THE USE OF FERROELECTRICS AND DIPEPTIDES AS INSULATORS IN ORGANIC FIELD-EFFECT TRANSISTOR DEVICES

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ABSTRACT

While the electrical transport characteristics of organic electronic devices are generally inferior to their inorganic counterparts, organic materials offer many advantages over inorganics. The materials used in organic devices can often be deposited using cheap and simple processing techniques such as spincoating, inkjet printing, or roll-to-roll processing; allow for large-scale, flexible devices; and can have the added benefits of being transparent or biodegradable.

We examine the role of solvents in the performance of pentacene-based devices using the ferroelectric copolymer polyvinylidene fluoride-trifluoroethylene (PVDF-TrFe) as a gate insulating layer. High dipole moment solvents, such as dimethyl sulfoxide, used to dissolve the copolymer for spincoating increase the charge carrier mobility in field-effect transistors (FETs) by nearly an order of magnitude and increase the remnant polarization in metal-ferroelectric-metal devices as compared to lower dipole moment solvents, suggesting that the degree of dipolar order is higher for the high dipole moment device.

We will also discuss the use of peptide-based nanostructures derived from natural amino acids as building blocks for biocompatible devices. Thin films of L,L-diphenylalanine micro/nanostructures (FF-MNSs) were used as the dielectric layer in pentacene-based FETs and metal-insulator-semiconductor diodes. It is demonstrated that the FF-MNSs can be functionalized for detection of enzyme-analyte interactions. This work opens up a novel and facile route towards scalable organic electronics using peptide nanostructures as scaffolding and as a platform for biosensing.