Thermophysical Properties Determination of Uranium Dioxide Fuel Pellets with Addition of Beryllium by the Flash Laser Method

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The uranium dioxide is the most used oxide as nuclear fuel due to many advantages such as: high stability even when it is in contact with water in high temperatures, high fusion point, and high capacity to retain fission products. The conventional fuel for pressurized water reactor with UO_2 ceramic sintered pellets stacked inside fuel rods, and presents disadvantages because its low thermal conductivity causes large and dangerous temperature gradients. The research project entitled "Beryllium Project" under development at CDTN (Centro de Desenvolvimento da Tecnologia Nuclear) aims the obtaining of fuel pellets made from a mixture of uranium dioxide microspheres and beryllium oxide powder to increase the thermal conductivity of the fuel pellets. This type of fuel promises to be safer than current fuels, improving the performance of the reactor, in addition to last longer, resulting in great savings. Increase in the thermal conductivity in the range of 8.6% to 125%, depending on the level of addition employed in the range of 1% to 14% by weight of beryllium oxide, has been obtained. In this work, a mixture of uranium dioxide kernels produced at CDTN's nuclear fuel laboratories using the Nukem's sol-gel process with 2 weigh percent of beryllium oxide was pressed into pellets. The pelletizing parameters and the thermophysical properties (density, thermal diffusivity and thermal conductivity) results are reported and compared with the values of the conventional uranium dioxide nuclear fuel.