Direct formation of organic single crystal arrays on a patterned polymer layer with controlled-position and orientation

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In order to obtain high performance OTFTs, single crystal phase of organic semiconductor is typically desired within a channel region, because the carrier transport typically depends on the molecular packing. In addition, for the controlled-location and direction of oragnic single crystal formation, diverse techniques such as inkjet printing and sheared deposition using a self-assembled monolayer pattern have been reported. In this study, we used deep ultraviolet(DUV) irradiation onto Poly(methyl methacrylate) (PMMA) film, which enables the determined re-organization of 2,7-dioctyl[1]benzothieno [3,2-b][1]benzothiophene (C8-BTBT) single crystals with desired location and direction, such as simple lines, perpendicular and radial direction. Subsequently, Solvent vapor annealing (SVA) process was used for re-organizing of C8-BTBT molecules. At this stage, C8-BTBT small molecules become mobile on soluble polymer layer and re-assembled into micro rod-shaped single crystal only at pristine PMMA region. The trench of pristine PMMA produced single crystal arrays of C8-BTBT. As shown in Figure 1, we fabricated high performance OTFT with multi-aligned C8-BTBT crystal arrays on 3-μm-thick flexible film, showing carrier mobility of about 2cm^2/Vs.

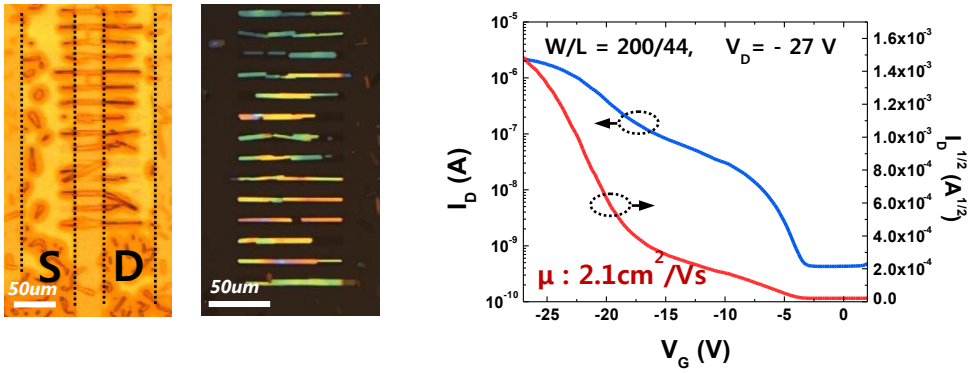

Fig. 1. Optical microscopy images of the device of organic single crystal arrays and its characteristics.

References

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