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Carbon Release Mechanisms in the DIII-D Divertors[1]

R.C. ISLER, R.J. COLCHIN, J.T. HOGAN, Oak Ridge National Laboratory, N.H. BROOKS, T.E. EVANS, W.P. WEST, GA, D.G. WHYTE, UCSD — Carbon release mechanisms are examined through analysis of fluxes and spectral profiles of C I, CD and C_2 emissions. Physical and chemical sputtering are the major production processes. The C I influx,Γ_{CD}^{total}, reflects the total carbon fueling rate; contributions from chemical sputtering are estimated from the measured molecular fluxes using $\Gamma_{CD}^{total} = 52 \times \Gamma_{C_2} + (\Gamma_{CD} - 8 \times \Gamma_{C_2})$. The first term accounts for dissociation of C_2D_y and C_3D_y and the second for dissociation of CD_4. When flux measurements indicate chemical sputtering dominates, the effective C I temperatures tend to lie in the range 1.0 ± 0.2 eV, as expected from molecular breakup. When $P_{inj} \geq 9$ MW, molecular emissions are not usually evident, and effective C I temperatures reach values consistent with high-energy physical sputtering, 4-5 eV. These results suggest the fractions of C I generated by each mechanism may be evaluated from its effective temperature. The apparent suppression of chemical sputtering from the plasma-facing a-C:H/DLC layer has been studied with the BBQ and CASTEM codes.

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