

IFE First Wall Survival : Development and Testing of a Refractory Armored Ferritic

L Snead¹, G. R. Romanoski¹, C. A. Blue¹, J. Blanchard²

¹*Oak Ridge National Laboratory, Oak Ridge TN 37830-6140*

²*University of Wisconsin, Madison WI 53706*

Two unique characteristics driving IFE first wall design are the intense pulsed heat loading and the significant levels of high-energy implanted helium. A tungsten coating on ferritic steel is being developed to handle the spiked heating of IFE while retaining the benefit of low activation. This paper will present the development and testing of refractory armored ferritics. Specifically, various fabrication methods were explored including the primary candidate vapor plasma spraying. Testing has focused on the response of the tungsten coating to helium implantation and cyclic thermal heating. Results indicate that the high-dose helium implantation, which was a serious concern to cause spalling of the tungsten surface leading to unacceptable erosion, is likely manageable through prudent selection of tungsten microstructure, chamber size, and annealing temperature. The second major area of testing has been on the thermal fatigue of the tungsten/ferritic duplex using a pulsed infrared testing stand. Specifically, tungsten/ferritic samples have been thermally fatigued to 10,000 pulses at a peak of 23.5 MW/m² without interfacial failure. In addition to a review of this testing and development work, next generation “engineered” structures under studied will be presented.