Fabrication and characterization of P3HT — based OFETs with TPU — polymeric gate dielectric prepared by electrospinning method with different thicknesses

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Current work reports the manufacturing and electrical characteristics of organic field-effect transistors in the top-contact bottom-gate configurations utilizing solution —- processed poly (3-hexylthiophene) films as an active semiconducting layer and thermoplastic polyurethane as gate insulator. A spin coating chemical polymerization technology and an electrospinning tool for polymeric mats production were used to prepare uniform organic thin films with controlled thickness from their solutions. Commercially available flat glass slides were used as the starting substrate. To form the gate electrode a thin layer of metal such as gold (Au) or silver (Ag) was deposited on the glass surface substrates by thermal evaporation through a shadow mask. Thermoplastic polyurethane insulating films with different thicknesses were electrospun from precursor solution on the substrates with Au or Ag electrodes. Patterned Au and/or Ag drain and source electrodes were deposited directly on the surface of as — fabricated poly(3-hexylthiophene) organic semiconductor layer. We used two kinds of metals that have different work functions and their combinations to investigate the influence of the source, drain and gate electrode materials on the output characteristics of fabricated organic thin film transistors. All fabricated of organic field-effect transistor devices showed typical *p*-type channel characteristics. Additionally, the effects of thermoplastic polyurethane gate dielectric thickness as well as the influence of processing parameters on electrical performances of organic field-effect transistors fabricated were also investigated. Results show that all developed transistors exhibit good and stable performance up to a relatively high drain voltage of $\sim 50\,\mathrm{V}$ and the drain-source current up to $\sim 0.5\,\mu\mathrm{A}$.

Keywords: organic field-effect transistors, P3HT organic semiconductor, TPU gate dielectric, electrical characteristics.

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