
Remote Plasma ALD for Low dielectric

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As the dimensions of devices has been reduced to sub-100 nm, resistive-capacitive (RC) time delay has become one of critical issues of device performance due to increase of the parasitic capacitance of dielectrics and resistance. One of solutions to reduce RC delay is reducing the parasitic capacitance using a low k materials. Gatespacers also require low k materials to reduce the parasitic capacitance. In addition, gate spacers has some stringent requirements such as low temperature (<400°C), high etch resistance and highly conformal thin film growth.

Atomic layer deposition (ALD) has been attracted much attention as solution because its self-limiting nature can satisfy the requirements above mentioned. In addition, the introduction of plasma can lower the deposition temperature. Thus, plasma ALD has been considered as the best promising deposition method for low k gate spacer.

In this work, we will discuss the trend of low k dielectric ALD studies and report the results of SiOC, SiOCN, and SiCN ALD. We used remote plasma ALD system. Octamethylcyclotetrasiloxane (OMCTS) and O₂, Ar, H₂, and N₂ plasmas were respectively used as a precursor and reactants for SiOC and SiOCN thin film deposition. Bis[(diethylamino)dimethylsilyl](trimethylsilyl)-amine (DTDN-2) and N₂ plasma were used as a precursor and reactant for SiCN thin film deposition. X-ray photoelectron spectroscopy (XPS), Auger electron spectroscopy (AES), transmission electron microscopy (TEM), I-V measurement, C-V measurement, and wet etch rate (WER) test were performed for investigating the characteristics of low k dielectric films.

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