Characteristics of Schottky Barrier Poly-Si Thin-Film Transistors with Excimer Laser Annealing Treatment

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The characteristics of Schottky barrier thin-film transistor (SBTFT) with poly-Si active channel layer were fabricated and explored in this work. Figure 1 shows the cross-sectional view of the SBTFT with field-induced drain (FID) structure. Detailed fabrication flow could be found in our previous reports [1][2]. During device operation, a proper fixed bias is applied to the sub-gate to form an electrical junction in the offset channel region. So depending on the polarity of the sub-gate-bias, the device can be set for either n- or p-channel operation.

In this work, the 50nm-thick active channel layer was made up of re-crystallized poly-Si layer by either excimer-laser annealing (ELA) or solid-phase crystallization (SPC) method. ELA was performed by irradiating the amorphous Si layer with an energy density of 250mJ/cm² for 100 shots. Gate oxide (100 nm) and passivation oxide (400 nm) were deposited using PECVD. Co silicide serving as the metallic source/drain of the SB TFTs was formed using self-aligned silicidation (salicide) method.

Our experimental results indicate that the crystallinity of the poly-Si channel plays an important role in affecting the device characteristics. For the device with SPC poly-Si channel, typical on/off current ratio is around 10² for both p- and n-channel operations. When ELA poly-Si is employed as the channel, excellent device performance in terms of steep subthreshold slope and high on/off current ratio higher than 10⁴ for both p- and n-channel operations are demonstrated on a single poly-Si TFT device. A typical example is shown in Fig. 2. We also found that source-side tunneling process is important for device operation, especially for the n-channel operation that has a larger barrier height.

References