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The properties of low-k thin film deposited by PECVD using the mixed precursors of hexamethyldisiloxane and triethoxysilylallylethylether as the precursors

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We investigated the properties of plasma polymerized film deposited by plasma enhanced chemical vapor deposition (PECVD) using the mixed precursors of hexamethyldisiloxane (HMDSO, $C_6H_{18}OSi_2$) and triethoxysilylallylethylether (TESAEE, $C_{11}H_{26}O_4Si$) as a function of deposition pressure from 0.3 to 0.9 Torr and the TESAEE carrier gas flow rate from 6 to 12 sccm. The carrier gas flow rate of HMDSO was fixed at 6 sccm. The deposited thin films were referred to as PPHMDSO:TESAEE films. The deposited PPHMDSO:TESAEE films were annealed in a furnace for 1 hour in N_2 ambient of 1 atmospheric pressure. The electrical and chemical properties of the PPHMDSO:TESAEE films were analyzed by I-V measurement and Fourier transform infrared spectroscopy. As the deposition pressure increased from 0.3 to 0.9 Torr, the dielectric constant k decreased from 2.37 to 1.98. As the TESAEE carrier gas rate increased from 6 to 12 sccm, the dielectric constant k increased from 2.17 to 2.49. Annealing of PPHMDSO:TESAEE films at 400℃ increased k value by about 0.2. FT-IR spectra showed that O-H stretching peak around 3100~3550 cm^{-1} had been increased after annealing. Plasma treatment also affected the properties of the PPHMDSO:TESAEE films. Especially, He plasma treatment caused a decrease of the k value and a reduction of the O-H stretching peak. The leakage current density of the PPHMDSO:TESAEE film was about 10^{-10} A/cm^2 at 1 MV/cm, and the breakdown field was about 3.7 MV/cm.