Electric characterization of poly(methyl methacrylate) thin films using the corona triode with constant current

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Thin polymeric films are used as the gate insulator in organic field-effect transistors (OFETs) and their electric characterization is of the major interest in order to achieve OFETs with very good performance. The poly(methyl methacrylate) (PMMA) is one of the polymers that is traditionally used in OFETs because its appropriate electric/dielectric properties and thin films are easily fabricate by casting a PMMA solution. In this work, the electric characterization of PMMA thin films is performed employing the corona charging technique, which consists to charge the film surface at a constant current, $I$, and measuring the surface potential build-up, $V(t)$, as well the potential decay after charging. Investigation of electric conduction process in PMMA was conducted using films with thickness of the order 500 nanometers fabricated by spin-coating, from a solution of methyl-ethyl-ketone at the concentration of 80 mg/mL. The first result is that deep traps does not exist in the PMMA films since the surface potential decays to zero after few hours after the charging. From the surface potential build-up, we had the indication that the Poole-Frenkel process dominates electric conduction. Plotting $\ln(I - CdV(t)/dt)$ versus the square root of $V(t)$, a linear dependence was observed, as predicted by the Poole-Frenkel model for the constant current charging. This electric conduction behavior is agreement with the non-linear dependence of the charging current versus the stationary surface potential and by the fact that the space charge limited current and ohmic conduction models cannot explain the potential build-up curves. Furthermore, measurements showed that the electric conduction in the PMMA films is slightly dependent on the corona polarity and on the relative humidity and the investigation of the influence of the PMMA molecular weight will be carried out.

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