Karlsruher Institut für Technologie

Institut für Technische Thermodynamik und Kältetechnik (ITTK)
Prof. Dr.-Ing. Karlheinz Schaber

Institut für Technische Physik (ITEP)
Bereich VAKUUM
Dr. Christian Day

Bachelorarbeit

Experimental investigation of superpermeable metal foils in the HERMES experiment

A very important part of deuterium-tritium fusion power plants is the fuel cycle which cleans the fusion exhaust gas, re-combines the hydrogen isotopes in the wanted ratio and injects the fuel back in the machine. To keep the plant systems - and thus the tritium inventories - small, a new concept, called the Direct Internal Recycling (DIR) concept was proposed recently by KIT. Heart of this concept is a vacuum pump, a so-called *metal foil pump*, that pumps the unburnt fuel specifically and thereby produces a gas stream of pure hydrogen isotopologues

The working principle of this pump is based on superpermeability: Here, atomic hydrogen can penetrate a (hot) metal foil, recombine on the downstream side and cannot flow back anymore. This leads to a compression effect.

In this work, the effect of hydrogen plasma on a thin metal foil shall be investigated. Therefore, the HERMES experiment (Hydrogen Experiment for Research of Metal foils and Superpermeability) has been set up at the Institute and is now available for parametric studies.

The work shall include the following tasks:

- Complete description of the experimental set-up (HERMES) in the as-built version
- Measurements of the permeation and the achieved compression ratio at two different particle fluxes (5 sccm and 10 sccm gas flow to the plasma source) and with helium, hydrogen, nitrogen and deuterium as test gas
- Measurements of the permeation and the achieved compression ratio at three different foil temperatures
- Development of a data analyzing procedure incl. an assessment of the resulting uncertainty budget (GUM procedure) in MS Excel
- Comparison of experimental results with qualitative theoretical predictions
- Mathematical description of the results obtained by simple correlation equations

The work will be done at Campus North and has to be written in English.

Supervisor (University):	Prof. Dr. Karlheinz Schaber (ITTK)
Supervisor (Campus North):	Dipl.-Ing. Thomas Giegerich (ITEP)
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