Quasi-Atomic Layer Etching of SiO_2 Layers for Surface Cleaning of Nanoscale Patterns with Fluorocarbons having Low Global Warming Potential

김용재, 채희엽[†], 조예근, 이상인
성균관대학교
(hchae@skku.edu[†])

As the critical dimension shrinks in nanoscale, cleaning patterns gets challenging due to high aspect ratio. Typically wet cleaning processes are applied to remove native oxide, but they are reaching the limits in high aspect ratio patterns. Recently new dry-cleaning technology are being studied to overcome the limitations of wet cleaning processes. Many perfluorocarbon such as CHF_3, and C_4F_8 gases are widely used in semiconductor processes for etching and cleaning processes.
$C_3F_7OCH_3$ gas has lower global warming potential (GWP) of 530 than CHF_3 (12,400) and C_4F_8 (8,900). In this work, a cyclic quasi atomic layer etching process was developed for high aspect ratio patterns (5:1) for oxide removal with surface fluorination in an inductively coupled plasma (ICP) reactor. The process consists of two steps. In the first step, SiO_2 surface is modified with fluorocarbon polymers generated with $C_3F_7OCH_3$. In the second step the fluorinated oxide is removed with Ar or O_2 plasma. Cleaning rate was investigated by varying bias voltage. Self-limiting removal rate under 10 Å/cycle was confirmed and the removal rate dependence on gases and plasma power was investigated.