Plasma-Enhanced Atomic Layer Deposition Processed Amorphous Indium Zinc Oxide Thin-Film Transistor for Ultra-High Definition Display Application

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As the resolution of display increases, the small footprint of thin-film transistors (TFTs) becomes important. The vertical TFT (V-TFT) is promising structure for driving device for the benefit of its extremely small footprint which is even smaller than the back-channel etch (BCE) TFT [1]. Therefore V-TFT is the best to materialize beyond high definition display such as holography display. However, it is critical to deposit oxide layers with good step coverage in fabrication of V-TFT. Plasma-enhanced atomic layer deposition (PEALD) which give superior step coverage with high uniformity, is very good candidate of V-TFT's channel.

Here, high mobility amorphous indium zinc oxide (IZO) was successfully grown by means of unique PEALD process and the atomic ratio of indium (In) and zinc (Zn) in IZO film was controlled. This was confirmed by X-ray photoelectron spectroscopy (XPS) analysis as shown in Fig. 1(a). The PEALD grown IZO was also investigated by X-ray diffraction (XRD) and it shows amorphous characteristic as shown in Fig 1(b). With this IZO, staggered coplanar structured oxide TFTs were fabricated and their electrical characteristics were reasonable as shown in Fig 1(c). With this result, finally, the PEALD grown IZO was applied to the channel layer of V-TFT for the first time. As shown in Fig 1(d), at this moment, the V-TFT did not show high performance characteristics, however, the optimization such as fabrication process, atomic ratio of the channel material and so on will be proceeded.

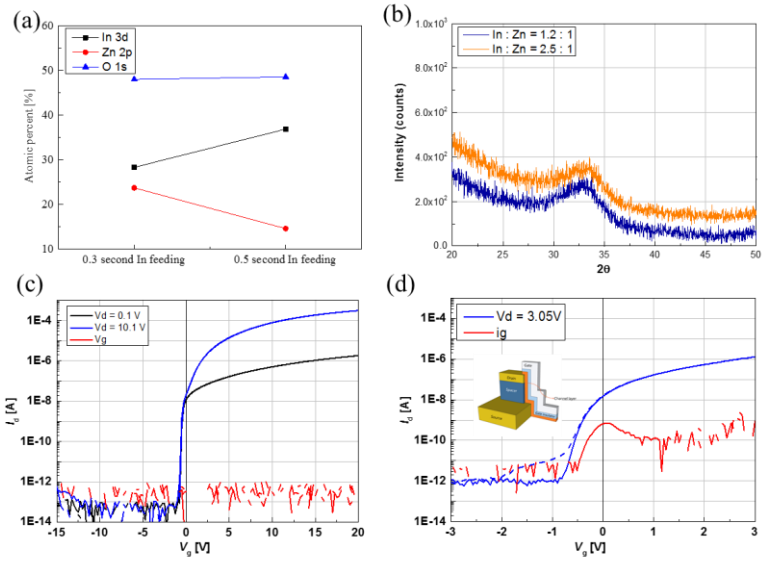

Fig. 1. (a) Atomic ratio of In, Zn and oxygen in PEALD grown IZO measured by XPS, (b) XRD result of PEALD grown IZO, (c) transfer characteristic of staggered coplanar oxide TFT with PEALD grown IZO and (d) Transfer characteristic of V-TFT with PEALD grown IZO

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References

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