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Analysis of Neutronic Performance for SMART Reactor With Uranium Nitride and Thorium Fuel

SMART (System-integrated Modular Advanced ReacTor), which is conceptually developed by KAERI (Korea Atomic Energy Research Institute), is a small-sized advanced integral PWR that produces 330 MW of thermal energy under full power operating conditions.

Maximizing the life cycle of fuel inside the reactor core has an important economic factor. In addition, it reduces the volume of spent fuel and spent fuel storage pools inside the reactor. In this paper, Uranium nitride and Thorium fuels in addition to traditional UO2 fuel were used to increase the fuel cycle time inside the SMART reactor. A model of the reactor core has been designed by using MCNPX Computer code package. The multiplication factor was calculated for the fuel time period. The results showed that uranium nitride of the same fuel enrichment gives a higher fuel cycle length than uranium oxide. The breeding ratio was compared between the different types of fuel that have been used. The isotopes produced as a result of burning and irradiating the fuel inside the reactor core are calculated. Safety parameters such as fuel and moderator temperature coefficient of reactivity were calculated for all fuel types. The Prompt neutrons lifetimes and the delayed neutrons fraction were also calculated and compared

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