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The Electrochemical Separation of Curium and Americium: Quarterly Report January - March 2004

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**DOE/TRP Quarterly Report
Funding Years 2004
January 2004 – March 2004**

This is a list of the personnel working with foams on the UNLV campus.

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M.S. Candidate Chemistry

Title: The Electrochemical Separation of Curium and Americium.

This research report outlines the current status and progress associated with the electrochemical separation of Curium and Americium. The following pages outline the progress on our project to date. We have been actively performing research on this project for six months and are currently on schedule for the proposed timelines.

Data collection and analysis of the Ce^{3+}/Ce^{4+} redox couple in various supporting electrolytes (0.3 M $NaNO_3$, 0.5 M HNO_3 , and H_2SO_4 at concentrations of 0.1 M, 1.0 M, 2.0 M, and 4.0 M) has continued. All electrolyte systems were investigated at Pt, Au, and Glassy Carbon working electrodes. Analysis of these data was accomplished by performing appropriate background subtractions to reveal net peaks due to Ce redox behavior. Successful identification of the Ce redox couple was achieved with all electrolyte/electrode systems, although a decline in peak resolution was observed with increasing acid concentration. Optimal conditions in this experiment were realized with a 6.0 mM Ce concentration, 0.1 M H_2SO_4 supporting electrolyte, and scan rate of 0.02 V/s. This is in stark contrast to previously studies where the acid concentration employed was on the order of 1 to 6 Molar. The influence of acid concentration on the voltammetric response of $Ce(NO_3)_3$ in sulfuric acid for Au electrodes is presented in Figure 1. The same trend is observed for both Platinum and Carbon electrodes indicating that either pH or ionic strength, μ influence the ability to resolve the redox properties of Ce.

An investigation into ionic strength is being conducted for the Ce system, using varying concentrations of K_2SO_4 in place of the H_2SO_4 supporting electrolyte solutions. This is being done to determine whether the observed decline in peak resolution with increasing acid concentration is due to a decreasing pH or ionic strength. Ionic strengths were calculated and pH of all solutions will be taken in order to analyze the data obtained. Preliminary results are presented in Figure 2 for a system with an ionic strength of $\mu = 0.3$ M. The data suggests that acidity is the key variable in the system with higher resolution and lower splitting of the Ce^{3+}/Ce^{4+} redox couple.

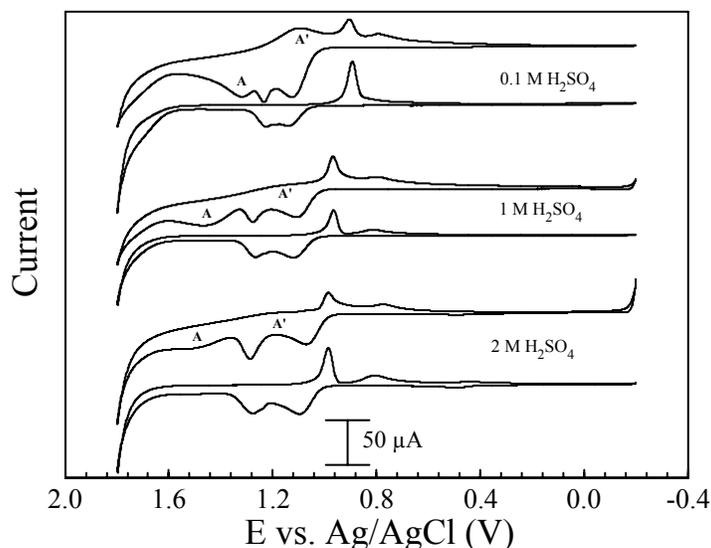


Figure 1. Influence of acid concentration on the redox properties of 6mM $\text{Ce}(\text{NO}_3)_3$. The redox couple $\text{Ce}^{3+}/\text{Ce}^{4+}$ are labeled using A and A'. The background in the supporting electrolyte is presented below the cyclic voltammetry for the solution containing Ce.

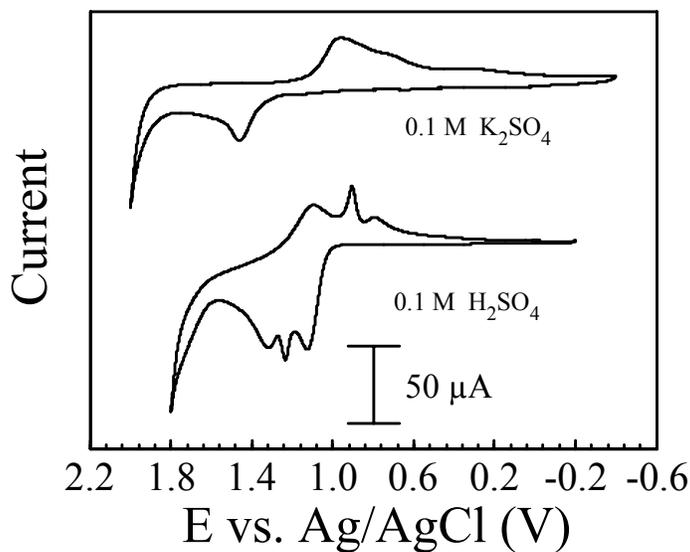


Figure 2. Influence of acid concentration on the redox properties of 6mM $\text{Ce}(\text{NO}_3)_3$ with constant ionic strength $\mu = 0.3 \text{ M}$.

Voltammetry will be taken at the other ionic strengths used to obtain Figure 1 to determine if the trends observed are consistent as ionic strength is increased.

Finally, the investigation of the Sm redox couple was initiated by employing the conditions determined as optimal for the Ce experiment. Successful resolution of the Sm redox couple was accomplished using this system. Future work on this species will include further experiments, similar to those conducted for Ce, which will vary the working electrode and supporting electrolyte.