Analysis on the Degradation Mechanism under Positive/Negative Gate Bias Stress in Zinc Oxynitride Thin-Film Transistors

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Amorphous oxide semiconductors are suitable for channel materials for thin-film transistors (TFTs) as display devices in active-matrix organic light-emiiting diode and active maxtrix liquid crystal display panels due to attractive advantages such as transparency, low temperature process, and excellent electrical characteristics [1]. Nevertheless, another alternative material having higher mobility than 40 cm^2/Vs is necessary for realization of next generation display technology like 3-dimensional, high-resolution, and large size flat panel display. In this point, zinc oxynitride (ZnON) is worthy of notice that it has a high mobility up to 110 cm^2/Vs [2].

In this paper, we conduct the positive (V_{GS}=30V/V_{DS}=0V) /negative (V_{GS}=-30V/V_{DS}=0V) gate bias stress (PGBS/NGBS) study in ZnON TFTs to investigate the reliability under the operation conditions. When the PGBS is applied, a positive threshold voltage shift (ΔV_T) with a striking increase of the off current is observed [Fig 1. (a)] while a negative ΔV_T without the degradation of subthreshold swing (SS) is shown during the NGBS [Fig 1. (b)]. Consequently, we find out that the main mechanism on NGBS instability is the charge trapping rather than the defect creation of active layer. The mechanism on PGBS is also discussed. Our study is potentially useful for the development of ZnON TFTs overcoming the trade-off between performance and stability.

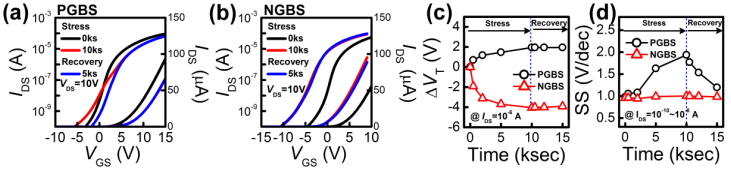

Fig 1. Transfer characteristics during (a) PGBS and (b) NGBS. Time-evolution of (c) ΔV_T and (d) SS

[1] E. M. C. Fortunato, *et al.*, *Appl. Phys. Lett.*, vol. 92, p. 222103 (2008)

[2] H.-S. Kim, *et al.*, *Scientific Reports*, vol. 3, p. 1 (2013)

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