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Thermo-hydraulic Analysis of Forced Flow Helium Cooled Cryopanels of Cryopump Using Venecia Code

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Cryoadsorption cryopump with large pumping speeds application has been developed at the Institute for Plasma Research (IPR). These pumps are cooled with liquid helium for cryopumping panels below temperature 5K to adsorb hydrogen and helium gases and with gaseous helium for thermal shields at around 80 K during fusion reactor relevant applications. The panels are coated with activated carbon as sorbent. Sorbent with micro-pores adsorbs gases and the pores get saturated after certain duration of pumping operation. During regeneration by increasing the panel temperature adsorbed gases get removed. A cycle of operation is thus followed comprising, cool down from 80K to ˜4K and warm up from ˜4K to 80K during the normal operation cycle of the cryopump. Cryopanels and shielding panels are mostly hydoformed quilted stainless steel panels with sheet thickness of 1.5mm. Hydroformed panel of size 1000mm (l)x 200mm (w) with the same sheet thickness connected by inlet and outlet tubes are used as 4K cryopanel. Thermohydraulic analyses are carried out in Venecia software developed by Alphysica for the 24 Panel cryopump for different cooling schemes. To investigate the necessary mass flow rates and cool down time, optimized selection of the cryopanel arrangements, flow paths and manifolds is required. Results of cool-down time, mass flow requirement and temperature and velocity profile will be presented for different cooling and regeneration schemes.

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