A New Design Concept for Single Fuel Enrichment in Self-Sustaining Lead-Cooled Reactor

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Abstract

New design measures have been studied to achieve single fuel enrichment (SFE) in a 900 MWth lead-cooled breakeven reactor with a burnup reactivity swing smaller than the β_{eff} value. The conversion ratio of the core is almost unity and depleted uranium is only used as the feeding material. For the SFE, a new fuel assembly design has been introduced, in which a combination of B_4C burnable absorber (BA) rods and neutron streaming tubes are utilized to control the power distribution. The BA rods are designed to have top and bottom cutback zones to reduce the peak fast fluence, which is a limiting factor in a fast reactor loaded with a metallic alloy fuel. An 18-month cycle core has been designed and its various characteristics are analyzed. Additionally, a subchannel thermal-hydraulic analysis has been performed for the peak power assembly to characterize its thermal-hydraulic properties.