

Annexure A

Shelf-Life Stability Study

A.1 PENTACENE BASED ORGANIC TFTs

The shelf-life stability of pentacene-based flexible TFTs is discussed. The transfer and output characteristics of these devices were measured occasionally with an interval of one to few days in between, for a period of 15 days. These measurements were done in yellow light (laboratory conditions) with a humidity of about 40-50%. The transfer and output characteristics of pentacene based TFTs summarizing this study are given in Figure A.1. It has been observed that after 15 days in the ambient conditions, field-effect mobility decreases to less than 20% from 0.5 cm^2/Vs . The shift in the threshold voltage remains insignificant in seven devices fabricated on same substrate after exposure to air for 15 days.

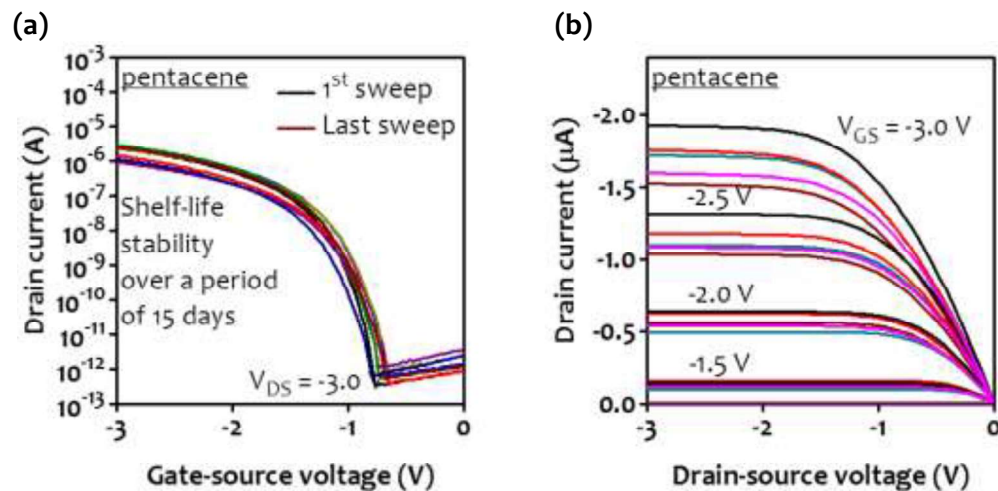


Figure A.1 : (a) Transfer, and (b) Output; Curves of Pentacene TFTs Fabricated on Same Substrate Measured Occasionally with a Period of a Day or Few Days for 15 days showing the Changes in Electrical Characteristics, upon Exposure to Ambient Conditions

A.2 DNTT BASED ORGANIC TFTs

The transfer and output characteristics of flexible DNTT TFTs fabricated on same substrates, which were exposed to ambient conditions all the time for duration of 15 days is given in Figure A.2. The electrical characteristics show good stability of these devices upon exposure to ambient conditions as well as from device to device variation in a substrate. The field-effect mobility of these TFTs reduces slightly *i.e.* less than 15% from 1.8 cm^2/Vs during the ambient exposure conditions. The change in threshold voltage is less than 10% from -1.2 V in these devices on exposure to air. These TFTs based on DNTT show better stability on exposure to air, when compared to pentacene TFTs, which suffer from a severe drop in field-effect mobility due to oxidation of pentacene films.

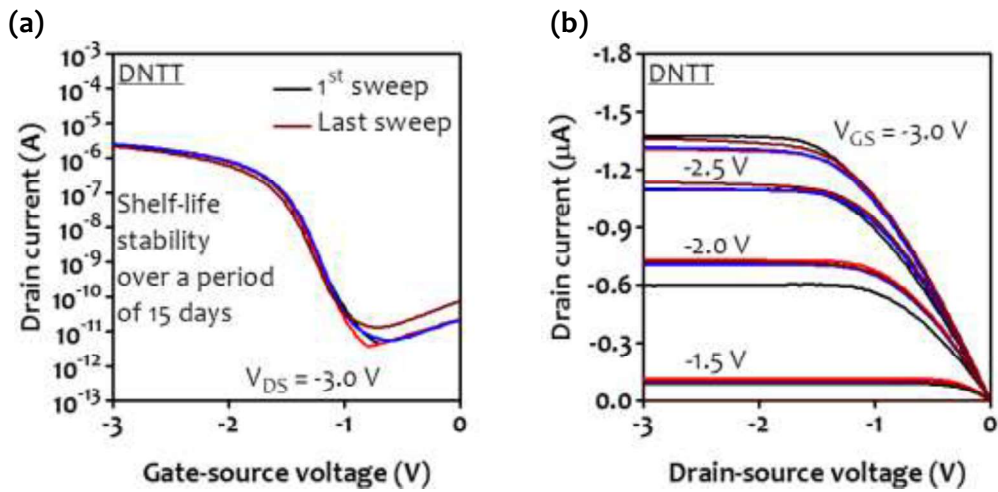


Figure A.2 :(a) Transfer and (b) Output; Characteristics of DNTT TFTs Fabricated on Same Substrate Obtained for Shelf-life Stability Study

A.3 C₁₀-DNTT BASED ORGANIC TFTs

Figure A.3 shows the transfer and output characteristics of a C₁₀-DNTT TFT, measured occasionally for a total period of 15 days in ambient air. These device characteristics of eleven C₁₀-DNTT TFTs fabricated on same substrate show 30% variation in subthreshold slope and threshold voltage upon exposure of these devices to air for 15 days. The extracted field-effect mobility of these devices reduces significantly from 4.1 cm²/Vs to 2.0 cm²/Vs during exposure in ambient conditions. Though reduction in field-effect mobility is significant in these devices, still these devices show high performance for an organic semiconductor.

