

Abstract Submitted
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Noninvasive sheath diagnostics in an inductively coupled plasma using a remote RF sensor SATORU KOBAYASHI, SHAHID RAUF, KEN COLLINS, Applied Materials — A commercial RF voltage/current (VI) sensor, mounted in the match circuit of an ICP chamber, is used to diagnose plasma density, sheath voltage and ion-energy distribution. The electrical measurements are related to plasma properties utilizing the algorithm proposed by Sobolewski (2000). This approach was previously confirmed by the authors in a commercial CCP chamber in which the VI probes were mounted on a surface close to the cathode surface, providing precise real-time RF VI signals. The VI sensor in the current work is mounted at the output of the match circuit with a complicated transmission line structure in-between. To transfer the RF voltage and current measurements at the match to the cathode surface, an ABCD matrix is calculated using the FDTD method for the specific cathode and chamber design. The resulting ABCD matrix well reflects the physical structure of the chamber, which allows one to approximate the ABCD matrix using simplified circuit concepts as well. The transformed voltages at 13.56 MHz are often 1.5 times larger than the measurement at the match, even though the total line-length is about 50 cm, which is attributed to the high characteristic impedances of some of the coaxial lines. The computed electron density is compared to measurements using a microwave resonant cavity probe and a Langmuir probe. The modeling shows good agreement with measurements.

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