

Investigation of Graphene N-type Doping Effects for S/D Electrodes via Cs_2CO_3 Doping in Amorphous InGaZnO Thin-Film Transistors

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Abstract

In this work, we investigate the doping effect of single-layer graphene (SLG) used as S/D electrodes on the devices performance of amorphous InGaZnO (a-IGZO) thin-film transistors (TFTs). Control of work functions of S/D electrodes are highly demanded to improve the contact characteristics between the channel and S/D electrodes. In the a-IGZO TFTs, S/D electrodes with relatively low WF are needed because a-IGZO is an n-channel material while a p-doping of graphene is an unintentional and natural result in a transfer process via wet chemicals^[1-2]. On the other hand, n-doping of graphene requires additional materials using evaporation or wet chemical doping method. The fabricated a-IGZO TFTs with SLG S/D electrodes are dipped in the 50mM Cs_2CO_3 aqueous solution for 30 minutes to decrease the work function of graphene electrodes. A UV photoelectron spectroscopy (UPS) analysis exhibits that the work function of SLG decreases from 4.8 eV to 4.1 eV. In the comparison of the measured transfer curves, the threshold voltage (V_{Th}) decreases from 4.4 V to 2.9 V and the extracted field-effect mobility (μ_{FE}) increases from 7.1 $\text{cm}^2/\text{V}\cdot\text{s}$ to 10 $\text{cm}^2/\text{V}\cdot\text{s}$ with increase of the drain current(I_{DS}) because of the improved ohmic contact between the a-IGZO layer and Cs_2CO_3 doped SLG S/D electrodes.

References

[1] X. Li, et al., *Nano Lett.*, 9.12 (2009).

[2] J. W. Suk, et al., *ACS Nano*, 5.9 (2011).

Figure

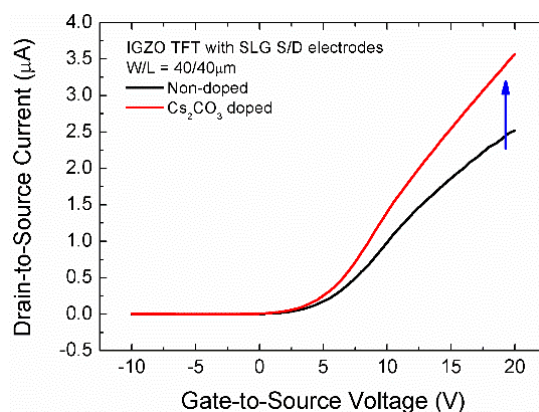


Fig 1. Representative transfer curves of the fabricated a-IGZO TFT with Cs_2CO_3 doped and non-doped SLG S/D electrodes.