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Laser-Induced Fluorescence for Sheath Characterization in Low-Density Argon Plasmas[1] ALEXANDER C. ENGLESBE, KAPIL U. SAWLANI, JOHN E. FOSTER, University of Michigan, Ann Arbor — Laser-induced fluorescence (LIF) spectroscopy has become a standard non-intrusive diagnostic technique for determining the energies and concentrations of ion and neutral species in plasmas. A limitation of this technique, however, is the small signal-to-noise ratio incurred when interrogating relatively low-density plasmas. This problem is exacerbated when examining regions such as the sheath at an electrode immersed in the plasma. If ion energetics within the sheath are of interest, then in principle thicker sheaths are desirable in that for a given laser spot size, the potential structure can be inferred with high resolution. We present a methodology for accomplishing LIF in the sheath of a low-temperature argon plasma with an electron density of the order $10^7 - 10^8$ cm^{-3}. This diagnostic is being developed for the purpose of studying the effect of secondary electron emission on sheath potential behavior in low-density plasmas. The plasma in this study is produced in a multipole ring-cusp ion source. A tunable diode laser excites the Ar II transition at 668.61 nm, which fluoresces at 442.72 nm. The LIF measurements of the ion density are corroborated with electrostatic probes at fixed locations, and the ion velocity distribution within the sheath is determined.

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