Development of Robust Endpoint Detection Algorithm for Cyclic Plasma Etching Process

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Endpoint detection (EPD) is necessary in plasma etching process to produce finely etched wafer under incoming and chamber-to-chamber variations. Since the etching process is usually scheduled to be completed in a fixed time period, the process cannot be controlled under those variations and unneeded patterns may appear on the wafer. Studies have been done on EPD with multivariate optical emission spectroscopy (OES) signals, but not on OES data in the cyclic plasma etching process. This study focuses on EPD of OES data under cyclic condition, where oscillation and tailing on each peak appear due to the RF/gas pulsing. In order to increase signal-to-noise ratio, low pass filtering is done in advance. Then, both principal component analysis (PCA) with T^2 statistic and support vector machine (SVM) are used for endpoint detection. PCA EPD algorithm, which is an existing EPD method, is implemented as a control group of the SVM classification. The result is that, the PCA algorithm showed 15 to 25 seconds EPD delay with a single training batch and 8 seconds delay with multiple training batches, whereas SVM algorithm detected endpoint with only 3 seconds delay.