Characterization of Chemical Sputtering Using the Mark II DiMES Porous Plug Injector in Attached and Detached Divertor Plasmas of DIII-D*

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An improved, self-contained gas injection system for the Divertor Material Evaluation System (DiMES) on DIII-D has been employed for *in-situ* study of chemical erosion in the tokamak divertor environment. The Mark II porous plug injector (PPI) releases methane from the tile surface into the plasma at a rate precisely controlled by a small orifice flow restrictor, through a porous graphite surface into the divertor plasma at the outer strike point (OSP). Perturbation to local plasma is minimized, while also simulating the immediate environment of methane molecules released from a solid graphite surface. The release rate was the same order of magnitude as natural sputtering, ranging from 1.5-6.7x10^{17} C/s and corresponding to the carbon release rate at intrinsic chemical erosion yield of 1-3% in both attached and detached divertor plasmas. Photon efficiencies of CH_4 for measured local plasma conditions are reported and compared to previous results. The contribution of chemical versus physical sputtering to the source of C^+ at the target is assessed through measurement of CII and CD/CH band emissions during release of CH_4 from the PPI, and due to intrinsic emission. A novel method based on historical CD-band emission analysis after boronization in DIII-D is implemented to account for BD-band contamination of the 4290-4310A CD/CH-band emission. Finally, broadband spectroscopic data from DIII-D is interpreted for the first time with consideration of a quantified lower detection threshold on the CCD detector of the Multichord Divertor Spectrometer (MDS).

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