Equilibrium Calculation on Oxidation of Cs-U-O Compounds at High Temperature under Four Different Gas Flows

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Cesium in SNFs which are supposed to be treated by a dry process in high temperature is an important element owing to its high radioactivity and heat load. The main component in SNFs is uranium and, therefore, cesium would exist with uranium oxides. In this work, component changes of Cs–U–O (cesium uranate) systems were calculated to design an oxidizing reactor and solid compositions were estimated with respect to temperatures and gas flow conditions.

Prior to calculating the component changes, stable cesium compounds with uranium oxide were identified by using TPP calculations. The results of the analysis at three temperatures of 500, 1000, and 1400 oC showed that cesium compounds of $Cs_2U_2O_7$ and Cs_2UO_4 were stable under realistic partial pressures of Cs and O_2 throughout the temperature range.

Gas flow conditions included O_2, air, Ar with 0.001% H_2O, and Ar with 4% H_2 to oxidize or reduce the complex cesium uranates. The reactions of $Cs_2U_2O_7$ in Ar with 4% H_2 showed that all of the cesium elements were removed from the reactor while those of Cs_2UO_4 at 1400 oC in O_2, air, and Ar with 0.001% H_2O dissociated it into $Cs_2U_2O_7$ and Cs_2O.