
Study of plasma diagnostics and algorithm for Virtual Metrology in etch process plasma

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In semiconductor industry, plasma process diagnosis technique became more important than before. Process diagnosis is necessary to minimize process variation and in-situ process fault detection. However, in semiconductor industry's, research to plasma process diagnosis technique is still insufficient. In this study, we have studied the characteristics of the process plasma and the algorithm for virtual metrology utilizing the diagnostic data. We have developed the integrated diagnostic system capable of diagnosing plasma in the etching system and developed virtual metrology algorithm using the measured data in the integrated diagnostic system. The diagnostic devices such as mass/energy analyzer, Langmuir probe, cut-off probe, VI probe, high voltage probe, OES, etc. has be installed in the integrated diagnostic system. We measured the potential, electron temperature and density of the etch plasma, at the same time measured the voltage and current applied to the substrate electrode. And we measured the types of ions, active species and neutral species and their respective energies and compared them with plasma physical properties. Also, recent advances in technology are taking place abruptly and analyzed using diagnostic data such as OES by applying the machine learning method utilized in various fields and by this we developed an algorithm that can predict plasma density. In addition, this data are plans to be use to predict the etching process.

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