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**Reactor and Out-of-Pile Testing of a High Density Uranium
Zirconium Carbonitride LEU Fuel**

S. Sikorin, A. Kuzmin

The Joint Institute for Power and Nuclear Research – Sosny
of the National Academy of Sciences of Belarus
PO 119, 220109, Minsk – Belarus

A. Zaytsev, Sh. Tukhvatulin, I. Galev

Scientific Research Institute Scientific Industrial Association “LUCH”
Zheleznodorozhnaya str., 24, 142103, Podolsk – Russia

A. Izhutov, V. Alekseev

State Scientific Center - Research Institute of Atomic Reactors
Zapadnoye Shosse, 9, 433510, Dimitrovgrad – Russia

D. Keiser, I. Bolshinsky

Idaho National Laboratory, 2525 Fremont Ave, Idaho Falls, ID 83401 – USA

Y. Gohar

Argonne National Laboratory, 9700 S. Cass Ave., Argonne, IL 60439 – USA

ABSTRACT

For many years, Russian researchers have developed and tested a high density, high temperature U-Zr-C-N fuel for potential application in different types of reactors. As part of this effort, reactor tests have been performed to low burnup. However, reactor-testing data is still needed at high burnup to confirm the optimal performance of the fuel. As a part of fuel testing activities under the Russian Research Reactor Fuel Return (RRRFR) Program, a reactor experiment will be performed to high burnup in the SM-3 reactor. The fuel material to be tested is composed of uranium, zirconium, carbon, and nitrogen ($U_{0.9}Zr_{0.1}C_{0.5}N_{0.5}$) with a density of 11.9 g/cm^3 and an enrichment of 19.75% (uranium-235). The uranium density of this fuel material is 10.8 g/cm^3 . Materials being investigated for possible use in a fuel element include Nb, W, Mo, and stainless steel. The SM-3 reactor is a high-flux reactor located in Dimitrovgrad, Russia that was given its current name in the 1990's after a refurbishment of the SM-2 reactor, which started operation in 1961. Fuel testing can be performed in the reactor at temperatures from 500°C to 2500°C . The goal for the reactor testing will be for the U-Zr-C-N fuel to reach ~40% burnup. This will require about 1000 effective days of irradiation. To support the reactor work, out-of-pile fuel/cladding compatibility studies will be performed, along with measurement of different as-fabricated fuel properties. This presentation will describe and status the reactor and out-of-pile testing program.