Abstract Submitted
for the MAR07 Meeting of
The American Physical Society

Aggregation of pentacene molecules on SiO2 substrates and its influence on the FET characteristics. GENKI YOSHIKAWA, J. T. SADOWSKI, A. AL-MAHBOOB, Y. FUJIKAWA, T. SAKURAI, IMR, Tohoku University, Y. TSURUMA, S. IKEDA, K. SAIKI, The University of Tokyo — Pentacene is one of the most promising materials for organic field effect transistors (OFETs). In order to improve the FET performance, dielectric layers, such as SiO2, are commonly modified by the self-assembled monolayers (SAMs), such as hexamethyldisilazane (HMDS). Owing to utilization of these SAMs, the performance of the pentacene FET has exceeded that of amorphous Si FET. However, we have found that pentacene molecules deposited on HMDS-treated SiO2 substrates aggregate with time even under ultra-high-vacuum (UHV) and ambient temperature conditions. We constructed an in situ atomic force microscopy (AFM)-FET measurement system and found that the FET mobility significantly decreased with the aggregation. Thus, this aggregation should be one of the major origins of the instability and irreproducibility of pentacene-based devices. In order to reveal the mechanism of the aggregation, we carried out an in situ and real time observation of growth and the aggregation of pentacene molecules on the several substrates, such as clean SiO2 and HMDS, under UHV conditions with low energy electron microscope (LEEM). We have found that pentacene tends to aggregate on the substrate with lower surface energy.

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Date submitted: 20 Nov 2006 Electronic form version 1.4