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Measurement of Curium Fluoride Anions by Accelerator Mass Spectrometry

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Radiotoxic actinides including ^{236}U, $^{239/240}$Pu, ^{241}Am, and ^{244}Cm are found in spent nuclear fuels and high-level radioactive waste. In particular ^{244}Cm (half-life 18.1 y) is a useful tracer of exposure to radioactive materials, but dose assessments typically require measuring atto- to femtogram levels of curium in biological and environmental media. Accelerator mass spectrometry (AMS) is the only technique able to measure such ultra-low level abundances, but suffers from relatively poor ionization efficiencies for curium oxides made in sputter-ion sources used by AMS. In our work (i.e. Cornett et al [NIMB 2015]) we have experimented with a variety of sample chemistries and target matrices in an ongoing effort to boost anion currents for AMS actinide measurements of U, Am and Pu. To-date, the addition of PbF2 is shown to boost specific fluoride anions for actinides, and the addition of Si and Ta appears to form the most promising matrix for UO– current enhancement, resulting in a 3x increase of anion currents (Kazi et al [this meeting]). The situation for Cm remains unknown. Here we present the first AMS spectrum of curium fluoride anions generated during sputtering. We use samples spiked with ^{244}Cm, and assess whether curium fluorides, with the assistance of PbF2, give an improvement in beam current compared to curium oxides, and whether Si/Ta matrices further boost curium oxide anion currents. The ability to increase curium currents may allow lower-level measurements of ^{244}Cm in natural samples, and may be useful for studies of even rarer heaver elements including Bk, Cf and others by AMS.

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