

InGaZnO active layer 두께에 따른 thin-film transistor 전기적인 영향

우창호, 김영이, 안철현, 김동찬, 공보현, 배영숙, 서동규, 조형균*

School of Advanced Materials Science and Engineering, Sungkyunkwan University, Korea

e-mail: chohk@skku.edu

Abstract : Thin-film-transistors (TFTs) that can be prepared at low temperatures have attracted much attention because of the great potential for transparent and flexible electronics. One of the mainstreams in this field is the use of organic semiconductors such as pentacene. But device performance of the organic TFTs is still limited due to low field-effect mobility and rapid degradation after exposing to air. Alternative approach is the use of amorphous oxide semiconductors as a channel. Amorphous oxide semiconductors (AOSs) based TFTs showed the fast technological development, because AOS films can be fabricated at room temperature and exhibit the possibility in application like flexible display, electronic paper, and large solar cells. Among the various AOSs, a-IGZO has lots of advantages because it has high channel mobility, uniform surface roughness and good transparency. [1] The high mobility is attributed to the overlap of spherical s-orbital of the heavy post-transition metal cations.

This study demonstrated the effect of the variation in channel thickness from 30nm to 200nm on the TFT device performance. When the thickness was increased, turn-on voltage and subthreshold swing was decreased. The a-IGZO channels and source/drain metals were deposited with shadow mask. The a-IGZO channel layer was deposited on SiO₂/p-Si substrates by RF magnetron sputtering, where RF power is 150W. And working pressure is 3m Torr, at O₂/Ar (2/28 sccm) atmosphere. The electrodes were formed with electron-beam evaporated Ti (30 nm) and Au (70 nm) bilayer. Finally, Al (150nm) as a gate metal was thermal-evaporated. TFT devices were heat-treated in a furnace at 250 °C and nitrogen atmosphere for 1hour. The electrical properties of the TFTs were measured using a probe-station.

The TFT with channel thickness of 150nm exhibits a good subthreshold swing (SS) of 0.72 V/decade and on-off ratio of 1X10⁸. The field effect mobility and threshold voltage were evaluated as 7.2 and 8 V, respectively.

Key Words : IGZO, TFTs, Al:ZnO

Topic : Defects in compound semiconductors

Type of presentation : poster

[1] Jong H. Na, M. Kitamura, and Y. Arakawa, Appl. Phys. Lett. 93.063501(2008)