

Solution-processed organic TFT for display application

Kazumasa Nomoto

Advanced Materials Laboratories, Sony Corporation

Kazumasa.Nomoto@jp.sony.com

An organic thin-film transistor (OTFT) has been attracting much attention, because OTFTs can be manufactured by solution process such as printing and coating at low temperature < 200 C. In order to improve performance of OTFT, formulation of organic semiconductor ink and printing technique are key technologies.

We have developed formulation of organic semiconductor ink with 6,13-bis(triisopropylsilylethynyl) pentacene (TIPS-pentacene) and poly(alpha-methylstyrene)(PaMS)[1]. The TOF-SIMS analysis of its spin-coated layer has revealed that TIPS-pentacene and PaMS are phase-separated vertically into three layers: a TIPS-pentacene layer/a mixed layer of TIPS-pentacene/PaMS, a TIPS-pentacene layer. We will discuss how the phase-separated channel layer has improved the mobility, uniformity, and thermal stability.

For semiconductor patterning, we have examined stamping and inkjet printing. The dry-stamping technique using an elastomeric stamp was applied to pattern a P3HT film [2]. This OTFT showed relatively high mobility of $0.04 \text{ cm}^2/\text{Vs}$ because the P3HT film formed highly-ordered lamella structure on a hydrophobic surface of the stamp. We applied inkjet printing to pattern a small-molecule organic-semiconductor layer. After optimizing the ink formulations of organic semiconductor and the inkjet conditions such as the substrate temperature and the shot number, the field effect mobility up to $0.4 \text{ cm}^2/\text{Vs}$ are obtained at short channel length of 5 μm , which has enabled to drive 4.8 in VGA (169 dpi) electrophoretic display [3].

[1] T. Ohe, et al., Appl. Phys. Lett., 93 (2008) 053303.

[2] A. Nomoto, et al., MRS spring meeting (2007).

[3] N. Kawashima et al, SID 2009 Digest (2009) 25.