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Extended plasma parameter extraction using in-line RF metrology for multi-frequency plasma reactors STEVEN SHANNON, DANIEL HOFFMAN, MATTHEW MILLER, Applied Materials Etch Engineering Technology Group — In-line RF metrology combined with plasma discharge models is a convenient, non-intrusive means for obtaining plasma parameters in industrial processing discharges. [1] Typically, this analysis is performed at the fundamental RF drive frequency used to sustain the discharge, and provides two equations (real and imaginary discharge impedance) from which at least two plasma parameters can be independently determined. This necessitates approximation of other plasma parameters such as discharge asymmetry and electron – neutral collision frequency to obtain accurate outputs. Currently, many state-of-the-art plasma reactors used for semiconductor manufacturing use multiple frequencies for independent control of multiple plasma parameters. [2] The purpose of this work is to demonstrate the extended capabilities of this in-line RF diagnostic when multiple frequencies are used to drive a CCP discharge, with particular focus on the replacement of approximated plasma parameters with calculated plasma parameters using this multi-frequency approach, and the extension of real time parameter tracking in plasma processing that it can provide.

[1] Bull. Am. Phys. Soc. **48** (5)
[2] IEEE Conf. Rec. 05CH37537 - 2005 Int. Conf. Plasma Sci., Talk 10498

Steven Shannon
Applied Materials Etch Engineering Technology Group

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