Anomaly detection during plasma etching process by high-sensitivity characteristic impedance monitoring

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High stability of plasma etching process is needed for manufacturing of semiconductor products. We have developed a method for high-sensitivity characteristic impedance (CI) monitoring for anomaly detection during plasma processing [1]. The time-delay-free and practical CI monitoring is achieved by using a directional coupler and newly developed vector processing equipment, Cross Domain Analyzer\textsuperscript{TM}. The system can simultaneously measure time variations of CI and higher-order frequency components of RF power when plasma is generated.

Figure 1 shows time variations of absolute values of CI, $|Z|$, and the signal of viewing port style plasma probe (VP probe) during etching process. VP probe can measure transient response of the electric potential on the inner glass surface [2]. When wafer fluttering occurs around 19 seconds, abrupt changes in $|Z|$ and signal of VP probe are clearly observed. This result suggests that the change in sheath capacitance causes the change in $|Z|$.

Our anomaly detection system using CI monitoring is useful for detection of sudden change such as wafer fluttering during plasma processing because of its sensitivity.