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Poly(3-hexylthiophene) organic thin film transistor on polyimide using electroplated gold electrodes

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Organic thin film transistors (OTFT) on flexible substrate using electroplated gold electrodes have potential advantages in the fabrication of low cost sensors, smart cards, and field-effect transistors. This method can be a competitive candidate for OTFT applications requiring large area coverage, structural flexibility, low temperature processing, and especially low cost. In particular, the application of electroplating enables one to obtain electrode with high aspect-ratio and good reliability in terms of mechanical flexibility and thermal stress. In this work, poly(3-hexylthiophene) (P3HT) OTFT device uses a top gate structure with electroplated Au source and drain electrodes. Organic thin film transistors (OTFTs) were fabricated using (P3HT) as a semiconducting layer and electroplated gold (Au) as source and drain electrodes. First, Cu(seed)/Cr(adhesion) layers were sputter-deposited in sequence on the plasma-treated polyimide substrate. Then, a negative photoresist, SU-8, was spin-coated on the Cu/Cr/polyimide substrate and patterned by ultra-violet photolithography for source and drain electrodes. After photolithography, Au source and drain electrodes were electroplated into the patterned SU-8 mask. After P3HT film was spin-coated, SiO2gate dielectrics and Al electrode were evaporated with a shadow mask. The channel length ranged between 10 and 25 m, and the channel width was 800 m. Electrical properties of fabricated OTFT were characterized and the effect of various process conditions and structures on the performances of fabricated devices will be discussed.