

POF007

## Utilization of a Cold Plasma Source for the Metal Foil Pump of a Fusion Reactor

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In the last decades, a lot of research has been carried out to advance the technology towards a nuclear fusion power station. The current programme is in the pre-conceptual design phase of a demonstrational fusion power plant with 2 GW fusion power. Due to the unprecedented scale of the facility, it faces its individual challenges. One of these is a most efficient recycling technology of unburnt fuel (an equimolar mixture of the two hydrogen isotopes deuterium and tritium), which has to be extracted from the exhaust gas of the fusion reactor.

The most promising technology concept to achieve the fuel separation at the low densities close to the divertor is superpermeation. This phenomenon describes the permeation process of energized particles across a metal foil with an inlet surface barrier. KIT is currently developing a design for a metal foil pump (MFP), the technical realization of this process. On the metal foil, a naturally forming monolayer of impurities raises the energy barrier for dissolution of hydrogen into the metal, prohibiting the absorption of ground-state hydrogen to a large extent. A cold plasma source is used to energize hydrogen which enables it to overcome this monolayer and be absorbed into the metal bulk in atomic form. Subsequently, it can recombine to a molecule on the downstream surface, yielding an effective pumping which follows an energy-gradient.

KIT has set up a facility to investigate the Duo-Plasmaline manufactured by *Muegge GmbH* and developed at IGVP Stuttgart for the purpose of suprathreshold hydrogen production. It is experimentally tested for its performance and reliability with varying operation parameters in view of application for fusion. Next to experimental findings and results linked to the above named varying operation parameters, the experimental facility of KIT and its diagnostics is presented. An outlook is given to future experimental activities at KIT.

### Keywords

Fusion  
Direct Internal Recycling  
Metal Foil Pump  
Superpermeation