Physics of Electronic Polymers

Lecture 3.2:
Crystallinity and Connectivity in OFETs

Learning Objectives

By the Conclusion of this Lecture, You Should be Able to:

1. **Clarify** why it is important to discuss the crystallinity of a polymer at different length scales when describing transport in OFETs.

2. **Describe** how the percolation of connective crystalline domains alters the observed mobility of a polymer semiconductor thin films in an OFET geometry.

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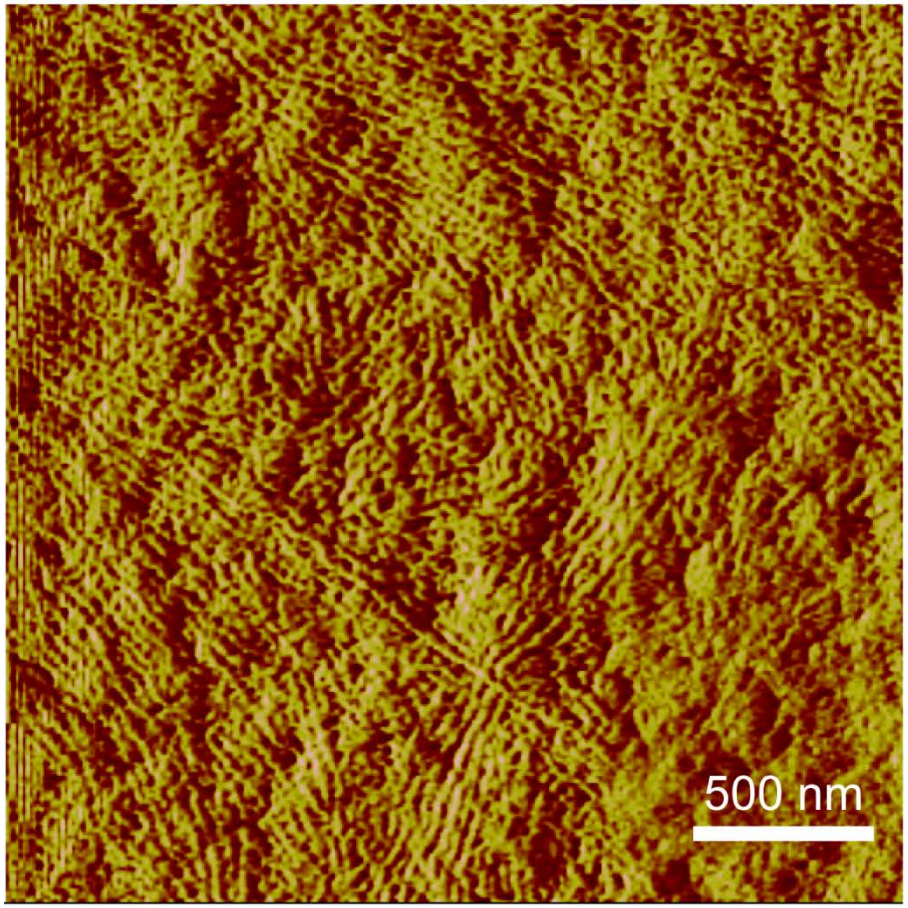
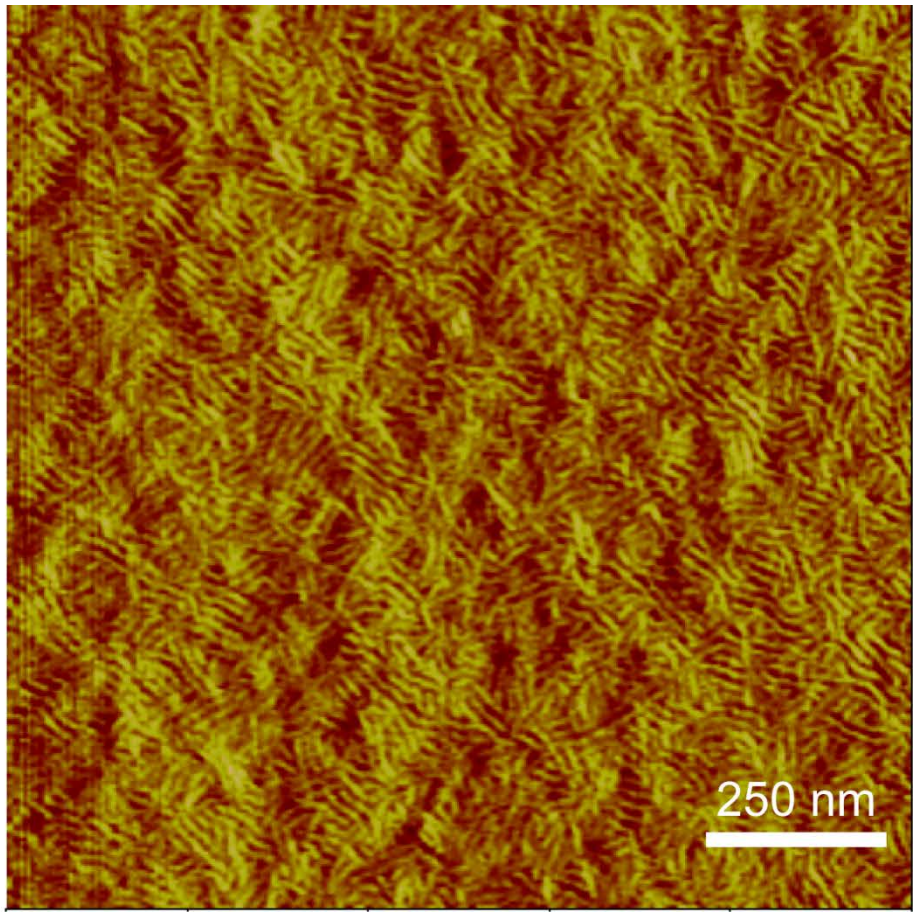
Rod-Like Domains Connect Crystalline Regimes in P3ATs

