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Mechanical flexibility and electrical stability in flexible organic thin film transistor with nano-laminated gate dielectric

설영국[1], 노화영[1], 맹완주[2], 김형준[2], 이내응[1]

[1]성균관대학교 신소재공학과, [2]포항공과대학교 신소재공학과

Employment of the nano-laminated gate dielectric was effective for flexible high-performance OTFTs with good mechanical flexibility operating at low voltage range. In order to improve mechanical flexibility with stable electrical characteristics of gate dielectric in the device, we applied various dielectric structure. Flexible organic thin film transistors employing the spin-coated organic (PVP) /inorganic (Al_2O_3 or HfO_2) nano-laminated multi-layer gate dielectric by atomic layer deposition (ALD) were fabricated using pentacene as a semiconducting layer. The channel length varied from 10 to 110 μm, and the channel width was 800 μm. Leakage current of nano-laminated gate dielectric was reduced by three order of magnitude compared to pure organic gate dielectric. For evaluation of the mechanical and electrical stability of fabricated nano-laminated multi-layer gate dielectric and the devices, we applied cyclic bending test with 5 mm bending radius. In case of the fabricated dielectric employing the nano-laminated gate dielectric with a thinner high-*k* inorganic layer (10～50 nm), the leakage current value was not changed even after 10^5 times of cyclic bending. electrical characteristics such as field-effect mobility, current on/off ratio in the device only slightly changed. Electrical and mechanical properties of the nano-laminated gate dielectric and the devices with them will be discussed in detail.