Effect of Side Chain and Molecular Weight on 3-(hexylthio)-2,5-dimethylthiophene (P3ST)-based Polymer Semiconductor for Solution-Processed Organic Field Effect Transistors

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Abstract

Charge transport in π-conjugated polymer determine by π-π interactions and polymer backbone, using the unidirectional solution process to fabricate uniform and highly oriented thin film enhance charge transport by well-aligned backbone. In this study, we present the synthesis and characterization of a new series of 3-(hexylthio)-2,5-dimethylthiophene (P3ST)-based polymer semiconductors with different alkyl side chain and different molecular weight, namely P3ST-6 and P3ST-10.

Previous investigation about poly(3-hexylthiophene) indicated improve electrical properties through fine tune the molecular weight show the importance of the role molecular weight play in charge transport. In this study, we comparing different molecular weight of new series P3ST to discover the relationship between molecular weight and mobility. The influence of the alkyl side chain lengths and the replace alkyl chain by alkyl thiols are also discuss in this research. Furthermore, thin film morphology, electronics structures and charge transport for these P3ST derivatives are systematically introduced in this research and analysis by UV-vis spectroscopic, Grazing incidence X-ray diffraction and atomic force microscopy.