Thin Film Image of P3HT



Thin Film Image of P3EHT

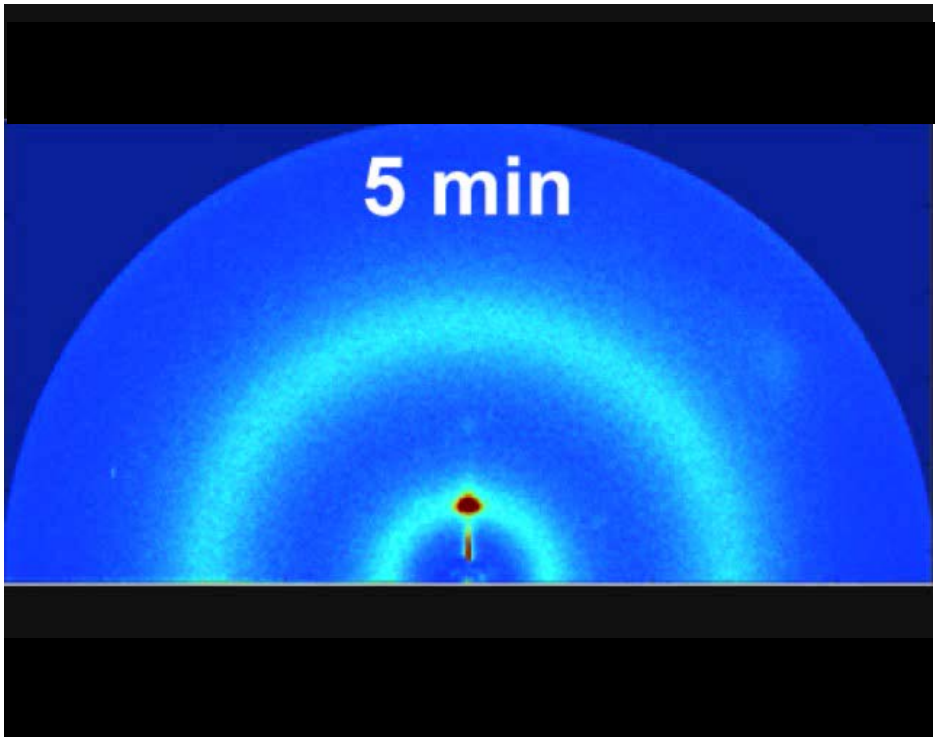


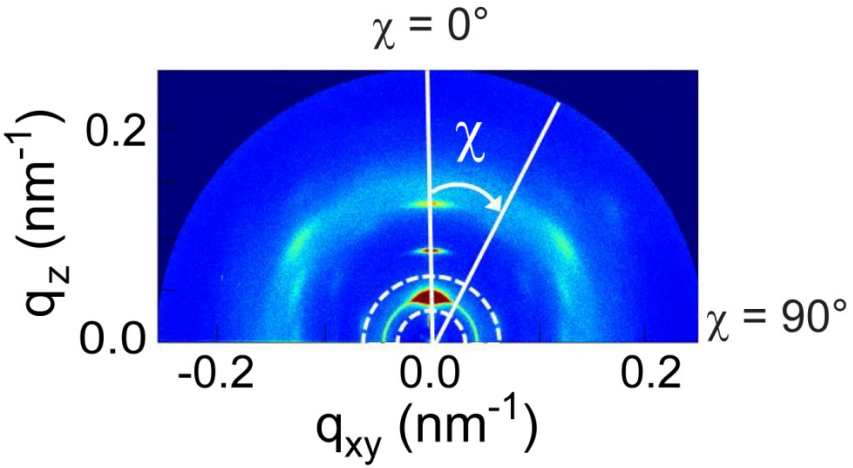
Films were spun from a 10 mg/1 mL chloroform