Oxidation Behavior of the Simulated Fuel with Dissolved Fission Products in Air at 573~873 K

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As a part of the direct use of spent PWR fuel in CANDU reactors (DUPIC) fuel development program, oxidation behavior of the simulated spent fuel with dissolved fission products has been studied using a thermo-gravimetric analyzer in the temperature range of 573-873 K in air in order to establish the oxidation temperature and time of the oxidation and reduction of oxide fuel (OREOX) process during fabrication of DUPIC fuel. Oxidation behavior of an UO_2 sintered pellet has also been measured for the purpose of comparison. From the XRD study, the simulated spent fuel has been converted to U_3O_8, in the temperature range of 573-873 K. The oxidation curves of the simulated spent fuel are displayed sigmoidal reaction kinetics which follows the nucleation-and growth mechanism of the formation of U_3O_8. The fission products forming the solid solution in UO_2 matrix delayed U_3O_8 forming. Activation energies of the simulated spent fuel are higher than those of UO_2. There are transition points in the rate of the oxidation of the simulated fuel and UO_2 between 673 and 723 K, and the activation energies in the low temperature range of 573-673 K are higher than those in the high temperature range of 723-873 K.