

**Proceedings of the 4<sup>th</sup> IEA International Workshop  
on Beryllium Technology for Fusion**

Karlsruhe, Germany, Sept. 15-17, 1999, pp. 49-55

**BERYLLIUM AND TUNGSTEN BRUSH ARMOR  
FOR HIGH HEAT FLUX APPLICATIONS**

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The inability to successfully join low thermal expansion armor materials such as beryllium and tungsten to high thermal expansion heat sink materials has been a major problem in plasma facing component (PFC) development. Conventional planar bonding techniques have been unable to withstand the high thermal induced stresses resulting from fabrication and high heat flux testing. Thermomechanical modeling has shown the desirability of using a brush like structure for plasma facing component armor because of the reduction in the stress at the armor/heat sink interface. Small-scale divertor mockups have been fabricated with beryllium and tungsten brush armor. The brush armor materials fabricated to date have been with preformed tungsten and beryllium rods, which are backed with specific matrix materials. These matrix materials are then used to bond the armor to copper alloy and aluminum alloy heat sinks. The results of high heat flux testing experiments by Sandia National Laboratories (SNL) in its Electron Beam Testing System (EBTS) of this revolutionary armor concept have been outstanding. PFC mockups using the tungsten brush armor have survived cyclic loading (10s beam on, 10s beam off) for 500 cycles apiece at 5, 10, 15, 22 and 30 MW/m<sup>2</sup> with no damage to the heat sink and little or no damage to the armor. A discussion of the methods used during the fabrication of beryllium and tungsten brush structures will be presented. Items of particular interest include measurement of the bond strength between the brush and its matrix material, results of heat treating on the matrix material and techniques for joining the brush structures to heat sink materials. The latest high heat flux test results and an analysis of these results will also be included.