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A Study for Properties of SiOC(-H) Thin Films with Low-κ Formed by UV-Assisted PECVD Method

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Low dielectric constant SiOC(-H) thin films were deposited on *p*-type Si(100) substrates by UV-assisted PECVD with a mixture of dimethoxydimethylsilane (DMDMS: $C_4H_{12}O_2Si$) and oxygen precursors. The emission intensity of plasma was observed by optical emission spectra (OES). During the application of UV irradiation, the intensity of CO, CH, C_3, OH species rapidly increased than that of without UV irradiation. Film thickness are measured by field emission scanning electron microscopy (FESEM). The deposition rate of films with UV irradiation increased than that of films without UV irradiation. Bonding configurations of Si-O-Si, Si-O-C, Si-CH_3, and OH-related bonds in the SiOC(-H) films were investigated by Fourier transform infrared (FTIR) spectroscopy. The electric properties including capacitance-voltage (C-V) and current-voltage (I-V) characteristics were investigated using metal-insulator-semiconductor (MIS), Al/SiOC(-H)/*p*-Si structure. The dielectric constant, fixed charge density and flat band voltage shift at 1 MHz were measured by using a HP4280A, HP4140B meter. When [DMDMS/(DMDMS+O_2)] flow rate ratios increased, the dielectric constant decreased, fixed charge density increased and flat band voltage shifted to negative voltage direction. And, the SiOC(-H) films prepared with UV irradiation, the dielectric constant decreased, fixed charge density increased than that of without UV irradiation. Leakage current density at 1 MV/cm increased as the [DMDMS/(DMDMS+O_2)] flow rate ratio increasing. The films deposited with UV irradiation, the leakage current density decreased than that of without UV irradiation. The SiOC(-H) film deposited by UV-assisted PECVD is a good candidate for low dielectric materials.