Synthesis and Characterization of Block Copolymers for Organic Photovoltaics

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Introduction

Working towards...
• Higher efficiency
• Greater understanding
• New materials
• Cheaper production
• Flexibility

Why block copolymer?
• Higher performance all polymer active layer
• Morphology control
• Better donor/acceptor interface
• Block crystallization

Target Copolymers

P3HT-b-PCPDTBT

PCPDT-b-PNDIbT

P3HT-b-PNIbT

P3HT-b-PFBT

Results & Characterization

Factors we consider...
• Literature homopolymer blend performance
• HOMO/LUMO levels
• Band gap
• Range of absorption

Reactions

Kumada Coupling

Suzuki Coupling

P3HT-b-PFBT Synthesis Scheme

Donor End Group Control

Polymerization Temperature | Polymerization Time | H/Br Fraction
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0°C | 20mins | 83%
Room Temp. | 15mins | 89%

Donor
Acceptor

MALDI-TOF End Group Analysis
• Intensities correspond to end group distribution
• Control critical for synthesis pathway
• Affected by O₂, H₂O, temperature, Grignard quantity

SUMMARY

• Synthesize other targets
• Test devices with new active layers
• Improve accuracy and range of characterization

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