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ISOTOPIC REPLACEMENT OF DEUTERIUM IN LOW-ACTIVATION STEELS *)

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The interaction of hydrogen isotopes, primarily tritium, with materials is one of the important issues in fusion reactors design. Tritium losses due to retention in materials and diffusion through the vacuum vessel wall are a source of potential danger for personnel and the population, as well as a mechanism for removing tritium from the fuel cycle. In order to ensure that tritium retention in the vacuum vessel doesn't exceed the established limit during operation of the fusion facility, periodic tritium removal from vacuum vessel materials is necessary. The tritium decontamination is also relevant for replacing reactor elements or preparing for final disposal.

The efficiency of tritium removal from metals and alloys can be increased by using other hydrogen isotopes in the form of plasma or gas. Isotope exchange, based on the replacement of tritium in a material with another isotope, can be considered as tritium removal technology for fusion reactor materials. To assess the prospects for using this method, experimental studies are often carried out for the protium – deuterium system due to the complexity of working with radioactive tritium.

This paper presents the results of a study of deuterium isotope substitution in domestic low-activation steels – ferritic-martensitic EK-181 and low-activation austenitic Cr-Mn steel. The steel EK-181 belongs to the class of reduced activation ferritic-martensitic steels, which are considered as structural materials of blanket and first wall in DEMO. Low-activation austenitic chromium-manganese steel is developed as a structural material for fast neutron reactors [1]. The isotopic exchange of deuterium in steel EK-181 with protium was studied during exposure to gaseous hydrogen and irradiation of hydrogen plasma. Isotopic replacement of deuterium in low-activation austenitic Cr-Mn steel was studied by applying hydrogen gas to one side of the membrane and vacuum pumping on the other side.

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References

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