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Low Pressure Discharge Initiation and LIF Diagnostic in a High Power Argon Helicon Plasma[1] MATT WIEBOLD, JOHN SCHARER, HE REN, University of Wisconsin - Madison — A flowing argon helicon plasma is formed in a 10 cm diameter, 1.5 m long Pyrex chamber with a peaked axial magnetic field, variable up to 1 kG. Upgrades have allowed for operation at high, pulsed RF powers (up to 10 kW at 13.56 MHz) and low flow rates and pressures (as low as 1 sccm, 10^{-5} Torr). Neutral-collisional plasma exists upstream of the half-turn, double helix antenna and neutral-collisionless plasma exists downstream, leading to bulk plasma acceleration due to reduced neutral drag. Microwave interferometry (105 GHz) and collisional radiative spectroscopic codes are used to measure electron density and temperature. An initial transient high-density peak ($>10^{14}$/cc) is seen observed followed a neutrally depleted steady state plasma ($>10^{12}$/cc). Neutral depletion is observed along with substantial plasma acceleration. Initial LIF results using a new MOPA system are reported. A static magnetic field threshold for discharge initiation is seen at low flow rates. Evidence is given that this is a consequence of the magnetic field quenching a multipactor discharge, which is the dominant mechanism for breakdown at low flow rates and pressures. A magnetic field ramping technique for starting discharges under these conditions is described.

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