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High Energy IED measurements with MEMs based Si grid technology inside a 300mm Si wafer

MERRITT FUNK[1], Tokyo Electron

The measurement of ion energy at the wafer surface for commercial equipment and process development without extensive modification of the reactor geometry has been an industry challenge. High energy, wide frequency range, process gases tolerant, contamination free and accurate ion energy measurements are the base requirements. In this work we will report on the complete system developed to achieve the base requirements. The system includes: a reusable silicon ion energy analyzer (IEA) wafer, signal feed through, RF confinement, and high voltage measurement and control. The IEA wafer design required carful understanding of the relationships between the plasma Debye length, the number of grids, intergrid charge exchange (spacing), capacitive coupling, materials, and dielectric flash over constraints. RF confinement with measurement transparency was addressed so as not to disturb the chamber plasma, wafer sheath and DC self-bias as well as to achieve spectral accuracy The experimental results were collected using a commercial parallel plate etcher powered by a dual frequency (VHF + LF). Modeling and Simulations also confirmed the details captured in the IED.

[1]In collaboration with Barton Lane, Lee Chen, Megan Doppel, Jianping Zhao, and Radha Sundararajan, Tokyo Electron, Austin Plasma Lab, Austin, Texas; Yohei Yamazawa and Chishio Kosimizu, Tokyo Electron Yamanashi, Technology Development, Hosaka, Japan.