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UV/Ozone Etching Processes of Organic Films on Si Studied by XPS and AFM.

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Contamination control becomes extremely critical in semiconductor technology. The UV/Ozone dry etching process has been studied intensively to remove organic contaminats on Si wafers that are mainly due to residuals of photoresists(PR) used in the lithography processes.

In this experiment, an UV/Ozone etching system was installed in a glove box which is connected to a XPS/AES/SIMS surface analysis system so that specimens can be transferred from the glove box to the UHV surface analysis system without being exposed to the air. Photoresist layers spin coated on Si (100) wafers were treated in the glove box by heating and UV/Ozone etching. After the treatments, the specimens were transferred to the surface analysis system and analyzed by XPS. According to the XPS analysis, it was observed that the PR undergoes thermal decomposition and desorption at 350^{0}C. It also showed that the UV/Ozone etching at room temperature oxidized the surface of PR but the removal rate of PR was very low. XPS analysis of the PR surface UV/Ozone exposed at 250^0 C as a function of expose time indicated that the hydrocarbons in the PR oxidized to carboxyl or ketone functional groups and desorbs as CO_2 or CO.

Since the PR is very complex polymer mixture, the above experiment was performed again with a well defined model organic thin film such as self assembled octadecyltrichlorosilane(OTS) thin film on Si. The XPS study with OTS model organic films showed consistent results with the above suggestions. AFM study showed that the surface morphology of the SA film is very flat after 100 ^{0}C heating and roughness develops with UV/Ozone etching.