solution at 1000 rpm for 60 sec.

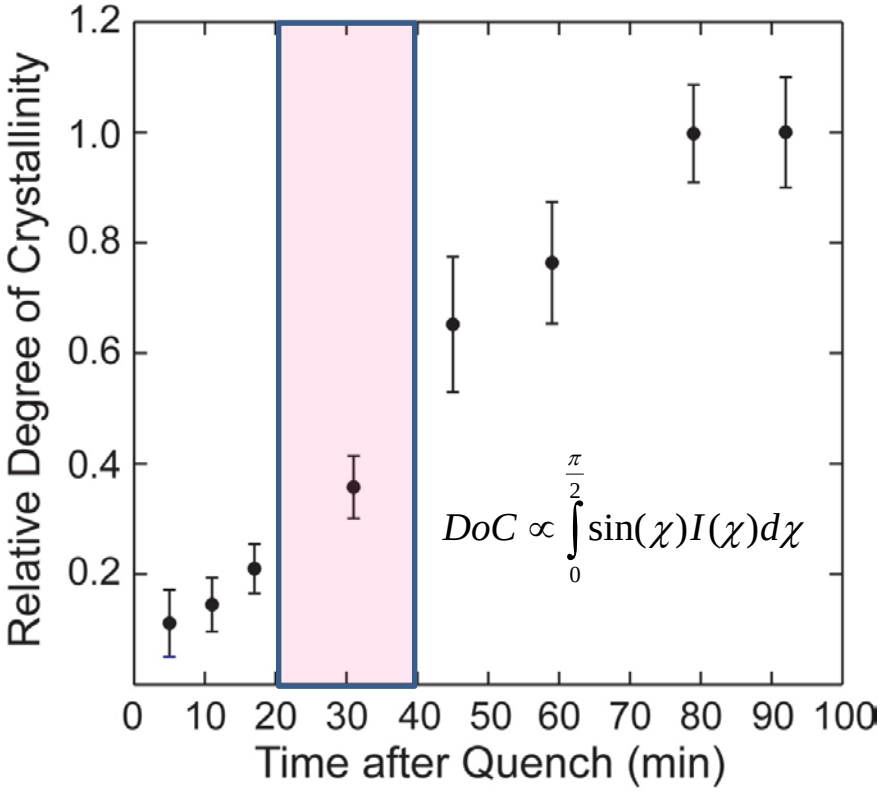
Further Reading: Ho, V.; Boudouris, B. W.; Segalman, R. A. *Macromolecules* **2010**, *43*, 7895.

