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Improvement in the negative bias stability on the water vapor permeation barriers on Hf doped SnO_x thin film transistors

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Recently, advances in ZnO based oxide semiconductor materials have accelerated the development of thin-film transistors (TFTs), which are the building blocks for active matrix flat-panel displays including liquid crystal displays (LCD) and organic light-emitting diodes (OLED). However, the electrical performances of oxide semiconductors are significantly affected by interactions with the ambient atmosphere. Jeong et al. reported that the channel of the IGZO-TFT is very sensitive to water vapor adsorption. Thus, water vapor passivation layers are necessary for long-term current stability in the operation of the oxide-based TFTs.

In the present work, Al_2O_3 and TiO_2 thin films were deposited on poly ether sulfon (PES) and SnO_x-based TFTs by electron cyclotron resonance atomic layer deposition (ECR-ALD). And enhancing the WVTR (water vapor transmission rate) characteristics, barrier layer structure was modified to Al_2O_3/TiO_2 layered structure. For example, Al_2O_3, TiO_2 single layer, Al_2O_3/TiO_2 double layer and $Al_2O_3/TiO_2/Al_2O_3/TiO_2$ multilayer were studied for enhancement of water vapor barrier properties. After thin film water vapor barrier deposited on PES substrate and SnO_x-based TFT, thin film permeation characteristics were three orders of magnitude smaller than that without water vapor barrier layer of PES substrate, stability of SnO_x-based TFT devices were significantly improved. Therefore, the results indicate that Al_2O_3/TiO_2 water vapor barrier layers are highly proper for use as a passivation layer in SnO_x-based TFT devices.

Keywords: Thin film transistor, SnO-based TFT, Passivation, ECR-ALD, Water vapor transmission rate (WVTR)

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Antireflective ZTO/Ag bilayer-based transparent source and drain electrodes for highly transparent thin film transistors

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We reported on antireflective ZnSnO (ZTO)/Ag bilayer and ZTO/Ag/ZTO trilayer source/drain (S/D) electrodes for all-transparent ZTO channel based thin film transistors (TFTs). The ZTO/Ag bilayer is more transparent (83.71%) and effective source/drain (S/D) electrodes for the ZTO channel/Al2O3 gate dielectric/ITO gate electrode/glass structure than ZTO/Ag/ZTO trilayer because the bottom ZTO layer in the trilayer increasea contact resistance between S/D electrodes and ZTO channel layer and reduce the antireflection effect. The ZTO based all-transparent TFTs with ZTO/Ag bilayer S/D electrode showed a saturation mobility of 4.54cm2/Vs and switching property (1.31V/decade) comparable to TTFT with Ag S/D electrodes.

Keywords: ZnSnO semiconductor, transparent thin film transistor, Source and drain electrodes