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Measurements of gross erosion of Al in the DIII-D divertor

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Abstract

Aluminum (Al) is a convenient proxy for beryllium (Be) plasma material interaction studies since they have a number of physical and chemical similarities. Al samples were exposed at the lower outer strike point of an L-mode divertor plasma in DIII-D (conditions 7-11×10^{18} D-ions $cm^2 - s$, T_e = = 12–47 eV). The gross erosion rate was directly measured using post-mortem ion beam analysis of small 1 mm-sized samples where local re-deposition was determined to be negligible. The gross erosion rate was also calculated using spectroscopic methods, but these rates greatly underestimate the direct (i.e. non-spectroscopic) measurement. The direct measured erosion yields were within the range of published $D^+ \rightarrow$Al ion beam sputtering yields. The ionizations per photon (S/XB) coefficients used in the spectroscopic analysis were determined in separate experiments using He plasmas at the PISCES-B linear plasma facility at UCSD. The measured S/XB coefficients were on average ~6X higher than the theoretically calculated values.