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Langmuir probe measurements in a VHF dielectric plasma etcher
LEONID DORF, KARTIK RAMASWAMY, KEN COLLINS, WALTER MERRY, Applied Materials — Langmuir probe (LP) measurements in a realistic VHF CCP discharge are complicated by a number of factors, such as absence of a well-defined DC ground reference and unpredictable behavior of standard electronic components at VHF. The VHF source can produce plasma very efficiently; therefore, to reach the same plasma density, VHF discharges require lower power than HF discharges. Nevertheless, even at low source power (∼100–200W with $N_e \leq 10^{10}$ cm^{-3}), RF potential in a VHF CCP discharge can be large, especially compared to that in an ICP discharge with similar parameters. Uncompensated RF potential distorts both electron and ion parts of the measured V-I characteristic, resulting in unrealistic plasma parameters. Here, we present preliminary results of our work to develop a LP system suitable for measurements in a 162 MHz dielectric plasma etcher. The probe design employs many previously developed RF compensation techniques. Furthermore, all electronic components of the probe and the measuring circuit were characterized using a network analyzer to select adequate values. The probe was used to study the effects of magnetic field, input power, pressure, and other operating conditions on electron and ion density profiles. Electron temperature was found to be in the range of 1.8 – 3.5 eV, and the shape of ion saturation curve was found to be in agreement with OML theory.

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