

Taking to service and first results of the Q-PETE/D2 hydrogen permeation setup

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The Q-PETE hydrogen permeation setup has been developed to (i) provide validation cases for DEMO HCPB (Helium Cooled Pebble Bed) breeder-zone relevant cases of hydrogen permeation, and (ii) to derive hydrogen transport properties of the purge gas contacting structural materials like ferritic-martensitic 9%-Cr steels and austenitic steels. The experiment features two gas-purged chambers separated by a membrane (made from the material under test), an experimental control periphery (with supply of hydrogen-containing feed gas and hydrogen-free sweep gas), as well as a quadrupole mass spectrometer for time-resolved measurement of hydrogen species concentration. Analysis of the time-dependent concentration signals provides insight to the involved hydrogen transport processes.

In the reported first series of experiments, a 1.2 mm thick membrane of X2 CrNiMo 17-12-2 (316L) austenitic steel was used, which was also the material of the permeator chambers. Experiments were performed at several temperatures and purge gas conditions in the blanket-relevant range. The experimental results (time constants, permeation levels and species distribution) are discussed and compared to numerical simulation results. An iterative procedure was applied to derive the hydrogen transport properties for the used austenitic steel.

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