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Diffusion and permeation of hydrogen isotopes in tungsten and F82H steel near room temperature.

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Fusion related devices require special materials to withstand the extreme conditions of the fusion reaction. These materials will receive impacts of ions, alpha particles and neutrons that will change their properties. Hydrogen isotopes will penetrate and diffuse leading eventually to material degradation.
Tungsten has been proposed as a material for the plasma facing wall, and F82H as a structural material in a second line. Also, the use of tungsten coatings deposited on the structural material has been proposed.
Experimental data on hydrogen permeation (P) and diffusion coefficient (D) of H isotopes in tungsten and F82H at service temperatures (i.e. 500-1000 K) is already available. The aim of this project is to add data at room temperature. This is important since hydrogen damage is likely to occur at room temperature, i.e. during plant stops.
We plan to measure P and D of hydrogen and deuterium in tungsten and F82H by a method of permeation with gas phase charging and electrochemical detection at the temperature range 30-90 ℃. For the measurements on F82H steel we will use massive permeation membranes. Either hydrogen or deuterium will be generated in situ by a hydrogen generator fed with light or heavy water, respectively.
For the measurements on tungsten we will use thin tungsten coatings deposited on a F82H substrate. This implies the development of a PVD deposition method and the characterization of the tungsten coatings.
We will attempt to rationalize the literature data and the data obtained in the present project in the frame of a model that includes quantum effects which are usually observed in H diffusion.

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