Triplet formation and migration in conjugated polymer

1. **Triplet absorption cross-section** of conducting polymer
2. **Triplet diffusion length** of conducting polymer

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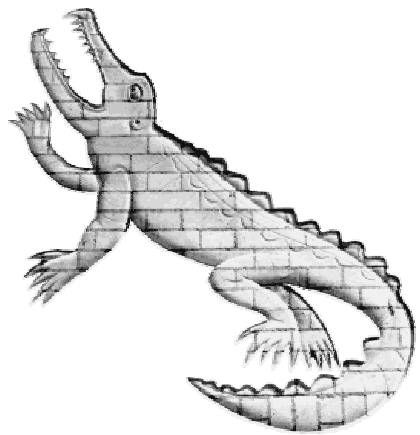
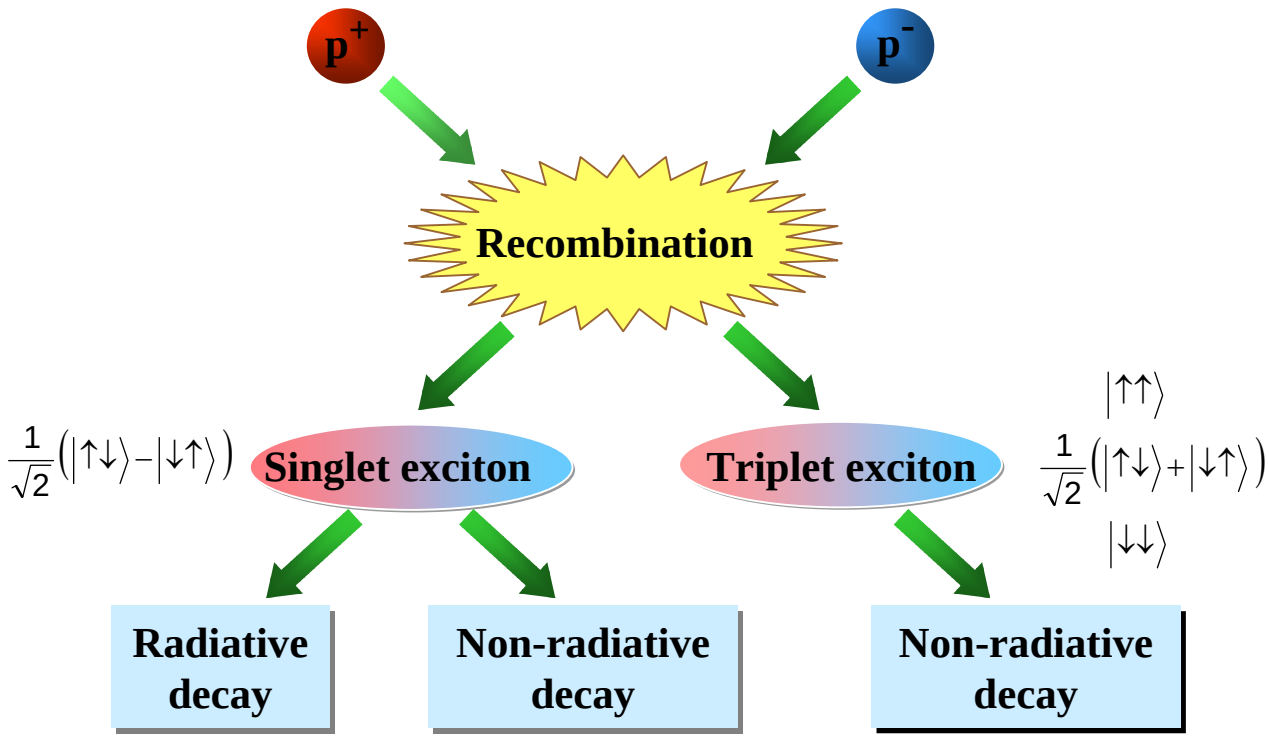


Content

➢Triplet absorption cross-section of conducting polymer

- Why the triplet state of polymer is so important
- How the **triplet absorption cross-section of polymer** can be measured
- Photoinduced absorption (PIA) spectroscopy
- **Triplet absorption cross-section of F8BT**

