Abstract Submitted
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Characterization of Inductively Coupled Plasmas in High Power, High Pressure Regime JUN-CHIEH WANG, JASON KENNEY, ANKUR AGARWAL, MICHAEL NICHOLS, JAMES ROGERS, SHAHID RAUF, Applied Materials, Inc — Inductively coupled plasmas (ICP) are widely used in the microelectronic industry for thin film etching. ICPs have typically been operated at low gas pressures (<50 mTorr) and they have been well-characterized in this regime. Several applications requiring high etch rates (e.g., vertical NAND etch) have recently extended the use of ICPs to the high power (>4000 W) and high pressure (>100 mTorr) regime. ICP operation in this high-power, high-pressure regime imposes a tremendous challenge of achieving good plasma uniformity over large substrates. This necessitates a good theoretical understanding of the underlying physics, thorough experimental characterization, and more accurate numerical models for hardware design guidance. In this study, we will focus on the characterization of ICP in the high-power, high-pressure regime. Computational modeling is done using CRTRS, our in-house 2D/3D plasma model. The fluid plasma model is coupled to a circuit model to self-consistently account for the capacitive coupling from the coils that is expected to dominate in this operating regime. Properties of Ar plasma will be discussed and compared with experiments. The impact of critical operating parameters such as ICP power, pressure, flow rate, and current ratio (in multi-coil antenna structures) on plasma characteristics will be examined. Results in relevant processing gases will also be discussed.

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