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Bias-Dependent Charge Accumulation in Pentacene-based Thin-Film Transistors

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Abstract

In this paper, we have demonstrated the current increase with repeated measurements of Id-Vds curves with different Vg values which results from the non-uniform carrier accumulation in the channel region of a pentacene-based thin film transistor (TFT). The mobility of our device reaches 0.07 cm2/Vs even the substrate was not heated during pentacene deposition. Besides, the devices show good air-stable properties. The magnitude of Id decreased less than 30% after exposure in air for 2 weeks. By repeating the Id-Vds measurements from 0 to -50 V with the Vg values of 0, -10, -20, -30, -40, and -50 V for 10 minutes, we observed a four times current increase from -0.75 to -2.8 μA at Vg= -50V and Vds=-50V. The current increase comes from the holes accumulation near the drain. When the source and drain were exchanged, the current decreases to the 0.08 μA. After another 10 minutes operation, the current will recover back to the original values. Such a process is reversible and shows the potential of the memory device base on this pentacene transistor.

Key words：Organic thin-film transistor; Mobility; Carrier transport