Boron-Loaded Tungsten Surface
for DEMO First Wall and Divertor*

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For the ITER design, the design guidance is to apply a Be layer onto the plasma facing chamber surface. When extrapolated to the DEMO design the Be layer will not be suitable due to radiation damage. Similarly, carbon surfaces will not be suitable due to nuclear radiation damage of the material and high physical and chemical sputtering rates. Unfortunately, the commonly proposed material tungsten (W) could suffer radiation damage from alpha particle implantation and resultant blistering at the first wall and the formation of submicron fine structure at the divertor. These effects could result in W influx to the plasma core and severely limit the plasma core performance. To resolve this potential impasse, different innovative material options have been proposed. We note that boron and silicon have been used to condition all high performance tokamak experiments with positive results for plasma purity (or performance). In order to maintain a boronized layer on the chamber wall for steady state operation, it was found that real-time boronization will be required. This boronized layer could also protect the W substrate while retaining low-Z wall characteristics. Based on these observations, the use of a boron-loaded W surface is proposed to withstand occasional ELMs and disruptions while retaining the capability of transmitting high-grade heat for power conversion. Development of this BW-surface concept will be reported.

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