Contribution ID: **291** Type: **POSTER**

The way of nitride fuel producing by high voltage electrodischarge compaction

Tuesday, June 27, 2017 5:30 PM (1h 30m)

Modern development of nuclear power industry is closing of nuclear fuel cycle. That is possible when fast neutron reactors is used. An attractive fuel for this type of reactor is nitride nuclear fuel. However, the widespread use of a nitride nuclear fuel encounters by problems of its manufacturing and, in particular, during the sintering of the finished powder material. So for the manufacture of tablets of uranium nitride traditionally use free sintering technology. To achieve the desired density (85-95%, etc.) tablets require exposure to high temperatures (1900 – 20000 C) for several hours, as well as the use of additional preliminary steps: powder granulation and pressing at high pressures (up to 1, 5 GPa). The whole process is quite time, energy and labor-intensive. To solve the problem the method of high-voltage electric pulse consolidation is proposed. This method consists of passing a short (up to 1 ms) high-voltage discharge (up to tens of kV) power of several kW directly through the powder. The result is an instantaneous sintering of powder materials. The main advantage of this method is the sintering times and lower temperature processes, which affect both the quality of the final product (smaller grain size and preservation of the original phase composition) and the overall unit energy consumption during the manufacture of the product. General regularities of the influence of the parameters of high-voltage electric pulse consolidation density of uranium nitride compacts are obtained. It is shown that the density of the compact is linearly dependent on the voltage on the capacitor bank (pulse energy) in the investigated range of energies. Depending on the application of pressure is increasing with the saturation curve. Compacts with densities of 85 - 96% are obtained. The peculiarities of formation of macro and microstructure, as well as the phase composition of the samples are studied.

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Session Classification: Poster Session 1

Track Classification: Track 5. Fast Reactor Materials (Fuels and Structures) and Technology