In-pile Assemblies for Testing of Li_2TiO_3 Lithium Ceramic Blanket

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Objectives. Carrying out the lithium ceramics radiation trials with the ^6Li 96 % enrichment and *Li* burnup up to ~20% and "in situ" registration of released tritium under various temperatures.

Methodology. The IVG.1M and WWR-K reactors of the National Nuclear Center RK were used for irradiation. Two type ampoules – active and passive ones – were used during irradiation. "Active" ampoules are intended for study of tritium release dynamics and contain capsules with ~1 mm lithium ceramic pebbles. Capsules in ampoules A1 and A2 have temperatures, which change within the campaign in the range 400-900 °C, ampoule A3 has fixed temperature of 650 °C. "Passive" ampoule is only intended for production of samples with *Li* burnup 20%; it contains capsules with ~1 mm pebble samples, and pellets with 8 mm diameter and 1 mm thickness. During testing the temperature of capsules in ampoules P1, P2, and P3 is fixed and equals 400, 650 and 900°C respectively. Every ampoule contains 2 grams of lithium ceramics Li_2TiO_3.

During long-term tests the temperature of lithium ceramic sample is regulated by changing the gas (helium) pressure in ampoules using gas-vacuum system of universal loop facility. The automated system for mass-spectrometer registration of hydrogen isotopes is used to measure tritium released from samples during reactor irradiation.

Results. The preliminary tests were carried out at the IVG.1M reactor. The tests' goal is development and experimental examination of ampoules on the basis of thermo-physical and neutron-physical calculations, work-out of temperature regulation modes and measurement of tritium release dynamics during reactor irradiation. In accordance with work results the experimental technique for long-term irradiation of lithium ceramic during 200 days was validated.

Validation of calculation models and experimental study of space-energy distribution of neutrons and reactivity effects were carried out at the critical test bench by using ampoule assembly physical mock-up. For that the WWR-K reactor core configuration was simulated at the critical test bench. Experimental value of lithium ceramic energy release was measured in the WWR-K reactor by using calorimetric method. This value is used for assessment of lithium burnup.

At present long-term irradiation is carried out in two irradiation channels of the WWR-K with simultaneous "in situ" registration of released tritium under various temperatures. It is planned to carry out the posterior material testing study of irradiated ceramic Li_2TiO_3.