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In-Situ Cavity Ringdown Spectroscopy of Methane Produced by Chemical Erosion of Carbon Surfaces by Deuterium Ions K.R. UMSTADTER, E. HOLLMANN, M. GHARAVI, R. DOERNER, G. TYNAN, University of California San Diego-CERFE — Carbon plasma-facing surfaces in tokamaks are subject to chemical erosion due to hydrocarbon (e.g.CD_4,C_2D_6) formation when deuterium ions and atoms are present. Understanding the formation, transport, breakup, and redeposition of these hydrocarbons is important for predicting the amount of tritium, which will become stored in the walls of ITER during operation. Traditionally, CD_4 release from carbon surfaces is estimated by using passive spectroscopy of CD-band emission. Calibration of these measurements requires either complex modeling of the CD_4 to CD breakup chain in the plasma or injection of a calibrated flow of CD_4 from the material surface. Ideally, one would like a direct, non-perturbing measurement of the methane production at the plasma-facing surface under a variety of plasma conditions. We are developing a technique that accomplishes this by using near-IR cavity ringdown spectroscopy: a high-Q cavity whose optical path includes the near-surface region of the carbon tile allows for in-situ monitoring of CD_4 production in the PISCES-A plasma device. By simultaneously measuring the absorption of IR radiation by CD_4 molecules and emission of CD-band photons, we can determine the range of plasma conditions where CD emission provides an accurate measure of CD_4 release. This work supported by grant DE-FG03-95ER-54301 from the US DoE.

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