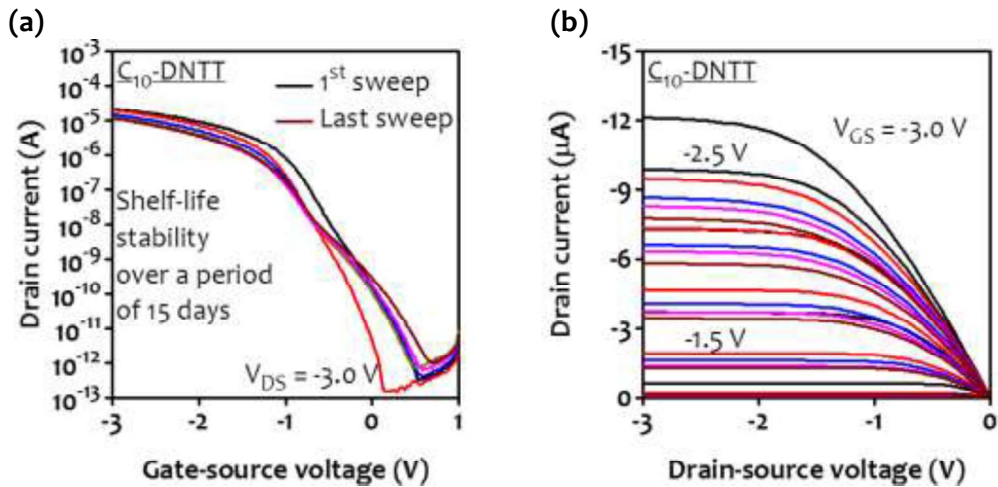


Figure A.3 :Plots of (a) Transfer, and (b) Output; Curves of Flexible C₁₀-DNTT TFTs Fabricated on same Substrate Measured at various Times for 15 days in Ambient Conditions

A.4 F₁₆CuPc BASED ORGANIC TFTs

The transfer and output characteristics of F₁₆CuPc based TFT devices on same flexible substrate, which are exposed to air for a period of 10 days is given in Figure A.4. The field effect

mobility decreases from $0.04 \text{ cm}^2/\text{Vs}$ to $0.01 \text{ cm}^2/\text{Vs}$ in these devices. The subthreshold swing in these devices changes by less than 15% *i.e.* from 183 mV/decade to 200 mV/decade, and threshold voltage also differs in these devices after exposure to ambient conditions. These TFTs show noticeable changes in the performance parameters, thereby reducing the stability of these TFTs on exposure to air for a period of 10 days.

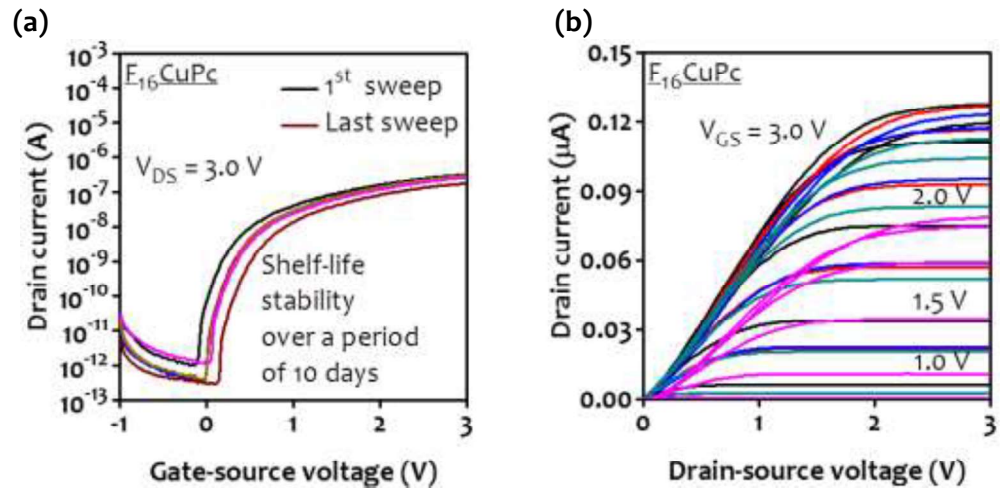


Figure A.4 : (a) Transfer and (b) Output; Characteristics of TFTs based on $F_{16}CuPc$ on same Substrate upon Exposure to Air for a Period of 10 days