ANALYSIS OF CARRIER INJECTION UNDER HIGH TEMPERATURE AC OPERATION IN TOP GATE IGZO TFTs

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Abstract– With the development of high-quality displays, metal oxides gradually become a popular active layer in TFTs [1]. In this work, InGaZnO thin film transistors with double-layer oxide are investigated. The oxide layer is divided into top and bottom layers. We improve the characteristics and reliability of the device through the design of double-layer oxide stack structure. The bottom oxide layer is deposited with a lower SiH_4 flow rate, and the top oxide layer is deposited with a higher SiH_4 flow rate. By increasing the SiH_4 flow rate of the top oxide layer, two effects can be achieved. Firstly, it is beneficial for speeding up the film deposition process. Furthermore, the hydrogen residue passivates the dangling bonds in the oxide layer and increases the bonding amount of silanol groups, SiO-H, and achieve hydrogen channel doping [2]. By modulating the SiH_4 flow rate of the top oxide layer, the basic characteristics of the devices and the reliability under alternating current (AC) operation are improved. In this work, we use three waveform types of switch process to analyze the degradation under AC stress, and the physic mechanism is proposed subsequently [3-4]. After AC stress, the top oxide layer with higher SiH_4 flow rate has a smaller threshold voltage right shift, and the reliability is significantly improved.

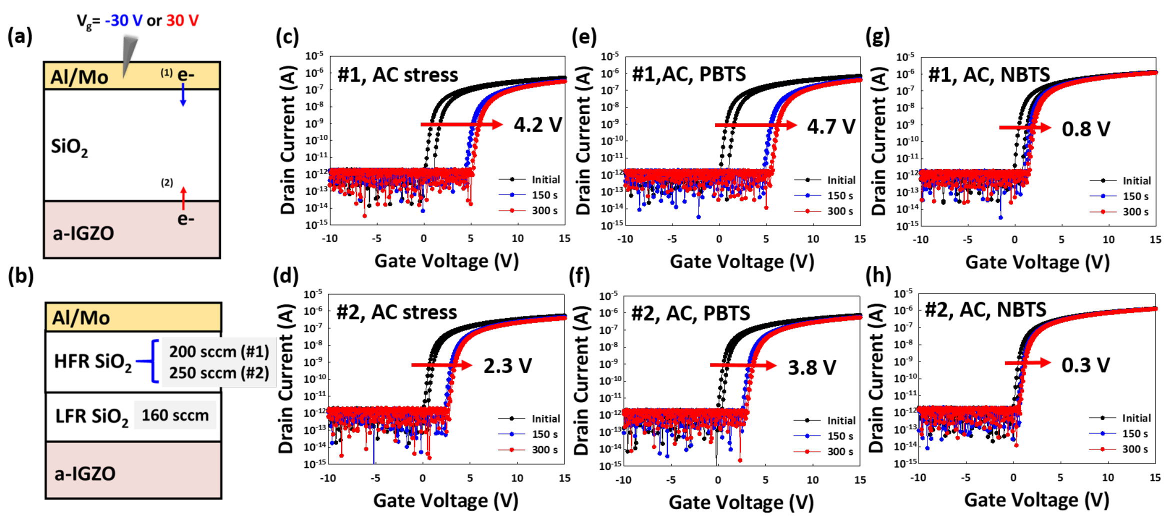

Figure 1 – The Physic Models For (a) Positive Bias Temperature Stress (pbts) And Negative Bias Temperature Stress (nbts). (b) The Design Of Double Stacks Sio2, Higher Flow Rate (hfr) Sio2, And Low Flow Rate (lfr) Sio2, Respectively. The Ac Stress For (c) #1 Devices And (d) #2 Devices, Respectively. The Ac Pbts For (e) #1 Devices And (f) #2 Devices, Respectively. The Ac Nbts For (g) #1 Devices And (h) #2 Devices, Respectively.

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