Singlet-triplet formation ratio after electrical excitation



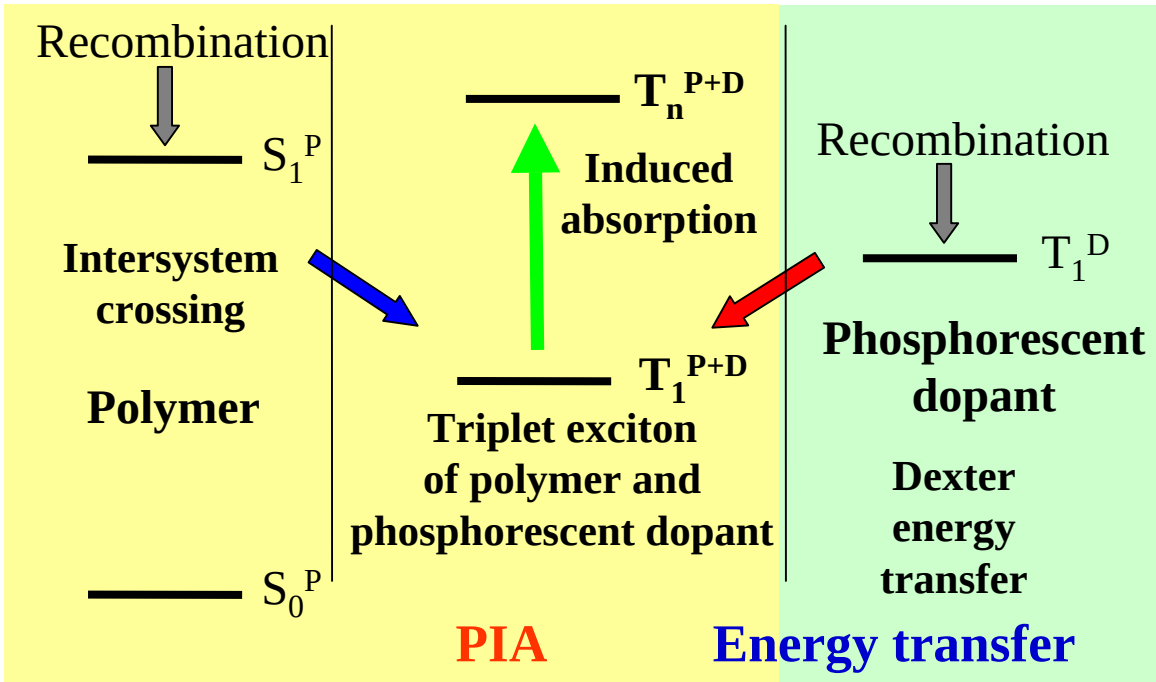
- Simple statistics suggests only 25% singlets
- Maximum efficiency = 25%?
- Does the 1:3 ratio hold in polymers?

Reference

1. M. A. Blado *et al. Phys. Rev. B, 60*, 14422 **1999**
2. A. S. Dhoot *et al. Chem. Phys. Lett. 360*, 195, **2002**
3. M. Wohlgenannt *et al. Nature, 409*, 494, **2001**
4. J. S. Wilson *et al. Nature, 413*, 828 **2001**

