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Wafer-level plasma parameters measurements in a multi-frequency capacitively coupled plasma discharge L. DORF, S. RAUF, J. KENNEY, K. BERA, N. MISRA, K. COLLINS, Applied Materials — Two complications with wafer-level measurements in a CCP discharge are very high DC (∼ -1kV) and RF (∼2kV peak-to-peak) voltages of the substrate, and the lack of theoretical basis for interpretation of volt-ampere characteristics (VACs) of the probes inside the RF sheath. In this work, we present the diagnostic apparatus that measures ion current to the wafer, along with near-sheath plasma density (ne) and electron temperature (Te). Particle-in-cell (PIC) and fluid plasma simulations are used to help interpret collected VACs. Measurements are performed using a set of radially distributed planar double probes (DP). The external circuitry provides: (1) DC isolation and RF filtering, (2) bias to the probes, (3) switching between the probes, and (4) probe current measurements. Results of wafer-based measurements at a variety of rf-frequencies (2, 13, 162 MHz), rf power levels (300 – 1000 W), neutral pressures (30 – 100 mT), chemistries (Ar, O2, Ar/CF4), and magnetic field configurations are presented. At low frequency, pressure was found to have stronger effect on ion current and plasma density than that at intermediate and high frequencies; in all chemistries. Magnetic field was confirmed to be a powerful knob for controlling radial uniformity of the discharge at all frequencies; namely, edge current and density tend to increase with application of the magnetic field.

Leonid Dorf
Applied Materials

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