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Hysteresis in cyclically bended organic thin film transistors by using Al_2O_3 nano-laminated gate dielectrics

설영국[1], 노화영[1], 권봉수[1], 이창수[2], 김형준[2], 이내응[1]

[1]성균관대학교 신소재 공학과, [2]포항공과대학교 신소재 공학과

In this work, reduction of hysteresis in the pentacene organic thin film transistors (OTFT) employing the nano-laminated multi-layer gate dielectrics with spin-coated organic (PVP) and atomic-layer deposited (ALD) inorganic (Al_2O_3) layers were investigated. For analysis of capacitance, leakage current, and hysteresis of pure PVP and nano-laminated PVP/Al_2O_3/PVP gate dielectric layer, metal-insulator-metal (MIM) and metal-insulator-semiconductor (MIS) structures fabricated on flexible polyimide substrate were cyclically bended up to 100,000 times with 5 mm bending radius. For evaluation of hysteresis characteristics of fabricated devices, we also applied cyclic bending test. In case of the fabricated dielectric employing the nano-laminated gate dielectric with a thin ALD Al_2O_3 layer (10~50nm), the leakage current and capacitance value in MIM structure was not changed even after 10^5 times of cyclic bending. However, hysteresis of transfer characteristics in the device with various dielectric structures showed different behavior with increasing cyclic bending. Hysteresis in the transfer characteristics of the device with increasing the thickness of ALD Al_2O_3 layer in the nano-laminated multilayer gate dielectric was decreased compared to that of the device with pure PVP layer. Electrical and mechanical properties of the nano-laminated gate dielectrics and the devices with them will be discussed in detail.