T2-003

Evaluation and Comparison of Nanocomposite Gate Insulator for Flexible Thin Film Transistor

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Organic materials have been explored as the gate dielectric layers in thin film transistors (TFTs) of backplane devices for flexible display because of their inherent mechanical flexibility. However, those materials possess some disadvantages like low dielectric constant and thermal resistance, which might lead to high power consumption and instability. On the other hand, inorganic gate dielectrics show high dielectric constant despite their brittle property. In order to maintain advantages of both materials, it is essential to develop the alternative materials. In this work, we manufactured nanocomposite gate dielectrics composed of organic material and inorganic nanoparticle and integrated them into organic TFTs. For synthesis of nanocomposite gate dielectrics, polyimide (PI) was explored as the organic materials due to its superior thermal stability. Candidate nanoprticles (NPs) of halfnium oxide, titanium oxide and aluminium oxide were considered. In order to realize NP concentration dependent electrical characteristics, furthermore, we have synthesized the different types of nanocomposite gate dielectrics with varying ratio of each inorganic NPs. To analyze gate dielectric properties like the capacitance, metal-Insulator-metal (MIM) structures were prepared together with organic TFTs. The output and transfer characteristics of organic TFTs were monitored by using the semiconductor parameter analyzer (HP4145B), and capacitance and leakage current of MIM structures were measured by the LCR meter (B1500, Agilent). Effects of mechanical cyclic bending of 200,000 times and thermally heating at 400^{o}C for 1 hour were investigated to analyze mechanical and thermal stability of nanocomposite gate dielectrics. The results will be discussed in detail.

Keywords: flexible devices, organic TFTs, nanocomposite, gate dielectrics

T2-004

Highly Flexible and Transparent ISO/Ag/ISO Multilayer Grown by Roll-to-roll Sputtering System

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We have investigated the highly flexible and transparent Si-doped In_2O_3(ISO)/Ag/ISO multilayer grown on polyethylene terephthalate (PET) substrates using a roll-to-roll sputtering system. The electrical and optical properties of ISO/Ag/ISO multilayer electrodes depended on the insertion of a nano-size Ag layer. Due to the high conductivity of a nano-size Ag layer, the optimized ISO/Ag/ISO multilayer electrodes showed the lowest resistivity of 3.679×10^{-5} Ohm-cm, even though the ISO/Ag/ISO multilayer electrodes was sputtered at room temperature. Furthermore, the ISO/Ag/ISO multilayer electrodes exhibited a high transmittance of 86.33%, because of the anti-reflection effect, comparable to Sn-doped In_2O_3 (ITO) electrodes. In addition, the ISO/Ag/ISO multilayer electrodes had a very smooth surface morphology without surface defects and showed good flexibility. The flexible OSCs fabricated on ISO(30nm)/Ag(8nm)/ISO(30nm) multilayer electrode showed a power conversion efficiency of 3.272%. This result indicates that the ISO/Ag/ISO multilayer is a promising transparent conducting electrode for flexible OSCs.

Keywords: TCO, Amorphous, flexible organic solar cell