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Surface-Treatment Effects on the Pentacene-Based Organic Field-Effect Transistors with Anodized Gate Dielectrics YEON TAEK JEONG, CHRISTOPHER LOMBARDO, DAVIANNE DUARTE, ANANTH DODABALAPUR, The University of Texas at Austin — The realization of low operating voltage organic field-effect transistors (OFETs) is technologically important with many methods having been proposed to achieve this goal. The use of anodized high-k dielectrics is very promising in that the approach is applicable to obtaining gate dielectrics at low temperature. We report on the device characteristics and proper surface-treatment effects on low voltage OFETs with anodized Ta_2O_5 and SiO_2 gate dielectrics. Pentacene-based OFETs with anodized Ta_2O_5 gate dielectric obtained from an e-beam-evaporated and a sputtered Ta thin film layer exhibited the saturation mobility of 0.52 cm^2/Vs and 0.45 cm^2/Vs at V_{ds} = -10V, respectively. Moreover, a hexamethyldisilazane (HMDS) and a mono-dodecyl phosphate surface treatment resulted in enhanced mobility and significantly reduced gate leakage current. In the case of anodized SiO_2 devices, an octadecyltrichlorosilane (OTS) treatment increased the saturation mobility from 0.38 cm^2/Vs to 0.88 cm^2/Vs at V_{ds} = -10V. The OTS treatment also proved to reduce gate leakage current by more than 90%. In related work, we will discuss the fabrication of all-organic dual-channel devices. These devices are promising because of their probable applications to organic sensing and CMOS transmission gates.

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