

Chemical Reduction of SIM MOX in Molten Lithium Chloride Using Lithium Metal Reductant

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A simulated spent oxide fuel in a sintered pellet form, which contained the twelve elements U, Pu, Am, Np, Cm, Ce, Nd, Sm, Ba, Zr, Mo, and Pd, was reduced with Li metal in a molten LiCl bath at 923 K. More than 90% of U and Pu were reduced to metal to form a porous alloy without significant change in the Pu/U ratio. Small fractions of Pu were also combined with Pd to form stable alloys. In the gap of the porous U-Pu alloy, the aggregation of the rare-earth (RE) oxide was observed. Some amount of the RE elements and the actinoides leached from the pellet. The leaching ratio of Am to the initially loaded amount was only several percent, which was far from about 80% obtained in the previous ones on simple MOX including U, Pu, and Am. The difference suggests that a large part of Am existed in the RE oxide rather than in the U-Pu alloy. The detection of the RE elements and actinoides in the molten LiCl bath seemed to indicate that they dissolved into the molten LiCl bath containing the oxide ion, which is the by-product of the reduction, as solubility of RE elements was measured in the molten LiCl-Li₂O previously.

Key words: Pyrometallurgical Reprocessing; Lithium Reduction Process; Actinoides; Uranium-Plutonium Mixed Oxide; Molten Salt.