

Environment-Friendly Dip-Coating Process of Conjugated Polymer Thin Film for Transistor Applications

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For the commercialization of organic electronics, use of a halogenated solvent in the solution processing of organic semiconductors should be replaced with environment-friendly solvents, which is crucial for large-area coating methods such as dip-coating. Here we report a novel bi-phasic dip-coating method not only to achieve green solution process by using water-based biphasic solution but also to produce uniform, smooth, and crystalline conjugated polymer thin film by using solvent additive. We demonstrated that solvent additive with high boiling point and similar solubility parameter affects solvent evaporation rate and improve crystallinity of the dip-coated polymer thin film. Moreover, we found that the solvent-adding method strongly influences how solvent additive diffuses into the polymer solution, which further affects resulting film morphology. The crystallinity and morphology of polymer films are correlated with electric characteristics, showing the enhanced hole field-effect mobility of $0.0391 \text{ cm}^2 \text{ V}^{-1} \text{ s}^{-1}$ when processed from the solvent mixture without post-treatment. Our findings will provide direction for developing more reliable and promising organic TFT technology.