Plasma-Enhanced Chamber Cleaning with CF3I Gas

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Periodicremoval of thick films coated at insides of CVD/ALD chambers is an importantrequirement to reduce the particle generation in solid-state devicemanufacturing technology. The plasma cleaning using fluorine-containing gases suchas CF4, C2F4, ClF, and NF3 is widely employed owing to their efficientreaction of -F radicals with the coated films and the high volatility of the by-products.Typically, NF3 plasmahas been dominantly used for cleaning of CVD/ALD chambersdeposited with Si, SiO2, SiN, and other materials. However, NF3 gas exhibits ahigh 100-year global warming potential of 17,200, which is considered as a majorcontributor to climate change and will be limited to use soon.

Hence,as alternative of NF3gas, several gases such as F2, F3NO, and CF3Ihave been considered in the chamber cleaning and pattern etching process forthe process chambers in semiconductor industry. Among these gases, CF3I hasvery low 100-year global warming potential of 0.4. However, the chamber cleaning ability of CF3I has rarely beendemonstrated and need tobe systematically studied further.

In this work, we have focused on feasibility ofCF3I gas for in-situ cleaning of the SiO2 CVD chamber using remote plasmasource instead of NF3 gas. Theclean rate and its uniformity on wafer with process parameters of relative gascontents, power of remote plasma, and chamber pressure were measured andcompared with CF3I and NF3 each other.The clean rate was increased with thepartial pressure of NF3 orCF3I and with the totally supplied amount of NF3 or CF3I. However, the uniformcleaning properties sensitively varied with process parameters.

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