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P3.15 Continuous and Cryogen-free Isotope Separation for DEMO

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An important goal for DEMO is the tritium inventory reduction in the fuel cycle. For that, the residence time must be minimized and the tritium content in the individual fuel cycle sub-systems must be reduced. One activity foresees the implementation of an isotope rebalancing and protium removal unit - requires less recycling, has lower hold-up and has a lower residence time than cryogenic distillation - to process the majority of the unbalanced fuel mixture.
For this purpose, a facility is currently being developed that runs continuously and also operates under non-cryogenic conditions. The concept is to design and build a two-stage system that meets the requirements for the above mentioned process steps. The first part consists of a membrane that can meet high flow rates under continuous conditions. It is therefore economical, lowers the tritium inventory, and causes a rough separation of the hydrogen isotopes. In the second part, which aims to achieve high purity of the hydrogen isotopes, the temperature-dependent absorption and desorption behavior of the individual hydrogen isotopes in the presence of certain metals is utilized. To enhance this effect, a process is being developed that uses two alternating metal getter beds, one interacting preferably with the lighter and the other with the heavier isotope.
The facility is currently under construction with detailed design, material characterization and modelling being carried out in parallel. This paper will describe the separation principle, experimental set-up and results from modelling.

Presenter: NEUGEBAUER, Cyra (Karlsruher Institute of Technology (KIT))

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