Fabrication of organic TFT arrays on a flexible sheet by microcontact printing

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Microcontact printing is a kind of soft lithography for forming patterns made of a target material on a substrate with a soft stamp. Poly(dimethylsiloxane) (PDMS) is often used as a resin for the stamp. We made a 6-inch ϕ PDMS stamp and successfully formed 1 μm-wide L&S patterns of ink containing silver by microcontact printing[1]. Recently we have equipped our microcontact printer with a new alignment system as shown in Fig. 1. In this paper we will report the results on the fabrication of organic TFT arrays for flexible display panels by microcontact printing. We tried to fabricate a TEG sample consisting of bottom-gate bottom-contact TFTs of channel length 5-50 μm (Fig. 2). Two masters for both gate layer and source-drain layer, made of 6-inch ϕ, 625 μm-thick silicon wafers, and another master for an organic semiconductor (OSC) layer, made of resist on a glass wafer, were prepared. Three stamps of PDMS provided by Shin-Etsu Chemical Co. were replicated from the masters. The gate layer, the gate insulator layer, the source-drain layer and the OSC layer were stacked on a 6-inch ϕ, 120 μm-thick polycarbonate (PC) film by microcontact printing except for the gate insulator layer, which was formed by spin-coating of polyvinylphenol (PVP). Ink of Poly-3-hexylthiophene (P3HT) was used for the OSC layer whereas a silver-containing ink was used for wiring. Both inks were prepared by DIC Corp. Figure 3 shows photographs of a TEG sample and finished TFTs in it. An excellent transistor characteristic of small variation was observed as shown in Fig. 4.

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1 S. Handa *et al.*, Abstract of MRS Fall Meeting 2007, KK10. 52.

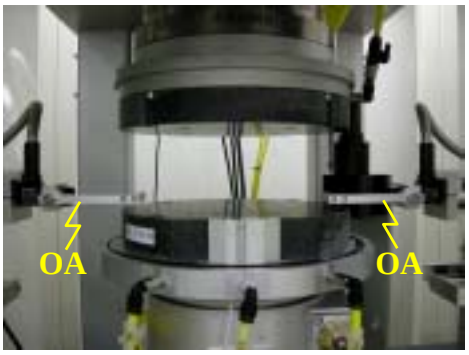

Fig 1: Microcontact printer equipped with an optical alignment system (OA).

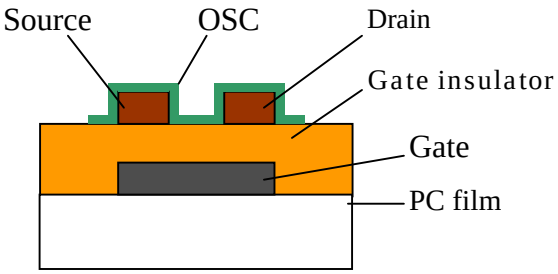

Fig 2: Cross-sectional view of a bottom-gate bottom-contact TFT.

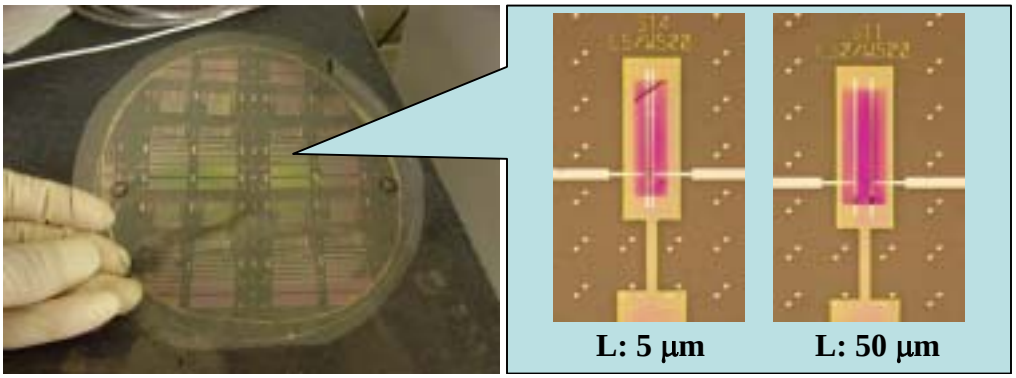

Fig 3: Photographs of a TEG sample formed on a 6-inch ϕ PC film and finished TFTs on it (in the blowup), where L stands for the channel length.

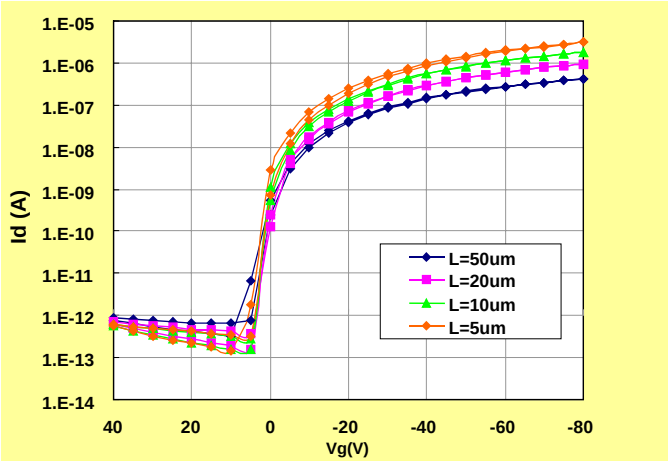

Fig 4: I_d-V_g characteristics of TFTs for channel lengths of 5-50 μm.