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A study for the hybrid low-k polymer thin films by PECVD and their electrical and mechanical properties

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Organic-inorganic hybrid polymer-like thin films have been deposited on Si (100) substrates at room temperature by PECVD method using single molecular precursors. Also as-grown thin films were annealed 200 ~ 500 ℃. Cyclohexane and TEOS (tetraethylorthosilane) were utilized as organic and inorganic precursors, and hydrogen and Ar(argon) were used as a bubbler and carrier gases, respectively. In order to compare the difference of the electrical and the optical properties of the plasma polymerized thin films, we grew the hybrid polymer-like thin films under the conditions of various RF (radio frequency using 13.56 MHz) powers in the range of 20 ~ 60 W and deposition temperatures. The as-grown polymerized thin films were in first analyzed by FT-IR, SEM, and AFM. The result of FT-IR shows that the plasma polymerized thin films have highly cross-linked density with increasing RF power and deposition temperature. AFM and SEM also showed that the polymer films with smooth surface and sharp interface could be grown under various deposition conditions. Impedance analyzer was utilized for the measurements of I-V and C-V curves. From the electrical property measurements, the lowest dielectric constant and best leakage constant were obtained to be 2.1 and 10^{-10} A/cm^2 at 3 MV/cm, respectively.