Physics of Electronic Polymers

Lecture 4.9: Solid-State Transport in Radical Polymers

Learning Objectives

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

1. **State** how the chemical nature of the pendant groups of radical polymers impacts their optical and electronic properties.

2. **Explain** why radical polymer materials tend to be robust with respect to ambient conditions and long exposures to voltage biasing.

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Spectra Acquired with 30 mg PTMA in 1 mL chloroform

Radical Polymers Synthesized Using a Controlled Route

The Deprotection of PTMPM and the Oxidation of PTMA is a Crucial Step

EPR Spectroscopy Shows a Change in Radical Density

Radical Concentration Changes as a Function of Oxidation Time

There is a Clear Maximum in the Radical Density at Shorter Oxidation Times

What Happens to the Radical Groups?

X-Ray Photoelectron Spectroscopy Confirms PTMA⁺

How Does the Chemical Environment Affect Charge Transport?

There is an Optimized Level of Doping in PTMA

Clear Peak in Conductivity

Three Distinct Regimes

1) Combination of PTMPM and PTMA
2) Beginning to Form PTMA and PTMA$^+$
3) Side Reaction Form Insulating Species
PTMA Has a Temperature-Independent Mobility and is Durable


Next Time: Doping in Radical Polymers