

DECONTAMINATION OF HIGHLY ENRICHED URANIUM USING ROOM TEMPERATURE IONIC LIQUIDS.

David A. Costa and Warren J. Oldham

Nuclear Materials Technology Division,
Mail Stop E-530, Los Alamos National Laboratory
Los Alamos, New Mexico 87545

Throughout the Department of Energy (DOE) Complex, there are holdings of oralloy (highly enriched uranium) contaminated with plutonium (Pu) and americium (Am). Uranium cannot be shipped to Oak Ridge National Laboratory, the DOE's uranium disposition site, until its surface is cleaned to a level of transuranic activity of below 20 disintegrations per minute (dpm)/100 cm², or to an oxide contamination limit of less than 210 ppb TRU. Together, the NMT and Engineering Sciences and Applications (ESA) Divisions at Los Alamos National Laboratory are continuing the development of an advanced HEU Decontamination and Conversion system. Our presentation will focus on the development of the Decontamination and Conversion (D&C) system at Los Alamos, and compare the baseline aqueous process with an ionic liquid based alternative.

The first stage of the D&C process involves electrolytic decontamination of a uranium surface, similar to the common industrial practice of electropolishing. This is accomplished by passing a constant current from the stainless steel cathode to the oralloy anode through an electrolyte solution. The anodic process results in the dissolution of uranium and transuranic contaminants, which are subsequently removed from the solution by precipitation and ultrafiltration. We have demonstrated that the surface contamination on oralloy parts can be reduced by this method to below either of two acceptance criteria.

Development of the aqueous D&C flow sheet has presented several challenges. Chief among these is the need to mitigate the safety concerns raised by the generation of hydrogen during electrolysis. We have also found that the effectiveness of the stripping process is in some cases limited by film formation on the uranium anode. The aqueous flow sheet is further complicated by the requirement for pH control throughout the run, and by the ill-defined plutonium bearing hydrolysis residues.

To address these issues we have begun to explore the use of ionic liquids as non-aqueous alternative electrolytes for the electrolytic decontamination of HEU parts. In this talk we will present an overview of the baseline D&C flow sheet, followed by a comparison between aqueous and RTIL electrolyte systems. The polarization curves for uranium in aqueous sulfate solutions and imide based RTILs will be analyzed, and we will explore the differences between the decontamination efficiencies and oxidation products of the two systems.