CHARACTERISATION OF A PERMCAT REACTOR FOR TECHNICAL SCALE

DEMONSTRATION OF HIGHLY TRITIATED WATER PROCESSING

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Tritiated water at very high tritium concentrations up to stoichiometric DTO (5.2 E16 Bqkg⁻¹) will inevitably be produced within future fusion machines, during nominal operation, maintenance or after of normal event. Although the Water Detritiation System (WDS) based on the Combined Electrolysis Catalytic Exchange (CECE) process enables processing of water at high throughputs, according to ITER baseline, it can accept only water below 1.1 E13 Bqkg⁻¹. Dilution of Highly Tritiated Water (HTW) is no option in waste treatment.

Isotope exchanges in a catalytic membrane reactor using the PERMCAT process, was identified as a promising solution for treatment of HTW. In parallel to experiments with tritium at a small scale, a newly designed technical scale PERMCAT reactor has been submitted to tests with D_2O and H_2 , in order to fully characterize its performances and behavior in view of its future operation with tritium.

The paper will first present the experimental results obtained, with emphasis on the influence of increasing the throughput up to 0.5 molh⁻¹ water vapor at different swamping ratios. The effect of pressure and gas velocities on the decontamination factor will also be reported. Based on these experimental results, the outline design of a technical scale facility for demonstration with tritium of HTW processing using PERMCAT at TLK will be given, together with the expected process performances.