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Mechanically flexible low-leakage Al_2O_3-PVP nanocomposite gate dielectrics

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We fabricated the flexible organic thin film transistors (OTFTs) with the improved electrical properties of gate dielectric material by enhancing the mechanical and electrical stabilities. Organic gate dielectric layer has a problem of increase in the leakage current as the gate dielectric layer becomes thinner. To work out this problem, the nanocomposite dielectric material was applied. In this work, we applied the nanocomposite dielectric layer containing Al_2O_3 nanoparticles in the PVP polymer in OTFTs. The OTFTs with a higher current on/off ratio could be fabricated due to reduced leakage current. Under repetitive cyclic bending, the leakage current density of the nanocomposite layer was not changed, while that of the PVP layer was increased significantly. The results suggested that the nanocomposite gate dielectric material has advantages such as lower leakage current and larger dielectric constant compared with organic dielectric material as well as mechanical flexibility compared with inorganic gate dielectric materials (SiO_2, Si_3N_4, Al_2O_3, Ta_2O_5, etc). It can be concluded that, the nanocomposite gate dielectric layer here provided the flexible OTFT device with improved mechanical and electrical stabilities.