

Low-temperature remote plasma-enhanced chemical deposition of SiO_x thin films on organic substrate

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In this work, silicon oxide(SiO_x) layers have been deposited on organic substrate by remote plasma enhanced chemical deposition (RPE-CVD) at low temperature (100°C) using a combination of SiH₄, N₂O, N₂, Ar. The N₂O was introduced into the remote plasma source that is a toroidal-type plasma source operated at the AC power of 10 kW and the frequency of 400 kHz and generated activated radicals flowed into the deposition zone of the chamber at the pressure of 1 Torr. Deposition rate, refractive index, atomic composition ratio, and electrical properties were characterized by ellipsometer, x-ray photoelectron spectroscopy (XPS), fourier transform infrared (FTIR) spectroscopy, transmission electron microscopy (TEM), I-V measurement (HP4145B) and C-V measurement (HP4275A). Under the current experimental conditions, as the N₂O/SiH₄ ratio increased, a gas phase reaction with powder formation was minimized. A maximum deposition rate of 63.9 Å/min were obtained at the condition of SiH₄(10sccm)/N₂O(100sccm)/N₂(500sccm)/Ar(300sccm). As N₂O/SiH₄ ratios were increased, silicon oxide thin films became Si-rich. The x value of the SiO_x films ranged from 1.62 to 1.81. Other properties of the deposited films will be discussed in detail.