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Thermomechanical behavior of the TRISO fuel under deep burnup and high temperature in the VHTR

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The Generation IV Very High Temperature Reactor (VHTR) is envisioned as an outstanding prototype among the six nuclear systems propose in the Generation IV. The characteristics that highlights this reactor are focused in the low electricity generation costs, short construction periods, in proliferation resistance and physical protection. Nevertheless, it presents essential challenges to be deployed as a sustainable energy taking into consideration the high temperatures (1000℃ in normal operation and up to 1800℃ in accidents conditions) and burnup degrees (150–200 GWd/TonU) achievable in these reactors. One of these key challenges is the nuclear safety which mainly relies on the quality and integrity of the coated fuel particles (TRISO). In this investigation will be studied the thermomechanical behavior of the TRISO fuel in function of the variation of different parameters taking into consideration the deep burnup degrees planned to be reached in the VHTR. The studies performed in this investigation included the evaluation of key parameters in the TRISO such as: release of fission gases and CO, gas pressure, temperature distributions, kernel migration, maximum stress values, and failure probabilities. In order to achieve this goal will be used coupled computational modeling using analytical methods and Monte Carlo and CFD codes such as MCNPX version 2.6e and Ansys version 14.

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