Determination of carbon release mechanisms in the DIII-D divertors from analysis of C I line profiles

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Abstract. During typical operation of the DIII-D tokamak, physical and chemical sputtering are the most important mechanisms for release of carbon at the divertor targets [J.L. Luxon, Nucl. Fusion **42**, 614 (2002)]. Modeling of C I spectral line profiles is discussed as a technique for evaluating the relative contribution of each process and is applied to several types of discharges. The line shapes are symmetric and have shifts of about -0.03 Å if they are produced solely from molecular dissociation, but they exhibit distinct asymmetries and shifts approaching -0.20 Å if generated by physical sputtering. Modeled profiles must, in general, take account of both mechanisms in order to match experimental data. An alternate approach to distinguishing between the two processes, which relies on the relative intensities of C I, CD, and C_2 emissions, is examined in light of conclusions drawn from the line-shape analysis.

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