

Status of the STS Target Segment Manufacturing R&D

Tuesday, 29 October 2024 09:00 (25 minutes)

The target assembly for the Second Target Station (STS) at Oak Ridge National Laboratory is working towards final design approval in late 2025, and R&D continues to focus on the manufacturing of the target segment. The novel design of the target segment and unique combination of materials (tungsten, tantalum, copper, and Inconel) has driven the process development towards solid state bonding techniques (vacuum hot pressing (VHP) and hot isostatic pressing (HIP)). The mismatch in thermal expansion between tungsten and Inconel, combined with the wedge-shaped geometry, create challenges for material interface bonding; however, the resulting “shrink fit” of the Inconel shroud around the tungsten/tantalum spallation package creates a beneficial state of compressive residual stress in the tungsten. The corresponding tensile residual stress state in the Inconel must therefore be accounted for in the fatigue lifetime estimate of the shroud. The HIP process is being developed through a series of small-scale test articles that mimic geometrical features of the target segment, and a smaller number of full-scale test articles to exercise the HIP process on prototypical geometry. VHP coupon samples are used to characterize material interface shear strength and thermal diffusivity as a function of bonding pressure. Corresponding simulations of the HIP process are leveraged to predict the bonding pressure, so that the expected bond quality can inform performance models. Furthermore, a verification is required that the residual stress prediction in the Inconel is conservative, so diffraction-based techniques using X-rays and neutrons have been used to compare with the simulation predictions. The process development status and current results are presented along with the remaining R&D tasks supporting the final design completion.

Primary author: Dr MACH, Justin (Oak Ridge National Laboratory)

Presenter: Dr MACH, Justin (Oak Ridge National Laboratory)

Session Classification: Spallation neutron/muon source component, systems & materials related technology and innovation

Track Classification: Spallation neutron/muon source component, systems & materials related technology and innovation.