The comparison of end-point detection between optical spectroscopy and residual gas analysis in silicon etching in NF3/Ar plasma

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Nowadays, Nitrogen-trifluoride (NF3) is mainly used as a reactive gas in cleaning and etching process in the semiconductor and display fabrication. In cleaning process, NF3 is generally highly dissociated as radicals containing fluorine in remote plasma source (RPS). Then, they flow down to chambers in order to remove by-products existing in chambers. In etching process, NF3 is directly discharged as a plasma, comparing to cleaning process. Then, NF3 plasma etches silicon, silicon dioxide, silicon nitiride and other materials.

We did silicon etching processes with NF3/Ar plasma. We compared results from end-point detection by optical emission spectroscopy (OES) with those by residual gas analyzer (RGA). For both the case of OES and RGA, more species intensity and signal, which containg fluorine, increase after finishing silicon etch. On the ohter hand, before finishing silicon etch, those decrease.

We used Capacitively Coupled Plasma (CCP) reactor. NF3 mixed with Argon was injected into the reactor to discharge plasma. The total sum of injected gas was constant. The plasma was discharged by RF generator (Radio-Frequency, 13.56 MHz) with matching-box. Pressure in the reactor was varied with manually pendulum valve.

Key words: Nitrogen-trifluoride (NF3) plasma, End-point detection (EPD), Silicon etching, Residual gas analyzer (RGA), Optical emission spectroscopy (OES)