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Performance Improvement of All Solution Processable Organic Thin Film Transistors by Newly Approached High Vacuum Seasoning

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Organic thin film transistors (OTFTs) backplane constitute the active elements in new generations of plastic electronic devices for flexible display. The overall OTFTs performance is largely depended on the properties and quality of each layers of device material. In solution based process of organic semiconductors (OSCs), the interface state is most impediments to preferable performance. Generally, a threshold voltage (Vth) shift is usually exhibited when organic gate insulators (OGIs) are exposed in an ambient air condition. This phenomenon was caused by the absorbed polar components (i.e. oxygen and moisture) on the interface between OGIs and Soluble OSCs during the jetting process. For eliminating the polar component at the interface of OGI, the role of high vacuum seasoning on an OGI for all solution processable OTFTs were studied. Poly 4-vinly phenols (PVPs) were the material chosen as the organic gate dielectric, with a weakness in ambient air. The high vacuum seasoning of PVP's surface showed improved performance from non-seasoning TFT; a V_{th}, a μ_{fe} and a interface charge trap density from -8V, 0.018 $cm^2V^{-1}s^{-1}$, 1.12×10^{-12} $(cm^2eV)^{-1}$ to -4.02 V, 0.021 $cm^2V^{-1}s^{-1}$, 6.62×10^{-11} $(cm2eV)^{-1}$. These results of OTFT device show that polar components were well eliminated by the high vacuum seasoning processes.

Keywords: High vacuum seasoning, OTFT