Thermal Analysis of Nuclear Fuel Using Silicon Carbide Nanocomposite Dispersion in UO2

Reference	Presenter	Authors (Institution)	Abstract
03-003	Daniel de Souza gomes	gomes, D.S. (Instituto de Pesquisas Energéticas e Nucleares); Oliveira, F.B. (Instituto de Pesquisas Energéticas e Nucleares);	After the Fukushima Daiichi disaster happened in Japan in 2011, it started a global effort to get more tolerant fuels. In 2019, the fleet of power reactors designated for electricity suppliers made up 451 power units, generating around 402 GWe. The nuclear power represents 11.2% of the electricity generated, avoiding about 1.2 GT of CO2. The civilian reactors are operating using the uranium dioxide (UO2) as the fuel, which shows poor thermal conductivity of 7.8 W/m-K at room temperature. The fuel temperatures can reach up until 1500 °C at regular operation. Silicon Carbide Nanotube (SiC-CNT) dispersed in the UO2 matrix containing 5 to 20% vol of SiC-CNTs permits to increases the thermal conductivity. The novel fuel concept improves the thermal conductivity of 30% with the addition of 5% of silicon carbide. The fuel pellet UO2-SiC/CNTs are sintered using Spark Plasma Sintering (SPS) with a hold time of 5 minutes, at 1300 °C, and a pressure of 40 MPa. The fuel mixture shows a better density, low porosity, and acceptable grain size distribution compared to traditional sintering routes. It simulated the fuel mixtures using fuel performance code FRAPCON adapted to the thermals and mechanic properties of compounds. This study showed the possibility of increasing the safety margins of nuclear fuel using the addition of a small fraction of nanocomposite.

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