

Highly Oriented and Aligned Semiconducting Polymers Using Nano-Grooved Flexible Substrates

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High degree of molecular orientation is required to avoid electronic localization of charge carriers in polymeric semiconductors. The oriented polymer thin films show minimized structural disorders and high anisotropy, implying the possibility of achieving high mobility along the polymer backbone. In this presentation, we show that highly oriented cyclopentadithiophene-based semiconducting polymers can be obtained by directed self-assembly onto nano-grooved substrates. The oriented polymer thin films along nano-grooves in the substrate exhibited strong anisotropy confirmed by polarization-sensitive grazing incidence wide-angle X-ray scattering and absorption spectroscopy. With semiconducting polymers highly aligned and oriented on nano-grooved substrates, we have demonstrated high-performance polymer field-effect transistors with enhanced mobilities fabricated onto rigid and flexible substrates.