Grain-Size Dependent Electrical Properties of Pentacene Thin-Film Transistors

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Pentacene is one of the most promising candidates for *p*-channel organic thin-film transistors (TFTs) to date, which mainly stems from its high hole mobility up to 5.5 cm^2/Vs [1]. Thermally sublimed pentacene films exhibit a polycrystalline nature wherein its grain growth is highly sensitive to deposition conditions and its crystallinity predominantly governs the performance of pentacene TFTs [2]. It has been reported that grain size and grain boundaries of pentacene films are one of decisive factors for charge transport and mobility in TFTs [3]. However, little is known about the TFT characteristic instabilities related with grain size and grain boundaries, which must be of primary importance to understand and forecast dynamic responses of organic TFT circuits.

In this work, we have investigated the grain-size dependent electrical properties of pentacene TFTs. Figure shows that total electrical resistance of pentacene TFTs is significantly increased with decreasing the pentacene grain size. Such an increase in total resistance results in a pronounced reduction in the drain current with time. Trap density with the grain size and dynamic properties of pentacene TFTs are also investigated using a pulsed gate voltage with varying the duty cycle. These results will be discussed.

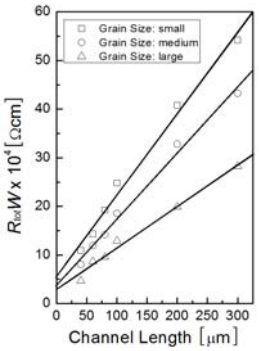

Figure. Total resistance of pentacene TFTs with varying the pentacene grain size.

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