Curium Chemistry's Curious Conundrum

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Abstract. The separation of curium from americium is a potential component of advanced, transmutation-based nuclear fuel cycles because it greatly simplifies fuel re-fabrication. However, separating curium from americium is among the most difficult separations in the periodic table. Chemical separations of americium from curium have typically relied either on chromatography to amplify the small chemical differences between Am(III) and Cm(III) through repeated separation, or on accessing the higher oxidation states of Am to affect a separation of Am from Cm(III). We are exploring a third way to separate Am from Cm. Using sterically constrained complexes to amplify the small thermodynamic differences normally observed between Am(III) and Cm(III) complexes, we can separate these ions efficiently based on their slightly different ionic radii. Sterically constrained aqueous complexes that are size-matched to the larger Am(III) cation preferentially hold back americium in the aqueous phase while allowing extraction of the smaller Cm(III) cation. Improvements in the system hold promise for cleanly separating americium from both curium and lanthanide fission products in a single process.

Biography. Mark Jensen is the Jerry and Tina Grandey University Chair in Nuclear Science and Engineering, Professor of Chemistry, and Director of the Nuclear Science and Engineering Program at the Colorado School of Mines. He earned a Ph.D. in inorganic and nuclear chemistry from the Florida State University studying the environmental chemistry of radioactive waste. Before coming to Mines in 2015, Dr. Jensen was a scientist in the Chemistry and the Chemical Sciences and Engineering Divisions at Argonne National Laboratory for two decades where he studied the environmental, biological, and separations chemistry of the nuclear fuel cycle, particularly the transuranium elements.