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Testing of Full-Scale Prototype Cryoviscous Compressor at SNS for ITER Vacuum System

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To pump the ITER torus exhaust gas from the regenerating torus cryopumps, which will be a mixture of deuterium, tritium, and helium with trace impurities, a prototype cryoviscous compressor (CVC) has been designed, fabricated, and is under test. This prototype, which was based on successful demonstration of a sub-scale version, consists of a set of 24 5-cm diameter, 1.27-m long stainless steel tubes with embedded static mixer flow enhancements that is cooled with supercritical helium (SCHe) to cryopump the hydrogenic species while allowing helium to be exhausted through the CVC. In order to test the CVC, flow controls and vacuum jacketed piping were installed at a connection to the Cryogenic Test Facility (CTF) at the Spallation Neutron Source to cool the CVC with SCHe supplied at 4.5K and 3 bar. Helium heated to 20-30 K is used to regenerate the CVC. The CVC is designed to pump up to 20,000 Pa-m³ of deuterium that is mixed with 100 Pa-m³ helium gas with a flow rate of 200 Pa-m³/s. The integrated operation of the CVC with the CTF will be presented along with the performance test results of the CVC.

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Primary author: DUCKWORTH, Robert (Oak Ridge National Laboratory)

Co-authors: BAYLOR, Larry (Oak Ridge National Laboratory); DREMEL, Matthias (ITER); HECHLER, Michael (US ITER Project Office, Oak Ridge National Laboratory); MORROW, Michael (Oak Ridge National Laboratory); PEARCE, Robert (ITER); MEITNER, Steven (Oak Ridge National Laboratory); HA, Tam (Oak Ridge National Laboratory)

Presenter: DUCKWORTH, Robert (Oak Ridge National Laboratory)

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