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Mechanism of Si Oxidation in $H_2/O_2/Ar$ Surface Wave Plasma
KEIGO TAKEDA, MASARU HORI, Department of Electrical Engineering and Computer Science, Nagoya University — In the plasma oxidation processes for forming dielectric films in ULSIs, the rare and O_2 mixture surface wave plasma with small amount of H_2 gas addition has been frequently used in order to obtain the higher oxidation rate. The Si oxidation rate in the SWP is increased at small amount of H_2 flow rate ratio around 0.2%, and then decreased at the H_2 gas flow rate ratio over 1%. This oxidation mechanism has never been clarified because the reaction is the very complex process by addition of H_2 gas. Therefore the effect of H_2 addition on Si oxidation in a $H_2/O_2/Ar$ SWP was investigated on the basis of behaviors of reactive species in gas phase. H atom, the ground ($^3P_2$) and excited ($^1D_2$) O atoms, OH radicals in the $H_2/O_2/Ar$ SWP were quantitatively measured by absorption spectroscopy. Electron and positive ions measured by Langmuir single probe and quadrupole mass analyzer. On the basis of these measurement and process results, we have investigated the mechanism of Si oxidation process with the $H_2/O_2/Ar$ SWP. From the result, it was found that $O(^1D_2)$ is a main oxidizing species in the Si oxidation with the SWP. Moreover, it is considered that the behaviors of H atom and positive ions affect the sticking coefficients of O atoms on the wafer.

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