POSSIBILITY OF APPLICATION OF ELECTROCHEMICAL HYDROGEN PUMP IN THE Fusion FUEL CYCLE [[1]](#footnote-1)\*)

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One of the most important systems of fusion devises is the fuel cycle (FC), which is a set of subsystems aimed at preparation of the fuel (hydrogen isotopes), fuel injection into the plasma and subsequent processing and purification of fuel extracted from the tokamak. Examples of such systems are FC of the JET [1], ITER [2], CFETR [3], and DEMO-FNS [4].

The electrochemical hydrogen pump (EHP) is a new, actively developing technology, which, despite a wide range of applications, high efficiency, the ability to purify and compress hydrogen in one stage, is currently used only in a limited area [5]. First, EHP is used for hydrogen energy. Another possible field of application of EHP is fusion power engineering, and the composition of the separated gas mixtures in the FC of fusion devises is in many respects like the gas mixtures formed during the production and usage of hydrogen [5].

EHP can be used in various parts of the FC for the extraction, purification or compression of hydrogen, as well as for analytical purposes for concentrating small amounts of hydrogen. Currently, for the separation of hydrogen-containing mixtures in the FC of fusion devises the following are considered: membrane reactors based on a palladium-silver alloy, cryoadsorption columns, adsorption columns based on hydride-forming materials, EPH. The most developed is the method of separation in membrane reactors, which makes it possible to obtain high-purity hydrogen in one stage and is resistant to the radiation of tritium. However, it requires a significant pressure drop from different sides of the membrane to carry out the separation process at a noticeable rate, which, firstly, leads to the need for additional equipment (compressors and vacuum pumps), and secondly, to an increase in the amount of expensive and radiation- dangerous tritium in the system.

The paper will consider the use of devices based on an electrochemical hydrogen pump of various types in the following FC systems:

* tokamak pumping out;
* removal of hydrogen isotopes from "exhaust" gases;
* separation of tritium from hydrogen-containing compounds (H2O, CH4, etc.);
* hydrogen extraction from "blanket" gas.

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1. \*) [abstracts of this report in Russian](http://www.fpl.gpi.ru/Zvenigorod/L/Mu/ru/DX-Ivanov.docx) [↑](#footnote-ref-1)