

SELECTIVE EXTRACTION OF CE(IV) AS A FIRST STEP OF THE SESAME PROCESS

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Abstract

SESAME process (selective extraction of americium by electrochemical method) is developed in the frame of the French SPIN programme (separation and incineration) whose main goal is the recovery and transmutation of minor actinides and long-lived fission products contained in the spent nuclear fuel. Depending on the flow sheet option, americium could be separated from curium (SESAME A process), from curium and lanthanides (B route) or from a PUREX raffinate (C route). Main studies are underway on the SESAME B process.

Am(III) is oxidised into Am(VI) in the presence of silver nitrate and lacunary heteropolyanion, and then extracted by tributyl phosphate (TBP). Concerning the B and C routes, the feed solutions contain cerium which is totally complexed by polyanion. As the concentration of lanthanides is 13 times higher than that of americium, the polyanion consumption could be dramatically lowered by previously removing the cerium from the feed solution. Selective extraction of cerium before americium oxidation and extraction has thus been studied on inactive solutions containing only cerium, lanthanum, neodymium and europium. Their concentrations have been chosen equal to that of a PUREX raffinate of an UOx1 spent fuel, concentrated 10 times.

After a complete oxidation of Ce(III) into Ce(IV) in 5 M nitric acid, its extraction by 50 vol % TBP in dodecane is carried out in a set of 2 or 4 centrifugal contactors. An oxidising aqueous scrubbing in the organic phase (AgO in 5 M nitric acid) is performed in 2 additional centrifugal contactors to improve the selectivity of the cerium extraction towards other lanthanides. Finally, the cerium stripping is achieved by using a reducing solution of hydroxylamine nitrate in 1 M nitric acid.

The tested solutions have been treated on line by using 2 sets of 4 centrifugal contactors. More than 99 mol % of cerium was extracted with less than 0.5 wt % of other lanthanides.