

Degradation of Irradiated UO₂ Fuel Thermal Conductivity Calculated by FRAPCON Model Due to Porosity Evolution at High Burn-Up

Authors : B. Roostaii, H. Kazeminejad, S. Khakshournia

Abstract : The evolution of volume porosity previously obtained by using the existing low temperature high burn-up gaseous swelling model with progressive recrystallization for UO₂ fuel is utilized to study the degradation of irradiated UO₂ thermal conductivity calculated by the FRAPCON model of thermal conductivity. A porosity correction factor is developed based on the assumption that the fuel morphology is a three-phase type, consisting of the as-fabricated pores and pores due to intergranular bubbles within UO₂ matrix and solid fission products. The predicted thermal conductivity demonstrates an additional degradation of 27% due to porosity formation at burn-up levels around 120 MWd/kgU which would cause an increase in the fuel temperature accordingly. Results of the calculations are compared with available data.

Keywords : irradiation-induced recrystallization, matrix swelling, porosity evolution, UO₂ thermal conductivity

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