Amorphous InGaZnO Thin Film Transistors with Sputtered Silver Electrodes

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It is very important to develop low-resistive electrodes for amorphous InGaZnO thin film transistors (a-IGZO TFTs) to drive large-size flat panel displays. For its best conductivity Ag should be a good candidate serving as the gate and source/drain (S/D) electrodes of a-IGZO TFTs. Recently some related studies by our group and the other researchers [1] have been reported but unfortunately none of their fabrication methods adopted sputtering, the most likely preparation technique for industrial productions. In this study, the a-IGZO TFTs with sputtered Ag/Ti or Ag/Mo bilayer S/D electrodes were prepared and investigated in detail.

Figure 1 shows the I_{DS}-V_{GS} curves of the a-IGZO TFTs with Ag, Ti and Ag/Ti bilayer electrodes. One may observe that the device with pure Ag electrodes exhibited the worst electrical performance probably due to a formed thin insulating layer like AgO_x at the a-IGZO/Ag interface [1]. By depositing a Ti interlayer, the electrical characteristics of the a-IGZO TFTs became much better, i.e. larger I_{on} and smaller V_{th}. One might assume here that the contact resistance between the metal electrodes and a-IGZO was effectively reduced by the formation of a TiO_x interfacial layer, which led to an oxygen deficient region in the IGZO contact area [2]. As shown in Figure 1, the improving effect increased gradually with the Ti interlayer thickness increasing from 10 to 30 nm.

The a-IGZO TFTs with Mo interlayer shows the similar but even better trends, as shown in Figure 2. One may notice here that the 10-nm-thick Mo interlayer could make the device performance very closely approaching that with the pure Mo electrodes. Since the resistivity of MoO_x is lower than that of TiO_x, the contact region between Mo and a-IGZO might be much better, as was experimentally confirmed by the investigation results with SEM and AFM (data not shown). Therefore, Mo should be preferred to Ti serving as the interlayer for the sputtered Ag electrodes of a-IGZO TFTs.

On the other side, the proper etching methods for these bilayer electrodes (Ag/Ti and Ag/Mo) must be developed for their potential applications in the mass productions of a-IGZO TFTs. The related studies are still undergoing.

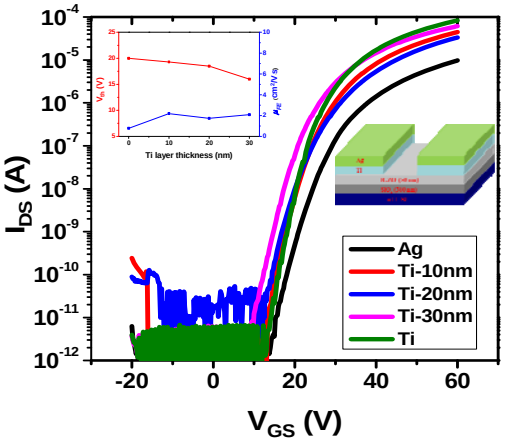

Figure 1. A-IGZO TFTs with Ti interlayer

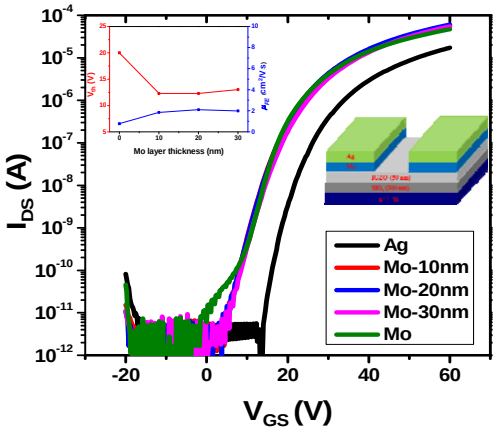

Figure 2. A-IGZO TFTs with Mo interlayer

In summary, the Ag films with Ti or Mo interlayers were proved to fit the S/D electrodes of a-IGZO TFTs.

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References

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