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P3.172 A set-up for studying synergistic isotope effects in the permeation processes of hydrogen isotopes through metals

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Tritium permeation into the structural materials and further in the coolant of the fusion devices is one of the most important safety issues. Various mathematical model and experiments have been carried out to estimate the amount of tritium permeated in the key components of the fusion devices. However, some issues related to the permeation of hydrogen isotopes through metals, like those regarding synergistic isotope effects (due to the competition and the coupling of the various isotopes), are still unresolved. Thus, to further explore such issues, a research project has been started by the Experimental Pilot Plant for Tritium and Deuterium Separation from ICSI Rm. Valcea. The aim of the project activities is to develop a simulation tool that eventually will be benchmarked against the experimental results. The co-existence of two or more isotope species in the permeation processes will be investigated basically considering the variation of the partial pressure of the hydrogen species on both sides of the permeating plates. In a further step the activities will be focused on the specific cases related to the needs for the EU DEMO Breeding Blanket and in particular targeting the tritium permeation from the He purge gas into the He coolant for the HCPB option. These activities can also be extended for the issues related to the tritium permeation from LiPb into the cooling water. In this paper we will discuss some modelling approaches that takes into account the isotope effects due to the competition and the coupling of the hydrogen isotopes that occur through surface processes, and that could have effect on predicted permeation rates, and also we will describe a versatile installation designed to experimentally investigate these effects, by various methods of testing.

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