Contribution ID: **479** Type: **Oral**

Tungsten-steel composites fabricated by roll bonding and ultrasonic welding for structural use in plasma-facing components

Wednesday 7 June 2017 12:00 (20 minutes)

Current fusion reactor designs often use a tungsten (W) to copper joint as part of the cooling structure in the plasma-facing components. Future fusion reactors may operate at temperatures above the operating window for copper. Therefore, robust joints between W and advanced steels are desired for fabricating plasma-facing components. A W-steel composite or functionally graded material is advantageous to minimize the stresses at the interface because of the thermal expansion coefficient mismatch between W and steel. Here, two methods of creating W-steel composites are examined: hot rolling and ultrasonic welding. Both methods utilize W foil because it has a ductile to brittle transition temperature below room temperature. Three initial thicknesses of W foil were utilized to fabricate the composites, 25 μm, 100 μm, and 250 μm. Before composite fabrication, each foil thickness has a different crystallographic texture and different grain size distribution. The differences in W foil properties resulted in different properties of the composites. The hot rolling method is a standard processing method and results in a significant intermetallic bond layer between the steel and the tungsten. The ultrasonic welding method is advantageous because it is a solid-state joining technique that reduces the thickness of intermetallic formed. However, ultrasonic welding of refractory metals presents other challenges such as a tendency of the W foils to shatter or delaminate during processing. The composites were analyzed with scanning electron microscopy and energy dispersive X-ray spectroscopy. Tensile and hardness tests were performed on the composites.

This work was supported by the Office of Fusion Energy Sciences, U.S. Department of Energy, under contract DE-AC05-00OR22725 with UT-Battelle, LLC.

Eligible for student paper award?

No

Authors: GARRISON, Lauren (Oak Ridge National Laboratory); MOON, Jeremy (Oak Ridge National Laboratory); KATOH, Yutai (Oak Ridge National Laboratory); NORFOLK, Mark (Fabrisonic LLC); WENNING, Justin (Fabrisonic LLC); OHRINER, Evan (Oak Ridge National Laboratory)

Presenter: GARRISON, Lauren (Oak Ridge National Laboratory)

Session Classification: W.OA1: Materials II

Track Classification: Materials and fabrication