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**Abstract**

**TITLE:** Effects of Alignment Layers on Pentacene Molecular Orientation and Thin-Film Transistor Characteristics

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**ABSTRACT BODY:** Pentacene, a fused-ring polycyclic aromatic hydrocarbon, is one of the most intensively investigated systems among various organic semiconductors due to great mobility and good semiconducting behavior. The electrical conductivity in this material strongly depends on the direction of applied electrical field to its long molecular axis. And also, it is known that the vertical alignment of pentacene molecules to the gate insulator surface provides a strong π-π* overlap and increases the electrical conductivity in the direction of perpendicular to the long-axis. These have motivated several studies of the effects of pentacene molecular orientations on the performance of organic thin-film transistors (OTFTs).
In the present work, we use different alignment layers to investigate their effects on pentacene molecular orientation and the concomitant performance of organic TFTs. For the fabrication of morphological alignment layer, polyimide films were formed by spin-coating and then rubbed in the parallel and vertical directions to conducting channel in OTFTs. And also, liquid crystal (LC) material was used for the fabrication of molecular alignment layer. LC molecules were aligned in the parallel and vertical directions to channel direction. Experimental results show that the transistor characteristics were dependent on the directions of alignment layers. The OTFTs with the morphological alignment layer exhibited an increase in the drain current compared to the device without rubbing treatment, independent on the rubbing directions. Dichroic ratio of the drain current was about 1.2, which is defined as the ratio of current for the device with the parallel alignment layer to that with the vertical alignment layer. On the other hand, the OTFTs with the molecular alignment layer showed a significant dependence of drain current on the direction of alignment layer: the drain current in the parallel direction increased compared with that for the device with unaligned LC layer, but the drain current in the vertical direction even deteriorated. In this case, dichroic ratio was about 2.1. These results indicate that the morphological effect on the pentacene molecular orientation is intrinsically different from that of a prior molecular orientation. We will report the detailed growth mechanism of pentacene molecule on these alignment layers, combining with the electrical characteristics of OTFTs.

(No Table Selected)