeCN^- rotates more slowly in all potassium halide solutions compared to pure water. While we do not yet fully understand the implications of these observations, further studies using a technique called two-dimensional infrared spectroscopy will enable us to learn about the hydrogen bonding networks in these solutions and gain a fuller picture of their behavior.



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Please contact SPS president Carly Healy at chealy2@mail.umw.edu with any questions!

Hosted by the Department of Chemistry and Physics

Open to all who wish to attend

