Organic thin film Transistors with polymer high-k dielectric insulator

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Organic field effect transistors consisting of the copolymer poly(vinylidene fluoride trifluoroethylene) (P(VDF-TrFE)) and P3HT (poly(3-hexlythiophene)) as active layer have been fabricated. We study the influence of P(VDF-TrFE) on the characteristics of the transistors. The gate effects are observed compared to similar transistors with PMMA (Polymethylmetacrylate) as gate dielectric. Due to the high dielectric constant of P(VDF-TrFE) ($\varepsilon=12$) an operation voltage smaller than for the conventional organic dielectric material PMMA ($\varepsilon=3.12$) is observed. Improved transconductances are found. The thickness of the spincoated dielectric layers is in the range of 2µm. For this thickness, we find no significant hysteresis, a prerequisite for transistor operation.

In contrast, for thinner films of P(VDF-TrFE, 250nm), spincoated on Si-substrates, we find the typical ferroelectric hysteresis of the copolymer by performing capacity-voltage (C(U)) measurements. This gives opportunities for building up an organic transistor with a thin P(VDF-TrFE) ferroelectric layer as nonvolatile memory element.