T2-004

Evaluation of Flexible Complementary Inverters Based on Pentacene and IGZO Thin Film Transistors

D. I. Kim[1], B. U. Hwang[1], H. S. Jeon[1], B. S. Bae[2], H. J. Lee[1], N.-E. Lee[1]

[1]School of Advanced Materials Science & Engineering and, Sungkyunkwan University, Suwon,
[2]Department of Semiconductor and Display Engineering, Hoseo University, Asan, Korea

Flexible complementary inverters based on thin-film transistors (TFTs) are important because they have low power consumption and high voltage gain compared to single type circuits. We have manufactured flexible complementary inverters using pentacene and amorphous indium gallium zinc oxide (IGZO) for the p-channel and n-channel, respectively. The circuits were fabricated on polyimide (PI) substrate. Firstly, a thin poly-4-vinyl phenol (PVP) layer was spin coated on PI substrate to make a smooth surface with rms surface roughness of 0.3 nm, which was required to grow high quality IGZO layers. Then, Ni gate electrode was deposited on the PVP layer by e-beam evaporator. 400-nm-thick PVP and 20-nm-thick ALD Al2O3 dielectric was deposited in sequence as a double gate dielectric layer for high flexibility and low leakage current. Then, IGZO and pentacene semiconductor layers were deposited by rf sputter and thermal evaporator, respectively, using shadow masks. Finally, Al and Au source/drain electrodes of 70 nm were respectively deposited on each semiconductor layer using shadow masks by thermal evaporator. The characteristics of TFTs and inverters were evaluated at different bending radii. The applied strain led to change in voltage transfer characteristics of complementary inverters as well as source-drain saturation current, field effect mobility and threshold voltage of TFTs. The switching threshold voltage of fabricated inverters was decreased with increasing bending radius, which is related to change in parameters of TFTs. Throughout the bending experiments, relationship between circuit performance and TFT characteristics under mechanical deformation could be elucidated.

Keywords: flexible electronics, complementary inverter, thiin film transistor