インクジェット印刷法を用いたデュアルゲート型有機トランジスタの作製

Fabrication of a Dual-gate Type Organic Transistor using Inkjet Printing

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【Introduction】 Dual-gate type thin film transistors (DGTFTs) (which possess a second gate insulator with a second gate electrode) have been numerously investigated, because the threshold voltage can be readily modulated by applying a voltage to the second gate electrode. Such properties are very valuable for the fabrication of integrated circuits as well as sensing applications. [1] Especially, DGTFTs using organic semiconducting materials (DG-OTFTs) are one of the more promising devices, due to their mechanical flexibility, printability and low-manufacturing costs. However, the fabrication of DG-OTFTs by printing technology (such as inkjet printing) is not fully established. In this paper, we report on the fabrication, characterization, and biosensing application of a DG-OTFT on a plastic film.

【Experimental】 The device structure of the DG-OTFT is shown in Fig. 1. The device was fabricated on a parylene film. A cross-linked poly(4-vinyl phenol) (C-PVP) was employed as an under layer. The silver bottom-gate, source and drain electrodes, and the organic semiconductor (2,8-difluoro-5,11-bis(triethylsilylethynyl)anthradithiophene, diF-TES-ADT) layer were fabricated by inkjet printing. The C-PVP and parylene were used as the bottom insulator and the top one, respectively. The gold top-gate electrode was finally deposited on parylene by thermal evaporation. The bottom-gate voltage (V_{BG}) was swept from 3 to -10 V while the top-gate voltage (V_{TG}) was kept at -1, -0.5, 0, 0.5, or 1 V.

【Results and Discussion】 The transfer characteristics of the DG-OTFT are shown in Fig. 2(a), indicating that the transfer characteristics were manipulated by changing the applied voltage to the top-gate. Importantly, the relationship between the threshold voltage (V_{TH}) and V_{TG} was linear (Fig. 2(b)), which means that the manipulation was successfully achieved. These data indicate the DG-OTFT is suitable for biosensing applications. Further details will be discussed on the presentation.

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[1] M.-J. Spijkman et al., *Adv. Mater.*, **23**, 3231 (2011).

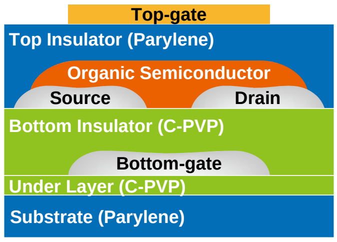

Fig. 1. The device structure of the fabricated DG-OTFT

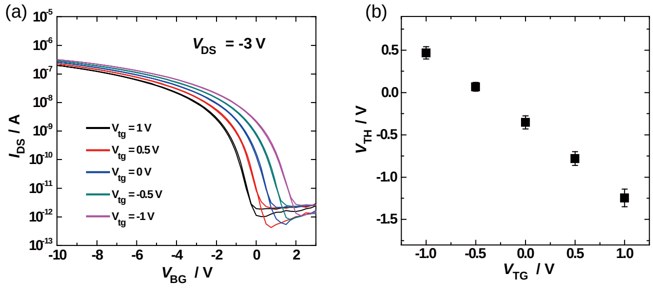

Fig. 2. (a) The transfer characteristics of the DG-OTFT. (b) The relationship of the V_{TH} and V_{TG}.