

**ELECTROACTIVE MATERIALS FOR ANION SEPARATION-
TECHNETIUM FROM NITRATE**

Final Technical Report

William H. Smyrl, PI

**University of Minnesota
Corrosion Research Center
Department of Chemical Engineering and Materials Science
Minneapolis, MN 55455**

October 2003

Prepared for

**U.S. DEPARTMENT OF ENERGY
AWARD NO. DOE/DE-FG07-98ER14927**

High Capacity Electroactive Materials for Radioactive Waste Removal

Dr. Ann Gronda (Postdoctoral Associate) and Professor William H. Smyrl

In order to increase the capacity of electroactive polymers for radioactive waste separations, we have focused on two ways of processing these polymers: phase inversion, and coating onto a porous conductive substrate. Both techniques are intended to increase the surface area for access of the guest anions to the intercalation host. Phase inversion of polyvinylferrocene (PVF) was unsuccessful, but we were able to use electro-precipitation to coat PVF onto porous carbon substrates such as Toray paper. Due to the wide molecular weight distribution and batch variations of commercial PVF, we have chosen to examine the more manageable polyaniline.

A solution of derivatized polyaniline in butyl cellosolve was obtained from Monsanto and it was diluted with xylene. Thirty micron thick films were deposited onto gold-coated silicon wafers using a draw-down blade, then heated for 10 minutes in air. Cyclic voltammetry demonstrated reversibility and stability over time and cycling. Methanol was then applied to the films for approximately ten minutes. After rinsing, the cyclic voltammetry currents increased by an order of magnitude. This was concluded to be due to reordering of the polyaniline microstructure and removal of nonconductive reactants from the original polyaniline material, as supplied. The process also converts the redox film from cation-inserting to anion-inserting as needed for the application of radioactive waste treatment.

We have been unable to coat polyaniline onto porous carbon substrates, nor has it been possible to utilize phase inversion processing on the material. These difficulties have prevented the use of polyaniline for anion removal. What has been learned from the studies will be useful in examining other electroactive materials for the application.

PRESENTATIONS:

“High Capacity Electroactive Polymers for Radioactive Waste Removal”, Ann M. Gronda and William H. Smyrl, Abstract #1905, Electrochemical Society Meeting in Honolulu, Hawaii, October 1999.