

## **Assessment of Pyrochemical Methods for the Molten Salt Reactor Fuel Clean-up**

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The molten salt reactor (MSR) was one of the six concepts retained for the future of nuclear energy during the Generation IV international forum. This concept is based on thorium cycle running with an epithermal neutron spectrum. The fuel  $\text{ThF}_4\text{-UF}_4$  is dissolved in a molten fluoride salt at a working temperature of about 600°C. Inherent in the process of fission is the creation of fission products. The clean up of the molten salt by extraction of fission products is of primary importance for limiting parasitic neutron captures and let MSR to reach a conversion ratio about unity. The gaseous fission products are removed continuously using Helium bubbling. Uranium and neptunium are removed by fluorination and all the uranium is put back into the molten salt reactor. To separate the other fission products (lanthanides, Zr, I...) from fuel salt, pyrochemical methods are studied such as liquid/liquid extraction with two options: (i) electrolysis on liquid cathod and (ii) reductive extraction using reductive metal (Li) introduced in metal solvent (Bi, Ga, Pb...). The separation methods based on the acido-basic properties of molten salts were also considered to realize a selective precipitation of actinide oxides. The purpose of this paper is to assess and compare the efficacy of these methods applied to actinides/fission products separations.