## Low Global Warming Gases for Plasma Etching Processes

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Perfluorocompounds (PFCs) are widely used in various plasma etching processes in semiconductor device fabrication, but they are considered as major greenhouse gases causing global warming. PFC emission can be reduced by optimizing processes, recycling PFCs, abatement after processing, or replacing PFCs with low GWP gases. Among them, replacing PFCs with lower GWP gases is considered as the ultimate solution. Studies have been reported on the potential replacement of PFCs with various hydrofluorocarbons, unsaturated fluorocarbons, hydrogen-containing fluorocarbons, oxygen-containing fluorocarbons, and iodofluorocarbons, to replace PFCs. In this talk, the research on feasibility study of replacing PFCs with fluoroethers, fluoroalcohols, fluoroketones will be discussed for dielectric etching processes. Various fluoroethers, fluoroalcohols, and fluoroketones are pre-screened based on carbon/fluorine atomic ratio in molecules, molecular weight, boiling points, as well as global warming potentials, and ten candidate gases were selected. Various chemical reactions were analyzed in plasma phase and on surface etching for the screened gases. Three different C4H3F7O isomers of fluoroethers and a fluorocalcohol were compared for both reactive ion etching reactions and plasma-based atomic layer etching processes. The emission characteristics of the processes were analyzed, and we demonstrated that the fluoroethers and fluoroalcohols can reduce global warming potential of exhaust gases up to 90%.