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A comparitive study of U(III) and U(IV) complexes in a room temperature ionic liquid system

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Room temperature ionic liquids (RTILs) were known as early as the 19th century beginning with alkylammonium nitrates. The field grew in the 1970s by using combinations of air and water sensitive aluminum halides with an organic cation salt. While these ionic liquids were useful and had many desirable features, they were extremely sensitive to air and water, limiting their utility. RTILs today are salts that are liquids from as low as -96 ℃ to up to 100 ℃. RTILs are of high interest in many fields of study because of their negligible vapor pressure, high electrochemical stability, high conductivity, and wide electrochemical windows. In addition, RTILs are useful systems for studying f-elements in the absence of hydrolysis.

Included in this work are studies of multiple uranium complexes in a room temperature ionic liquid system, [Me3NnBu][N(CF3SO2)2]. Uranium materials in the 3+ and in the 4+ oxidation states were prepared in inert atmosphere conditions. Infrared and ultraviolet-visible spectroscopy was utilized to give details regarding the speciation of each system. Electrochemical analysis was executed, including cyclic and square wave voltammetry as well as electrodeposition from both oxidation states. The resulting electrodes were then analyzed using scanning electron microscopy, energy dispersive spectroscopy, and x-ray diffraction to evaluate the nature of the uranium deposit on the electrode surface. A comparison of the resulting oxidation and reduction processes observed during electrochemical analysis as well as the electrodeposits will be made.

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