Dry Etching of SiO_2 Layers Using Low Global Warming Potentials Gases

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Impurity control and cleaningprocesses are essential in the semiconductor manufacturing. Etching processgenerates many contaminants. Among them, native oxide is considered as one ofcritical contaminant to remove because it causes higher contact resistance. [1]Typically wet cleaning processes are mainly applied to remove native oxidelayer in silicon devices. However, the wet processes are reaching the limits inhigh aspect ratio patterns in nanoscale and highly integrated devices. [2]Recently new dry-cleaning technology are being studied to overcome theseproblems of wet cleaning processes. [3] Many perfluorocarbon (PFC) such as CF_4,C_4F_8, and CHF_3 gases are widely used insemiconductor processes for etching and cleaning processes. PFCs are globalwarming gases and the have long lifetime, causing global warming problems. [4]

?In this work, plasma etchingprocess was studied for SiO_2 (native oxide) removal in aninductively coupled plasma (ICP) reactor with CHF_3, $C_3F_7OCH_3$,Ar, O_2 chemistries. After the etching process, etch rate andemission gases were analyzed and their etching characteristics were compared. Emissiongases were analyzed using FT-IR. Depending on the pressure and gas ratio,different etch rates were obtained. Cleaning rate was investigated by varyingbias voltage and ion density by monitoring the processes with a VI probe and anion probe. Removal rate were compared at various conditions of reaction gasesand plasma power and pressure. MMTCE values were about 90% lower than $CHF_3$when $C_3F_7OCH_3$ gases were used to etch SiO_2Layers.

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