Melt Processing Complementary Semiconducting Polymer Blends for Organic Field-Effect Transistors

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Abstract

Complementary semiconducting polymer blends (c-SPBs), composed of a matrix polymer with conjugation-break spacers along the polymer backbone and a fully conjugated polymer that functions as a tie chain, was recently proposed and established by our group. Compared with traditional fully conjugated polymer, c-SPBs have low and tunable melting points, enhanced solubility and decent electronic performance. These properties make melt processing—a proven technology in the plastic thin film industry—applicable for c-SPBs based devices. Here we introduce melt-processable c-SPB and develop a solvent-free process for fabricating organic field-effect transistors (OFETs, Figure 1). The melt-processed devices exhibited an average mobility of 0.4 $cm^2V^{-1}s^{-1}$ and current on/off ratios higher than 10^5. In-situ temperature-dependent grazing incidence X-ray diffraction (GIXRD) and charge transport measurements provide the evidence that the c-SPB has a reversible morphology and device performance. Based on the reversible feature of melt processing, thermally healable OFETs were further demonstrated. This study opens up a new venue to melt-processable semiconducting polymers and bodes well for melt-processed organic electronics.

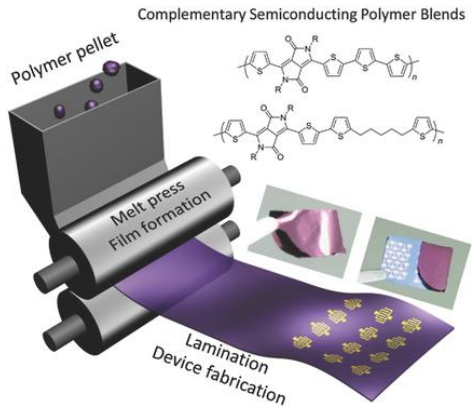

Figure 1: Chemical structure of c-SPBs and the scheme of melt-processing approach.

References

1. Zhao, Y.; Zhao, X.; Roders, M.; Gumyusenge, A.; Ayzner, A. L.; Mei, J., Melt-Processing of Complementary Semiconducting Polymer Blends for High Performance Organic Transistors. Adv. Mater. 2017, 29 (6), 1605056.