

## Flexible pentacene thin film transistors with an nano-composite gate dielectric layer

노화영, 설영국, 이내웅

성균관대학교 신소재공학과

Flexible organic thin film transistors (OTFTs) with low threshold voltage ( $V_T$ ), low-leakage current, flexibility of device are needed for their application to flexible electronics. To achieve low  $V_T$  and flexibility improvement of the OTFT, use of nano-composite gate dielectrics with high- $k$  nano-particles would be useful. For this purpose, the nano-composite gate dielectric with  $Al_2O_3$  nano-particle embedded in the poly(4-vinyl phenol) (PVP) matrix was investigated in this work. Flexible OTFTs were fabricated using pentacene as a semiconducting layer and electroplated Ni gate electrode on flexible polyimide substrate. First,  $Al_2O_3$  nano-particles with 40~60 nm size were surface-treated by silane for improved dispersion and adhesion with the PVP matrix. The nano-composite gate dielectric layer containing the  $Al_2O_3$  nano-particles was spin-coated on the deposited gate electrode. Pentacene as a semiconductor layer and gold source-drain electrodes was thermally evaporated on the gate dielectric layer using a shadow mask in vacuum chamber. The OTFT devices with single PVP dielectric layer were also fabricated for comparison. The channel length varied from 10 to 110  $\mu m$ , and the channel width was 800  $\mu m$ . For investigation of nano-composite gate dielectric, I-V output and C-V characteristic was measured with different volume fraction of  $Al_2O_3$  in the PVP matrix. The device with nano-composite gate dielectric layer exhibited the current on-off ratio of  $10^4$  and the lower  $V_T$  with comparable field effect channel mobility. The electrical results will be discussed in more detail.