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Computational investigation of nuclear waste incineration efficiency in a subcritical molten salt driven by 50-100 MeV protons

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Molten salt reactors were designed and operated at 1960s. The subcritical accelerator driven MSRs are being considered recently. In the present work, accelerator driven homogeneous subcritical core configuration was Modelled using MCNPX code. The composition of NaF-BeF2-ThF4-TRUF4 and NaF-233UF4-ThF4-TRUF4 was selected as the fuel loaded inside a 58×60 cm cylindrical core respectively. NaBF was selected as coolant salt of the fuel salt circuit. Accelerated proton particles were used to induce fission in the transuranic nuclei. The projectiles energy was changed from 50 MeV up 100 MeV in five steps. TRU fission rate, deposited heat distribution and neutron flux distribution were determined inside the subcritical core. Neutron and proton flux distribution inside the subcritical molten salt core was compared with each other. Energy gain, source multiplication factor and proton importance parameters were calculated for any different projectile energy. Optimized proton energy was suggested to be applied for nuclear waste incineration using such system. Burn-up calculations were carried out for the cores with different fuel loading.

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