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Evaluation of Silicon Carbide Coatings as Primary Armor Material in DIII-D H-Mode Discharges[1] TYLER ABRAMS, S. BRINGUIER, D.M. THOMAS, G. SINCLAIR, S. GONDERMAN, L. HOLLAND, GA, D.L. RUDAKOV, UCSD, R.S. WILCOX, E.A. UNTERBERG, ORNL — Silicon carbide coatings on ATJ graphite exposed to 25 H-mode plasma discharges with edge localized modes (ELMs) in the DIII-D lower divertor demonstrated minimal changes to the macroscopic or microscopic surface morphology. Post-exposure compositional analysis reveals Si enrichment of about 10%. To interpret these results, an analytic surface model is developed using calculated physical and temperature-dependent chemical sputtering yields from Si, SiC, and C (graphite). The Si content in the plasma-facing surface layer is predicted to increase with both surface temperature and divertor electron temperature, $T_{e,div}$, due to more efficient physical and chemical sputtering yields of C relative to Si. The total gross erosion of Si from this mixed Si-C-SiC layer increases strongly with $T_{e,div}$ but erosion of C stays relatively constant. These trends are reproduced by measurements obtained via spectroscopic inference using the S/XB method. Quantitatively, the model slightly under-predicts the measured erosion rates; this is attributed to ELMs, which have minimal (but non-zero) impact on SiC erosion. Extrapolating to a case with all-SiC walls in DIII-D, an order-of-magnitude decrease of the overall C source is predicted, motivating further investigation of SiC as a non-metallic plasma-facing material with favorable erosion properties.

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