23P4F17

Bonding strength evaluation of VPS-tungsten coated F82H using ultra-small double notch shear compression testing

Wu Xiangyu [1], S. Kondo [2], H. Yu [2], Y. Okuno [2], R. Kasada [2]*

1) Tohoku Univ., 2) IMR, Tohoku Univ.

The evaluation of the interface bonding strength is of great significate for assuring the feasibility of material designs of dissimilar bonding structures in various devices and components including fusion power plants. Particularly, the tungsten coated reduced activation ferritic/martensitic steel (F82H) shows promise in the first wall of blanket structural components which require a good interface bonding strength to resist thermal load during service. However, due to the limited thickness of the tungsten coating layer and interface area in such tungsten coated F82H, it is still difficult to properly measure the bonding strength by using conventional mechanical testing.

In the present study, the ultra-small double-notch shear (DNS) compression test was utilized to evaluate the bonding strength of vacuum plasma spraying (VPS) tungsten-coated F82H at room temperature. To comparably analyze the strength result of the interface area, the DNS compression tests were performed on tungsten, F82H, and bonding interface areas. In addition, all the DNS pillars were fabricated in different sizes, and the ratio of notch distance to the side length of pillars is kept below 0.5. The results of DNS compression tests on tungsten showed brittle fractures not only occurred at the shearing plane but also at other parts of the pillar, and the obtained shear stresses differ greatly from each other and are smaller than the tungsten coating of explosive welded tungsten-foil coated F82H[1]. However, the results of DNS F82H indicated a typical plastic deformation and fracture within the localized shear region, and their shear stresses were in good consistency with the value. Moreover, DNS results at the interface displayed significant differences both in fracture types and in the value of shear stresses due to the non-uniform interfacial area. In this study, we further investigated the microstructures and fracture surfaces appearance. The shear strength of the interface area will be discussed.

[1] X. Wu, R. Kasada et al. *Materials Science and Engineering: A*, 826 (2021): 141995.