Effect of Channel Widths on Electrical Characteristics of Bendable a-Si:H TFTs

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Recently, bendable thin-film transistors (TFTs) have attracted much attention as one of components for bendable display [1, 2]. Especially, a-Si:H TFTs used as driving devices for organic light-emitting diode (OLED) have been intensively studied in order to realize high performance OLED even under bending stress [3]. However, up to now, there is a lack of research on the effect of the TFT channel dimensions on the electrical characteristics under bending stress. Hence, in this study, we investigate the channel dimension affecting the electrical characteristics as a function of bending radius.

In this study, n-type a-Si:H TFTs with a back-channel-etching structure were fabricated on polyimide substrates. The TFTs were constructed with the different channel widths of 8, 20 and 50 µm and the channel length of 10 µm. The TFTs were bent by means of homemade bending stages (Fig. 1(a)) and the electrical characteristics were measured using an HP 4155C semiconductor analyzer at room temperature.

The mobility and the threshold voltage of an a-Si:H TFT with a channel width of 50 µm were 0.2 cm^2/V and 0.93 V in the flat state, respectively. In the flat state, the mobility and the threshold voltage were nearly identical to the other TFTs with different channel widths. Under the bending, there was considerable change in the threshold voltage as a function of the bending radius as shown in Fig. 1(b). Especially, the shift of the threshold voltage in the TFT with a channel width of 8 µm was up to 6.6 V at a bending radius of 6 mm. Compared to the TFTs with narrow channels, the TFTs with wide channels show relatively more stable performance even under a bending radius of 6 mm due to the more number of electrical conducting paths in the wide channels.

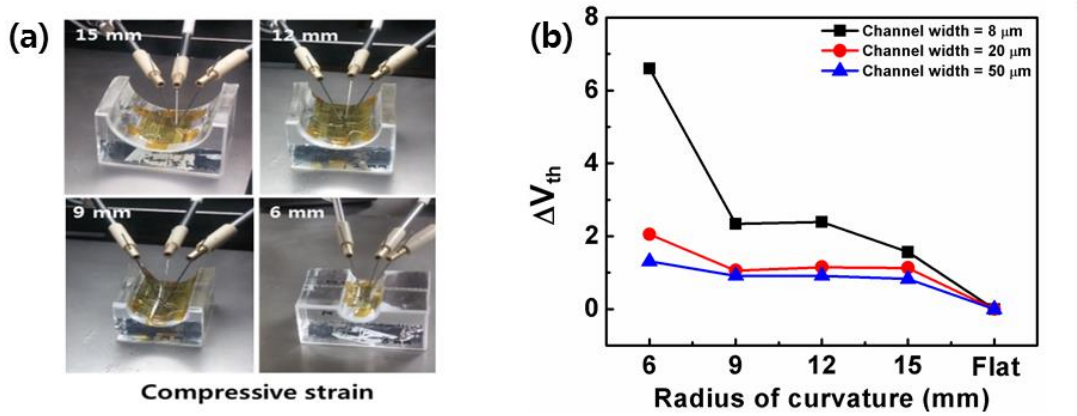

Fig. 1. (a) Optical images of the homemade bending stages and (b) the shift of the threshold voltage as a function of the radius curvature.

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