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NEUTRON-PHYSICAL MODELING OF THE TRITIUM-REPRODUCING TOKAMAK ITER BLANKET *)

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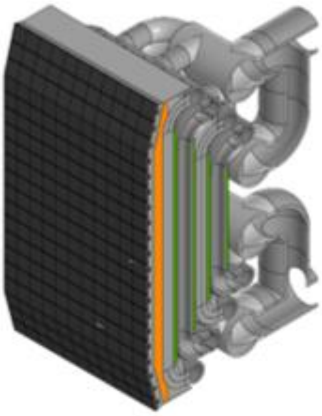
The central task of the work was to develop the design of a blanket module with the tritium production function in a tokamak reactor. Tritium is not found in nature, so the issues of obtaining this isotope are relevant for ensuring the future operation of industrial thermonuclear reactors [1]. The work is presented in two parts.

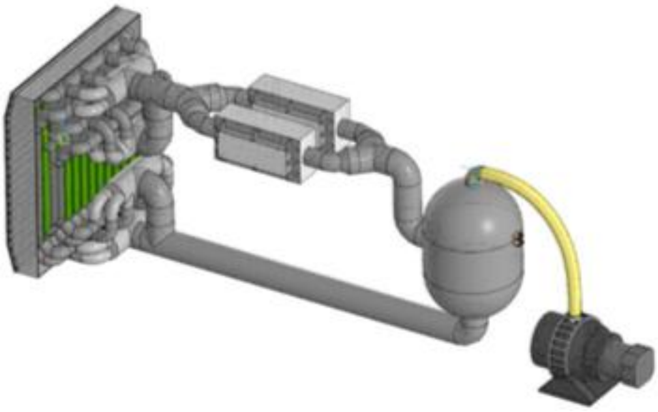
In the first part of the paper, we estimate the characteristic value of the average neutron flux on the surface of tokamak blanket modules. Based on the geometry and nominal parameters of the plasma of the ITER reactor under construction, analytical and neutron-physical calculations were performed to determine the efficiency of tritium production in lithium under the action of neutrons [2], as well as changes in the neutron flux as they pass through fixed thicknesses of layers of materials that are effective multipliers (beryllium, lead) and reflectors (carbon) of neutrons.

In the second part, a chemical and technological process for separating tritium from lithium hydride is carried out. The concept of a system for the production and separation of tritium from lithium and its chemical compounds is presented. For separation, it is assumed to use porous silica ceramics. When lithium hydride reacts with silica, it releases free tritium, which can already be collected in its pure form.

Using the results of neutron physics calculations and relying on the characteristic dimensions and geometry of the ITER tokamak, materials and their optimal thicknesses for all structural elements are selected. A 3-D model of the developed design of the blanket module is shown in Figure 1a. Thanks to the patented chemical scheme [3], in Figure 1b, it is possible to obtain thermonuclear fuel in its pure form, during the operation of the tokamak.



a – section of the blanket model;



b – blanket with chemical elements

Figure 1-Blanket model

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*) abstracts of this report in Russian