

Fusion Material Irradiation Test Facility (FMITS) at SNS

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Abstract

A conceptual level design for a fusion materials irradiation test station (FMITS) for installation at the Spallation Neutron Source (SNS) has been completed. Samples would be located within two horizontal, 19-mm-diameter tubes in front of the mercury target, one above and one below the mid-plane. Each tube has an outer water jacket and a gas insulating layer with an inner 12-mm-diameter sample holder. The sample positions relative to the beam would be selected for each experiment, but for the purpose of demonstration this report includes 17.5-cm-long sample regions located 3 cm above, and 5 cm below mid-plane, in front of the mercury target, where the back scattering neutron flux spectrum should be close to the ITER fusion spectrum.

The concept includes a new water-cooled target shroud design with accommodation for the FMITS tubing, thus avoiding interference between the target assembly and the inner and outer reflector plugs. Thermal analysis shows that the gas mixing system is capable of maintaining sample temperatures as high as 600°C even if beam average power varies by 50%. The FMITS assembly is designed to be installed over a target module and can be reused with multiple targets. This report describes the design concepts for the FMITS gas system with additional hardware and controls, the mechanical layout of the FMITS assembly including an example experiment, revisions to the existing target shroud, target carriage modifications for FMITS utilities, and remote handling procedures and logistics. Safety and reliability impacts were also evaluated and appear to be acceptable.