# Large-area Oriented Films of Semiconducting Polymers by Unidirectional Floating Film Transfer Method

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Solution processable semiconducting polymers have made the fabrication of active layer of organic field-effect transistors (OFETs) easy and cost-effective [1]. Improvement in charge transport in semiconducting polymers has been well studied in the recent past by orienting the polymeric main chains along the channel direction of OFETs. However, the inevitability of pre-aggregation in solution and difficulty in layer-by-layer film coating of films by various methods to orient polymer is still a major limitation for their use in large-area fabrication of thin films for high-performance printed electronics with adequate repeatability [2].

The unidirectional Floating film transfer method (UFTM) is an efficient film fabrication method to solve the above issue. In this technique, one drop of polymer ink is placed on the orthogonal viscous liquid, and polymer solution spreads on it. Viscous drag arising from the liquid substrate continuously acts opposite to the polymer film expansion direction, resulting in polymer backbone orientation perpendicular to the film expansion direction [3]. At the same time, simultaneous solvent evaporation results in solid-oriented thin films of semiconducting polymers floating at the liquid-air interface, which can be transferred to any desired substrate. UFTM possesses various advantages, such as minimum material wastage and high performance due to polymers' uniaxial orientation. In addition, layer-by-layer film fabrication is possible in UFTM as the film preparations are done on the liquid substrate and then transferred on actual device substrates [2]. We have actively worked on this method.

Large-area (40 $cm^2$) of ribbon-shaped films using 10-20 µl of the polymer ink can be prepared using UFTM [3]. This method can be used for orienting a variety of semiconducting polymers, as shown in Fig. 1. Recent progress in UFTM will be presented in this work, which includes the orientation of different kinds of semiconducting polymers like p-type and n-type, and other basic requirements necessary to utilize this method for the facile fabrication of printable electronic circuits. Orientation distribution throughout the thickness of the thin films by charge transport anisotropy in top- and bottom-gated OFETs will also be discussed.

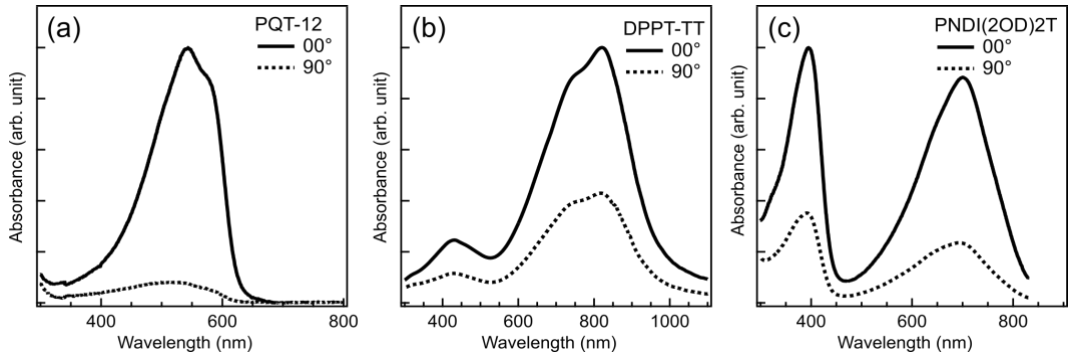


Fig. 1. Polarized UV-vis-NIR absorbance of different SCPs. (a) PQT-12, (b) DPPT-TT, and (c) PNDI(2OD)2T

References:

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[2] M. Pandey et al., *J. Mater. Chem. C* **2019**, *7*, 13323.
[3] M. Pandey et al., ACS Appl. Mater. Interfaces **2021**, *13*, 38534.