Control of patterning line width of organic thin film by Electrospray Deposition method

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Organic transistors have attracted attention for use in wearable devices: smartphones, tablets, and other devices. Although several fabrication methods exist, vacuum evaporation is difficult to fabricate patterned organic films in simple and compact equipment. Therefore, we try to fabricate organic transistors by using the new Electrospray Deposition (ESD) method without shadow masks. This method can reduce the production cost. However, this process requires control of patterning widths without shadow masks. Therefore, we need to explore conditions to control the injection of liquid material. Organic material 6,13-bis (triisopropyl-silylethynyl) pentacene in 1 wt% toluene and Dimethylformamide added to toluene as an additive. We sprayed the liquid onto a Polyethylene film placed on the top of an aluminum electrode used as the counter electrode. Then, we measured the current during the spray phenomenon. The change in patterning width was measured when a Polyethylene film was placed on top of an electrode with a line width of approximately 269 μm and sprayed onto it. Fig. 1 shows the change in current and patterning width during spraying when the electric field strength is varied. The current becomes constant and stable spraying is possible at 6.0 to 7.2 kV/cm. However, the current increased significantly above 7.2 kV/cm. Therefore, we should use an electric field of 6.0 to 7.2 kV/cm for the ESD method. We also measured the patterning width when the electric field strength varied from 5.0 to 7.0 kV/cm, and the results show that the patterning width increased as the electric field strength increased. The stronger the electric field intensity is, the larger the patterning width tends to be than the targeted line width.

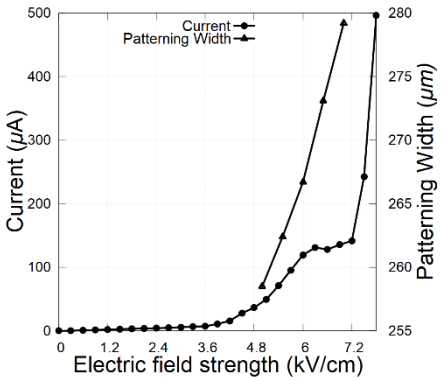

Fig. 1 Current and patterning width versus electric field strength