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Abstract
Undoped α-Si films and Poly-Si films have been employed to fabricate α-Si thin film transistors (α-Si TFTs) and poly-silicon thin film transistors (poly-Si TFTs) on glass and Si wafer, respectively. This study aims to investigate the effects of different gate oxide, buffer layer and channel W/L ratios on TFT devices.
The results show that TEOS-base gate oxide provides superior electric properties for Poly-Si TFTs than E-beam gate oxide, including a steeper sub-threshold slope (S.S.) and a higher Ion/Ioff current ratio (>10-4). These results reveal that the step-coverage and film density of TEOS-base oxide deposited by LPCVD are better than that of E-beam evaporation.
In order to fabricate TFTs on glass substrate at low temperatures, E-beam SiO2 was used as a buffer layer. The results show that the a-Si TFTs with a SiOx buffer layer on glass have much lower leakage current because of a better interface between P-Si and the glass. Based on this result, buffer layer is considered as an important component for TFTs.
Sputter SiO2 was also used as another buffer material in the structure of TFTs. Compare to sputter SiO2 buffer layer, a-Si TFT devices with an E-beam oxide buffer layer provide lower leakage (Ioff) and saturation current (Isat). The result should be due to the use of reactive Si-O2 sputter process instead of SiO2 target sputtering.
Finally, the channel with various width (2μm、5μm、10μm、20μm) and various length (2μm、5μm、10μm、20μm) have been investigated. Results reveal that the Id-Vg curves of the L= 2μm TFT devices are rather poor with low saturation current. This is should be the reason for the poor layer-to-layer alignment with our photolithography system for dimensions less than 5μm. When L> 2 μm, the Id-Vg curves of TFT devices are much better, including low leakage current, high and stable saturation current. For devices with W/L= 10/10μm, the TFTs exhibit the best electrical properties. When the channel width is fixed, the sub-threshold slope and saturation current of TFT devices become steeper and larger with increasing channel length. In all cases, devices with W/L= 1 was found to perform the best characteristics in this study.
Advisory Committee C. M. Hsu - advisor

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