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## Using Amide-Functionalized Electrodes to Elucidate Interfacial Actinide Redox Chemistry for Improved HALEU Supply

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### ABSTRACT:

Reprocessing of advanced reactor fuels has the potential to increase the domestic supply of high assay low enriched uranium (HALEU). Established schemes to recover U from used nuclear fuel rely on solvent extraction using complexants including tributyl phosphate (TBP) and amides, such as N,N-di-2-ethylhexyl-isobutyramide (DEHiBA). To achieve effective separation, actinide oxidation states must be controlled. Actinide redox potentials in organic solutions and at the organic-aqueous interface are different compared to their aqueous potentials. These changes introduce challenges associated with maintaining oxidation state control. U, Np, and Pu, which are critical nuclides in HALEU recovery, can exist in oxidation states ranging from +3 to +6. Np, which is a burnable neutron poison, is a major concern in the implementation of HALEU reprocessing schemes as it not only exists in each of the three oxidation states listed, but readily undergoes radiolytically driven oxidation state changes, and also disproportionates in the +5 state. This project will use amide functionalized electrode to: 1) Obtain thermodynamic data associated with the redox potentials of actinides (including U, Np, and Pu) at the aqueous-organic interface during extraction, and in organic media after extraction; 2) determine the effects that solutions with actinides in multiple oxidation states may have on actinide redox-properties and extraction.