Gate-Dielectric Controls for Improving Organic Field-Effect Transistor Performances

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For several decades, organic field-effect transistors (OFETs) have been widely investigated as the driving units in flexible displays and chemical sensing applications. Significant progress in device physics and engineering has advanced the potential to pioneer emerging devices. Several issues must be addressed before commercialization of OFETs. In particular, the charge carrier mobility is low, and device stability tends to be low compared to inorganic FETs. The electrical performance of an OFET depends strongly on the dielectric surface controls, which is because the carrier transport takes place under few nanometers of active layers adjacent to the dielectric surface.
Here, we demonstrate the studies of dielectric controls for improving OFET performances, surface-order-mediated assembly of semiconductor molecules, surface viscoelasticity effects on the crystalline nanostructure of organic semiconductor, and effects of chemical chain structures of dielectric polymers. The systematic investigation of the dielectric surfaces presented here provides a significant step toward optimizing the device performance, by engineering the interfaces in the OFETs.