Contribution ID: **45** Type: **not specified**

Applying a Pressure System Safety Code to Spallation Target Design

Tuesday, 29 October 2024 09:50 (25 minutes)

The Second Target Station (STS) project at Oak Ridge National Laboratory (ORNL) has entered preliminary design review activities with an innovative edge-cooled spallation target. The tungsten/tantalum laminate spallation block is clad in copper and contained inside a thick Inconel shroud. The shroud provides structural support. It also provides thermal management by flowing water through cooling channels. This structure is subsequently bonded to a stainless steel support.

This talk will present challenges and successes in applying a pressure system safety code to the STS target design. Specifically, Section VIII Division 2 Part 5 (Design by Analysis) of the ASME Boiler & Pressure Vessel Code (BPVC) is used to analyze the Inconel shroud and stainless steel support against static and cyclic failure modes.

For static loading, an elastic-plastic analysis is appealing, however, the special geometry and loading of the spallation target presents challenges with the factored load methodology. For cyclic loading, Inconel 718 in the solution annealed form is considered a special material by the Code, and the Hot Isostatic Pressure (HIP) manufacturing operations induce significant residual stresses in the shroud. The plastic deformation and subsequent residual stresses from manufacturing create challenges with determining elastic-plastic material curves, fatigue curves with mean stress effects, and stress margins. Modifications and comparisons will be presented for fatigue models and plastic ratcheting assessment.

As will be shown, residual stresses from manufacturing drive the design performance. The challenges of simulating HIP, machining, and welding steps will be presented. These enhanced simulation tools are then used to further inform design choices for manufacturing.

Primary author: TIPTON, Joseph B. (1. Oak Ridge National Laboratory, Oak Ridge, TN, USA)

Co-author: MACH, Justin

Presenter: TIPTON, Joseph B. (1. Oak Ridge National Laboratory, Oak Ridge, TN, USA)

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

Track Classification: Application of new materials data and/or safety codes, computational modelling/analysis.