Organic field-effect transistors with reversible threshold voltage shifts for memory element

Abstract

We introduce an charge-accepting layer on a poly(methyl methacrylate) (PMMA) dielectric to investigate the reversible threshold voltage (V) shifts in all-polymer n-channel organic field-effect transistor (OFET) using an organic semiconductor of an poly{[N,N'-bis(2-octyldodecyl)-naphthalene-1,4,5,8-bis(dicarboximide)-2,6-diyl]-alt-5,5'-(2,2'-bithiophene)} (P(NDI2OD-T2)). Top contact drain-source with a bottom-gate contact structure device exhibited a unipolar property with n-channel behavior. Furthermore, the existence of poly(3-hexylthiophene) (P3HT) films as a charge-accepting-like storage layers resulted in a reversible Vth shifts upon the application of external gate bias (V). Hence, all-polymer organic transistor with the charge-accepting layer exhibited a large memory window (Vth bias = 10.7 V) for write and erase electrically without major degradation in saturation mobility (μsat =1.8~2.8×10-4 cm2V-1 s-1).