World Academy of Science, Engineering and Technology
International Journal of Nuclear and Quantum Engineering
Vol:17, No:11, 2023

Fuel Inventory/ Depletion Analysis for a Thorium-Uranium Dioxide (Th-U) O2 Pin Cell Benchmark Using Monte Carlo and Deterministic Codes with New Version VIII.0 of the Evaluated Nuclear Data File (ENDF/B) Nuclear Data Library

Authors : Jamal Al-Zain, O. El Hajjaji, T. El Bardouni

Abstract : A (Th-U) O2 fuel pin benchmark made up of 25 w/o U and 75 w/o Th was used. In order to analyze the depletion and inventory of the fuel for the pressurized water reactor pin-cell model. The new version VIII.0 of the ENDF/B nuclear data library was used to create a data set in ACE format at various temperatures and process the data using the MAKXSF6.2 and NJOY2016 programs to process the data at the various temperatures in order to conduct this study and analyze cross-section data. The infinite multiplication factor, the concentrations and activities of the main fission products, the actinide radionuclides accumulated in the pin cell, and the total radioactivity were all estimated and compared in this study using the Monte Carlo N-Particle 6 (MCNP6.2) and DRAGON5 programs. Additionally, the behavior of the Pressurized Water Reactor (PWR) thorium pin cell that is dependent on burn-up (BU) was validated and compared with the reference data obtained using the Massachusetts Institute of Technology (MIT-MOCUP), Idaho National Engineering and Environmental Laboratory (INEEL-MOCUP), and CASMO-4 codes. The results of this study indicate that all of the codes examined have good agreements.

Keywords : PWR thorium pin cell, ENDF/B-VIII.0, MAKXSF6.2, NJOY2016, MCNP6.2, DRAGON5, fuel burn-up.
Conference Title : ICNRTM 2023 : International Conference on Nuclear Reactor Technology and Materials
Conference Location : Jeddah, Saudi Arabia
Conference Dates : November 20-21, 2023