

Enhanced charge-transporting behavior for solution-processable organic transistor through microwave impetus

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[Introduction]

The morphology and molecular packing structure of conjugated polymer affect their charge transporting behavior in the intrachain and interchain, which determine the carrier mobility, an index parameter for transistor device. Therefore, the post-processing called thermal annealing is generally required to induce more crystallization in a standard fabrication process for OFET. Thermal annealing is conventionally implemented through thermal conduction methods such as the use of hot plates, however, the energy loss, low efficiency of energy usage and time-consuming question still needs to be modified.

Herein we improve the solubility of semiconducting polymer in the solvent by microwave instead of thermal annealing process. Dissolving materials by microwave inherent a fast and efficient advantages via direct energy transfer. The electromagnetic field is used to rotate the polar molecules so we are based on this property to let the polymer swell well in the polar solvent. As the degree of microwaves absorption depends on the rotation of the dipoles of a material, microwave heating, which can be used to heat material selectively, is a potential approach toward enhancing the efficiency of energy usage.

[Result and Discussion]

The FETs mobility has achieved $0.443 \text{ cm}^2/(\text{V}\cdot\text{s})$ by the microwave method. It's higher than thermal annealing (Fig.1). The microwave method can achieve the same effect within shorter time of annealing preparation. Detailed steady-state UV-vis and PL measurements on solutions of P(NDI2OD-T2)(Fig.2). The measurement immediately after the microwave it will be seen that the blue shift of the CT peak and decreased intensity.

A strategy was developed to improve the charge carrier transport of conjugated polymers. In the future, if microwave combine with printing, the production line of transistors will greatly reduce the cost and simplify.

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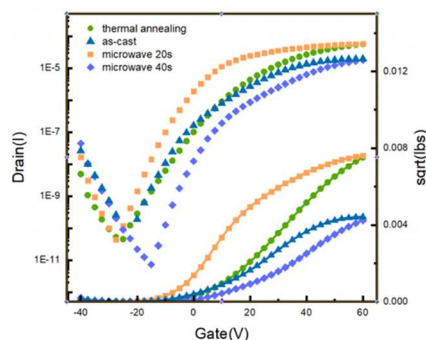


Figure1. Transfer characteristics of NDI2ODT2 TFTs annealed by microwave(green) and by hotplate(orange).

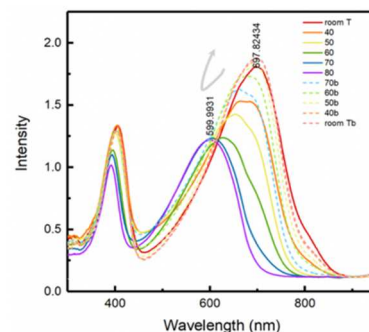


Figure2. Absorption spectra of P(NDI2OD-T2) by various heat-treatment at concentration of 0.05mg/mL.