Reliability Study of MILC Poly-Si TFTs on Plastic Substrates Using PostFlex Transfer Process

Handong Li and Stephen J. Fonash
The Pennsylvania State University
University Park, PA 16802

Transfer approaches for fabricating poly-Si TFTs on plastics can avoid the problems caused by the use of these substrates, such as temperature limitations and mechanical instability during processing,: consequently, transfer processes are becoming an important method for realizing poly-Si TFT based flexible displays and electronics. Some prototype displays using these methods have already been demonstrated. Transfer approaches include surface free technology by laser annealing (SUTLA) from Seiko/Epson, total mother substrate etching by Sony, and PostFlex transfer technology from Penn State University/Nanohorizons.

PostFlex transfer technology using wet chemical etching can reliably release poly-Si TFTs/polymer substrate from the mother substrate quickly. Poly-Si formation can be by laser or solid phase crystallization. Here we report on the reliability of PostFlex high performance poly-Si TFTs on plastic made by the MILC solid phase crystallization approach.. These p-type poly-Si TFTs typically had a linear field effect hole mobility of ~170 $cm^2/V{\cdot}s$, on/off current ratio of 10^8 at Vds= -0.1V, and sub-Vt swing of 200mV/dec which remained the same before and after separation and transfer.

In actual applications, thin film transistors on polymer substrates will be unavoidably exposed to different environmental conditions. Temperature, light, humidity, and mechanical strain will all affect the performance of the devices. The characterization of the devices under these factors is very important for the system design . For example, control of the off-state leakage current under various temperature, light, humidity, and strain conditions is a very serious problem in projection and/or video LCD displays. In this study, electrical characterization results of PostFlex process prepared MILC poly-Si TFTs on BCB/parylene substrates under various temperature, light intensity, and mechanical strain conditions will be discussed. A summary of the results are shown in Fig. 1-Fig 3.

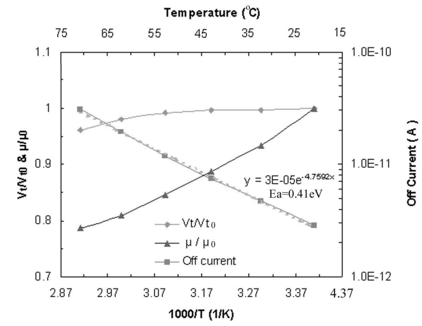

Figure 1. The effect of temperature on MILC poly-Si TFTs on polymer substrates.

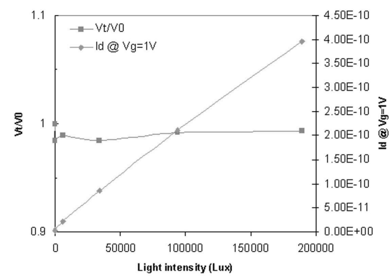

Figure 2. The effect of light illumination on MILC poly-Si TFTs on polymer substrates.

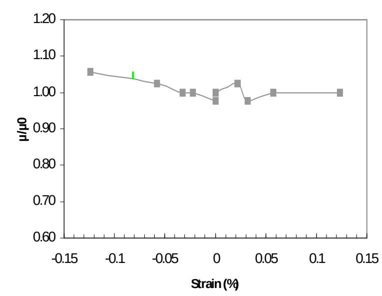

Figure 3. The effect of mechanical stress on MILC poly-Si TFTs on polymer substrates.