



Contribution ID: 130

Type: Oral

Parametric survey on critical core of RFBB-SS

The Breed-and-Burn reactor maximizes uranium utilization due to use of depleted or natural uranium and breeds fissile fuels while burning them. For this design, neutron economy is necessary to be high during core operation to achieve critical core. It can be accomplished by locating fuels with large neutron multiplication factors in the high neutron flux region by appropriate shuffling schemes.

Our previous analysis showed that the small power (750 MWe) Rotational Fuel-Shuffling Breed-and-Burn reactor with Silicide fuel and Sodium coolant (RFBB-SS) core without considering fuel assembly (FA) duct and control rod assemblies (CRAs) can operate at critical condition and can sustain the breed-and burn operating mode.

The objective of the present study is to clarify the impact of several parameters on burnup performance in practical core of RFBB-SS including FA duct and CRAs by conducting burnup analysis using Monte Carlo SERPENT code. By the analysis, the impact of the parameters on the criticality of the core in the equilibrium state was clarified. As a result, small practical RFBB-SS core loaded with fuel of 85 TD, 180 cm in height, 55 FAs per one of sixth core, and 700 days of shuffling interval can operate in critical condition.

Country OR International Organization

Mongolia

Email address

sodmaa1@num.edu.mn

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Author: Dr SAMBUU, Odmaa (School of Engineering and Technology, National University of Mongolia and Nuclear Research Center, National University of Mongolia)

Co-authors: Dr VAN HOANG, Khanh (Phenikaa University); Prof. TORU, Obara (Tokyo Institute of Technology); Dr AMARJARGAL, Tsendsuren (Nuclear Research Center, National University of Mongolia)

Presenter: Dr SAMBUU, Odmaa (School of Engineering and Technology, National University of Mongolia and Nuclear Research Center, National University of Mongolia)

Track Classification: Topical Group A: SMR Design, Technology and Fuel Cycle: Track 1: Design and Technology Development of SMRs