The effect of negative bias stress stability in high mobility In-Ga-O TFTs

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Abstract : In this work, we investigated the characteristics and the effects of light on the negative gate bias stress stability (NBS) in high mobility polycrystalline IGO TFTs. IGO TFT showed a high drain current on/off ratio of ~10^9, a field-effect mobility of 114cm^2/Vs, a threshold voltage of -4V, and a subthresholdslpe(SS) of 0.28V/decade from log(I_{DS}) *vs* V_{GS}. IGO TFTs showed large negative V_{TH} shift(17V) at light power of 5mW/cm^2 with negative gate bias stress of -10V for 10000seconds, at a fixed drain voltage (V_{DS}) of 0.5V.

1. Introduction

Oxide thin film transistors (TFTs) have attracted considerable interest for gate diver and pixel switching devices of the active matrix (AM) liquid crystal display (LCD) and organic light emitting diode (OLED) display because of their high field effect mobility, transparency in visible light region, and low temperature processing below 300°C. Recently, oxide TFTs with polycrystalline In-Ga-O(IGO) channel layer reported by Ebata.et.al. showed aamazing field effect mobility of 39.1cm^2/Vs. Though the polycrystalline IGO TFTs were reported to have high mobility, the gate bias stress stability study as a function of different ambient condition have not been investigated in detail yet.

2. Results

In this work, we investigated the characteristics and the effects of light on the negative gate bias stress stability (NBS) in high mobility polycrystalline IGO TFTs. The TFTs were fabricated using a polycrystalline IGO thin film as the n-channel active layer by rf-magnetron sputtering. The 30nm thickness IGO TFT showed a high drain current on/off ratio of ~10^9, a field-effect mobility of 114cm^2/Vs, a threshold voltage of -4V, and a subthresholdslpe(SS) of 0.28V/decade from log(I_{DS}) *vs* V_{GS}.

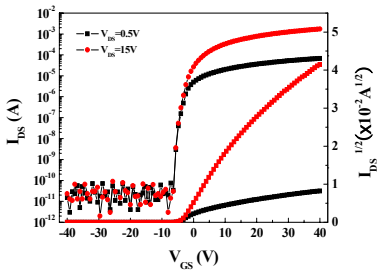

Fig. 1. Source-to-drain current(I_{DS}) as a function of gate voltage(V_{GS}) at a fixed drain voltage of 0.5V and 15V

3. Conclusion

The IGO TFTs irradiated by only light power of 5mW/cm^2 without negative gate bias stress for 10000seconds, at a fixed voltage(V_{DS}) of 0.5V. Negative V_{TH} shift(ΔV_{TH}) was observed with 5.1V and unchanged SS value and μ_{FE}. And the IGO TFTs showed large negative V_{TH} shift(17V) at light power of 5mW/cm^2 with negative gate bias stress of -10V for 10000seconds, at a fixed drain voltage (V_{DS}) of 0.5V.

References

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