REACTOR STUDIES OF TWO-PHASE LITHIUM CERAMICS IN KAZAKHSTAN

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Abstract

Lithium ceramics is one of the most promising materials for reproduction of tritium in the blankets of fusion reactors, including the DEMO reactor. The most technological new material of lithium ceramics has been developed at KIT (Karlsruhe Institute of Technology), where samples of two-phase mixtures Li2TiO3 and Li4SiO4 have been made, getting the properties of these two types of ceramics such as finer grained microstructure and high strength, which determine their optimum performance characteristics. To select the most promising material, samples with different phase ratios and with different geometric sizes of pebbles were made, the properties of which are important to study under reactor irradiation conditions in order to determine the parameters and mechanisms of tritium release in lithium-containing materials.

There are numerous publications in the literature related to the study of samples based on lithium ceramics, but scientific papers on experimental studies of such materials under reactor irradiation are insufficient, both because of the difficulty of organizing such studies and the limited access to research reactors in the world.

This paper presents the results of reactor experiments with samples of two-phase lithium ceramics of different molar composition and geometric sizes of pebbles. The experiments were performed at the research reactor WWR-K of the Institute of Nuclear Physics (Almaty, Republic of Kazakhstan) at neutron flux density of $5*10^{13}$ n/cm^2*s and sample temperature of 650-700ºC. In the process of irradiation mass spectrometric registration of tritium and helium release from samples at different temperature modes was carried out.

On the basis of the received results of measurements the summarized data on rate of approach of process of equilibrium release of tritium-containing molecules from samples of investigated lithium ceramics are presented. The calculated values of the rate of tritium generation in the ceramic samples are given and their comparison with the released tritium fluxes in the experiment is carried out.