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Neutronics Analysis of a Small PWR using TRISO fuel particles with MCNPX

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Tri-structural Isotropic (TRISO) based fuel with SiC matrix can be used in Light Water Reactors (LWRs) for enhancing its safety features in extreme situations. Besides the simplification of the design, the utilization of TRISO fuel particles in PWR technology enhances its integrity by confining the radioactive fission products within fuel itself during the reactor operation. In this work, the preliminary conceptual design of a small PWR core using TRISO fuel was carried out. The neutronic simulation of the core is carry out using MCNPX program version 2.6e. This reactor produces 25MW of thermal power and with approximately 4 years of effective full power years. A multifactorial statistical study about the influence of three parameters in the effective multiplication coefficient value was carried out; particles size, fuel enrichment and packing fraction. The core was optimized in order to obtain in the first load the necessary excess of reactivity to reach the cycle duration. The power distributions in the first load and at the end of the cycle were obtained, with a total maximum power peaking factor of 2.55. The integral effectiveness of the absorber rods and the energetic spectrum in the most important cycle states were calculated.

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