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Confocal LIF Measurements of the Plasma Meniscus Boundary¹

DAVID CARON, DEREK THOMPSON, West Virginia University, COSTEL BILOIU, Applied Materials, EARL SCIME, West Virginia University — The extraction of ion beams from plasmas has found many applications over the years; from neutral beam heating in tokamaks to ion engines on spacecraft. One major application is in semiconductor manufacturing where it is used in ion implantation and the etching of silicon wafers. The characteristics of these ion beams are strongly dependent on the plasma-vacuum boundary, i.e., the plasma meniscus. The meniscus controls the beam emittance, a key parameter that determines manufacturing rates and efficiency. To this end we used WVU's confocal system to perform laser induced fluorescence (LIF) measurements of the plasma boundary. The confocal system is unique in that it allows for the injection and collection of light along the same axis and can probe into the optically restricted area inside the reactor. With this optical system, we scan single points inside and outside the reactor to create a meniscus depth profile at different source parameters. Here we present measurements of the ion temperature and bulk flow at and around the meniscus boundary as a function of meniscus shape. Armed with knowledge of ion properties in the meniscus, it should be possible to tailor ion beams for a wide range of applications and industries.

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