

High Performance Top-Gate Organic Field-Effect Transistors Based on Novel Thienoacene Derivatives

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Organic electronic devices are attracting more and more interest, and a lot of progress has been done recently. OLEDs displays are already commercialized but in order for organic electronics to really spread and to be extended to integrated circuits, organic field-effect transistors (OFETs) characteristics must be improved. Especially materials allowing mass fabrication by printing methods need to be found. Bottom gate bottom contact thienoacene derivatives “OSK-040” OFETs with a mobility higher than 3 cm²/Vs and high thermal durability, processed by spin-coating method [1] have been shown. We report here top gate bottom contact OSK-040 OFETs that have high field-effect mobility, and good thermal stability. The OFETs structure is shown in **Fig. 1**.

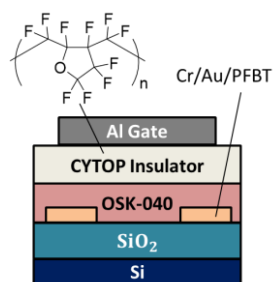


Fig. 1 Device structure.

A pentafluorobenzenethiol self-assembled hole injection monolayer was spin coated. Then, the

OSK-040 (Nippon Kayaku) semiconductor layer was spin coated using a 0.4 wt% *o*-xylene solution and immediately annealed at 140 °C for 10 min. The OFET structure was completed by the spin coating of a fluoropolymer insulator CYTOP™ (CTL-809M, Asahi Glass). This preparation and the measurements were done in a N₂ filled glove box.

We found that the mobility of OSK-040 OFETs could be enhanced by using the top gate configuration. The maximum observed mobility is 4.3 cm²/Vs with a subthreshold slope of 240 mV/dec, a threshold voltage of -0.9 V and an ON/OFF current ratio of 10⁵. **Fig. 2** shows the transfer characteristics of an OSK-040 OFET measured during a gate bias stress of -30 V during 10⁴ s, and excellent stability was observed. The devices also went through a thermal stress of 140°C during 1h and the mobility maintained a high value.

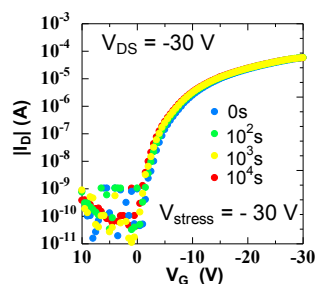


Fig. 2 Variation of the OSK-040 OFET transfer characteristics during the bias stress.

References: [1] S. Inoue *et al*, ICFPE 2016, Yamagata, Japan, No. 0115.

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