Californium Electrodepositions at Oak Ridge National Laboratory

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Electrodepositions of californium isotopes were successfully performed at Oak Ridge National Laboratory (ORNL) during the past year involving two different types of deposition solutions, ammonium acetate ($NH_4C_2H_3O_2$) and isobutanol ($(CH_3)_2CHCH_2OH$). Purification and handling of the highly radioactive californium material created additional challenges in the production of these sources.

The ammonium acetate deposition method was used to deposit 1.7 Ci of ^{252}Cf onto a stainless steel substrate. This was the largest single electrodeposition of ^{252}Cf ever prepared. The ^{252}Cf material was initially purified using traditional cleanup columns, such as AG50-AHIB and AG50-HNO_3 columns, and further purified using a TEVA-NH_4SCN system to remove any lanthanides, resulting in the recovery of 5.1 mg of purified ^{252}Cf. Two attempts were made in the production of this large californium source. The first was unsuccessful and was run with a current of 0.5 A, which resulted in a 115 mCi deposition (<10%). The second was successful and was run with a current of 1.0 A, resulting in a 91.5% deposition.

A californium product that was decay enriched in ^{251}Cf was recovered for use in super-heavy element (SHE) research. This neutron-rich isotope, ^{251}Cf, provides target material for SHE research for the potential discovery of heavier isotopes of Z=118. The californium material was recovered from old ^{252}Cf neutron sources in storage at ORNL. These sources have decayed for over 30 years, thus providing material with a very high ^{251}Cf-to-^{252}Cf ratio. After the source capsules were opened, the californium was purified and then electrodeposited using the isobutanol method onto thin titanium foils for use in an accelerator at the Joint Institute for Nuclear Research in Dubna, Russia.

Processing and chemical steps involved in the recovery and purification of the feed materials as well as the parameters of the different electrodeposition methods will be presented.