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SiO_2 Film Etching Process Using Environment-Friendly New Gas C_5F_7H YUDAI MIYAWAKI, KEIGO TAKEDA, Nagoya University, AZUMI ITO, MASAHIRO NAKAMURA, Zeon Corporation, MAKOTO SEKINE, MASARU HORI, Nagoya University — With the continuous miniaturization of semiconductor memory devices, a much precise etching process for a high aspect ratio contact hole in SiO_2 film is indispensable. Furthermore, deterioration of the SiO_2 selectivity over a fragile, thin ArF photoresist would cause the sidewall roughness and poor pattern-width definition. In this study, we utilized a newly designed C_5F_7H gas. We compared the etch performances between the new gas and conventional C_5F_8. Ar and O_2 were introduced with the each fluorocarbon gas to controll the etching rate. A dual frequency (60 MHz / 2 MHz) capacitively coupled plasma was employed. The SiO_2 etching rate and selectivity to ArF photoresist were investigated as a function of O_2 flow rate. The maximum selectivity of only 3.7 and the SiO_2 etching rate of 416 nm/min were obtained at O_2 flow rate of 20 sccm for the $C_5F_8/O_2/Ar$ plasma. For the newly developed $C_5F_7H/O_2/Ar$ plasma, the maximum selectivity of 13.5 with the etching rate of 356 nm/min was achieved at 25-sccm O_2 flow rate. From these results, it was confirmed that almost four times higher selectivity than that of the conventional C_5F_8 gas was obtained by using the new C_5F_7H gas.

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