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Application of an RF Biased Langmuir Probe to Etch Reactor Chamber Matching, Fault Detection and Process Control

DOUGLAS KEIL, JEAN-PAUL BOOTH, NEIL BENJAMIN, CHRIS THORGRIMSSON, MITCHELL BROOKS, MIKIO NAGAI, LUC ALBAREDE, JUNG KIM, Lam Research Corporation — Semiconductor device manufacturing typically occurs in an environment of both increasing equipment costs and per unit sale price shrinkage. Profitability in such a conflicted economic environment depends critically on yield, throughput and cost-of-ownership. This has resulted in increasing interest in improved fault detection, process diagnosis, and advanced process control. Achieving advances in these areas requires an integrated understanding of the basic physical principles driving the processes of interest and the realities of commercial manufacturing. Following this trend, this work examines the usefulness of an RF-biased planar Langmuir probe[1]. This method delivers precise real-time (10 Hz) measurements of ion flux and tail weighted electron temperature. However, it is also mechanically non-intrusive, reliable and insensitive to contamination and deposition on the probe. Since the measured parameters are closely related to physical processes occurring at the wafer-plasma interface, significant improvements in process control, chamber matching and fault detection are achieved. Examples illustrating the improvements possible will be given. [1]J.P. Booth, N. St. J. Braithwaite, A. Goodyear and P. Barroy, Rev.Sci.Inst., Vol.71, No.7, July 2000, pgs. 2722-2727.

Douglas Keil
Lam Research Corporation

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