6D07:

Plasma Assisted Deposition Technique for Synthesis of low Dielectric Constant Polyanisidine Thin Films

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One of the fastest growing techniques in the field of polymer thin film deposition is plasma assisted methods. Polymer thin film deposited by this technique has unique advantages like, pin hole free, chemical inertness, thermal stability and low dielectric constant. Synthesis of low dielectric constant materials is now an extremely active area of research. Low dielectric constant materials are suitable candidates for replacing the conventional inter metal dielectrics (IMD). These materials lower the RC constant between interconnects, thus improving the overall IC response speeds. Polymer and organic thin films have evoked a great deal of interest due to their low dielectric constant. However they are prone to thermal instability.

We report here the preparation of low dielectric polyanisidine thin films by employing ac plasma polymerization technique. FTIR studies revealed that the aromatic ring is retained in the polymer films. This will enhance the thermal stability of the films. Dielectric permittivity and dielectric loss of these films were measured by a HP4192A Impedance Analyzer in the frequency range of 100Hz to 1MHz. These films sandwich between two metal electrodes were subjected to dielectric studies in a home built conductivity cell in the temperature range of 300K to 343K. Dielectric constant of these films lie in the range of 2.22 to 2.37 for the entire temperature and frequency range scanned. Initial studies indicate that these materials are potential candidates where low dielectric constant is one of the criterion.

6D08:

Fluorocarbon film preparation in C_8F_{18} vapor rf plasma and its electrical properties

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Amorphous polymer films composed of C and F (CF film) have been deposited on metal surfaces in a per-fluorocarbon (C_8F_{18}) vapor rf plasma. The spatial and temporal evolution of the optical emission of CF_2 and C_2 radicals was observed and kinetics of a C_8F_{18} decomposition process was discussed. The films were deposited on Al and Cu electrodes at room temperature with a flow rate of 50 sccm keeping a C_8F_{18} pressure of 0.4Torr and an Ar pressure of 0.04Torr. The electrode arrangements were parallel plates, and concentric solid sphere – mesh sphere electrodes. Electrical properties of the film such as, the breakdown voltage V_s, dielectric constant and the binding structure of the CF films were analyzed with Fourier transform infrared spectroscopy and X-ray photoelectron spectroscopy techniques and scanning electron microscopy.
CF films show an attractive material as an insulator in the multiple layered interconnections of deep-submicron LSIs used to minimize the parasitic capacitance of the interconnection and in electrical apparatuses, due to its low dielectric constant and high breakdown strength. The CF film coated electrode system prepared in per-fluorocarbon vapor rf plasmas could be practical to apply to power equipments, since the deposition speed is more than one order of magnitude larger than the case that conventional CF_4 and C_2F_6 were used[1,2]. In particular, values of effective secondary electron emission coefficient (γ_{eff}) from the CF films coated metal electrode against the reduced electric field (E/N) are important data. The γ_{eff} from 50 Td up to 4000 Td in nitrogen and argon gases was presented. γ_{eff} values were computed from the experimentally obtained Paschen curves and the published values of the ionization coefficient α at the breakdown condition. In the case of the CF film coated electrodes, for curves and the published values of the ionization coefficient α at the breakdown condition. In the case of the CF film coated electrodes, for reduced electric field between 400 and 1000 Td, γ_{eff} has very low values ~10^{-6} for nitrogen and ~ 3×10^{-5} for argon. These lower γ_{eff} values would correspond to the dramatic increase in V_s for the CF film coated electrode system.

[1] C.P.Lungu, et.al., Jpn. J. Appl. Phys. **38** (12B) L1544-6 (1999)
[2] C.P.Lungu, et.al., Vacuum **59**, 210-9 (2000)

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