P3EHT Crystallizes at a Useful Timescale at Room Temperature

P3EHT Crystallization Movie

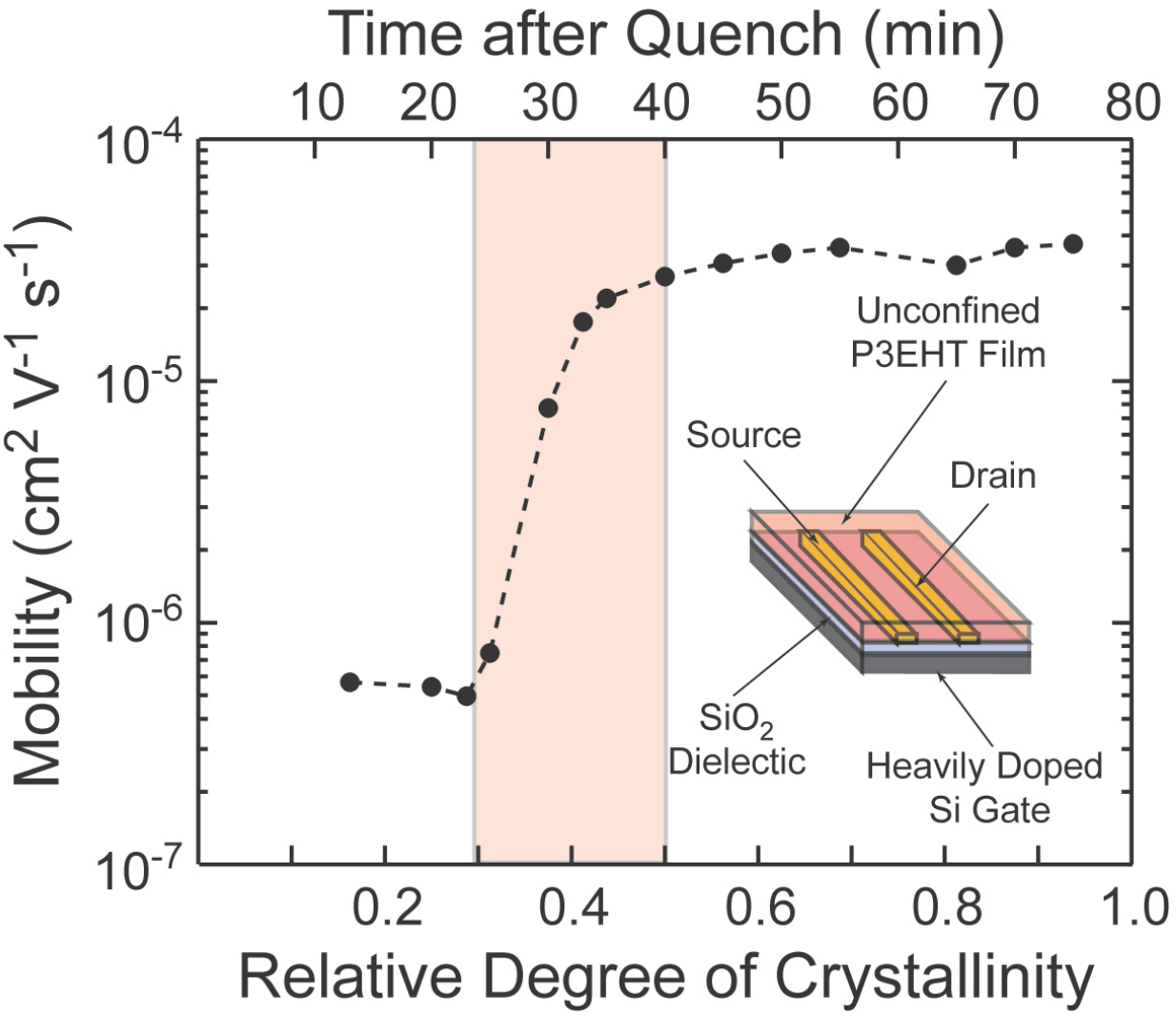






- The film was cooled from 120 °C to room temperature, and this was defined as 0 minutes.
- The film remains nearly 100% amorphous before reaching a highly crystalline nature.

Percolation of Crystalline Domains Causes Rapid Mobility Increase



Next Time: A Model for How Crystalline Domains Connect in Semiconducting Polymers

Further Reading: Boudouris, B. W.; Ho, V.; et al. *Macromolecules* **2011**, *44*, 6653.