How the triplet absorption cross-section of polymer can be measured

- **Excited state absorption measurement and energy transfer**



- Absorption measured in PIA

$$\frac{\Delta T}{T} = -n\sigma d$$

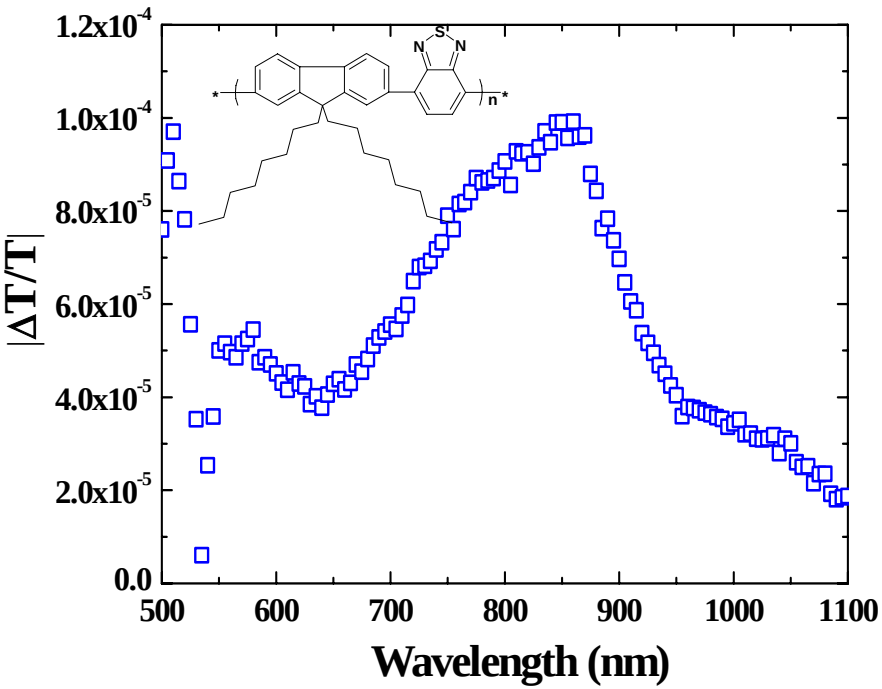
n : Triplet excited state population

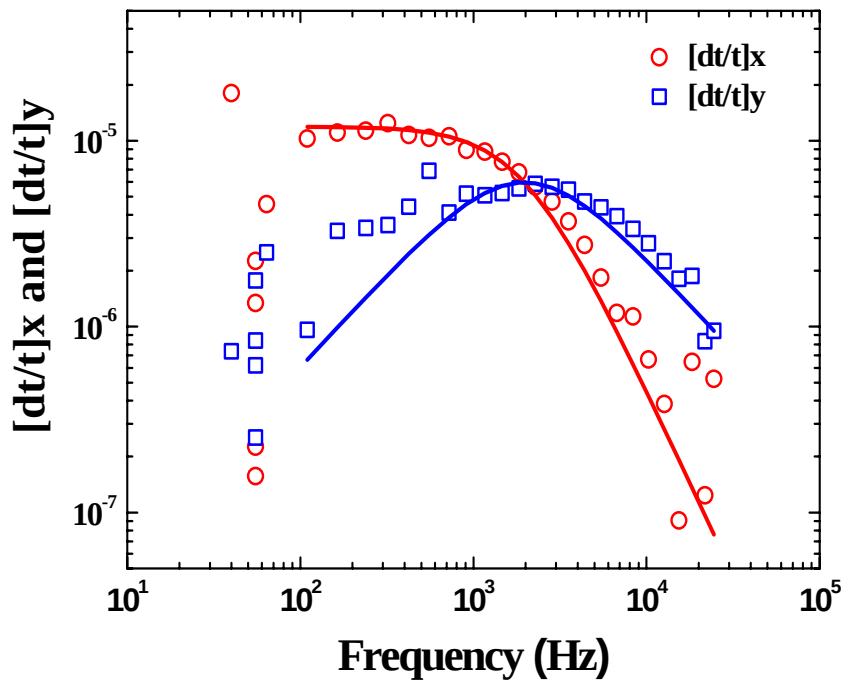
σ : Triplet absorption cross-section (~ $\mathbf{10^{-15}\ cm^2}$)

d : Thickness of film

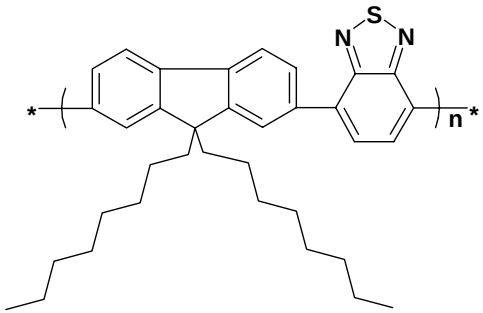
Photoinduced absorption (PIA)

- Study of **long-lived excited states** in organic systems
- Steady-state absorption spectroscopy of charge and neutral excitations (min lifetime ~ 50μs)
- Study **triplet exciton formation** and decay in **LEDs**
- Frequency dependence of absorptions in PIA can be used to probe recombination kinetics

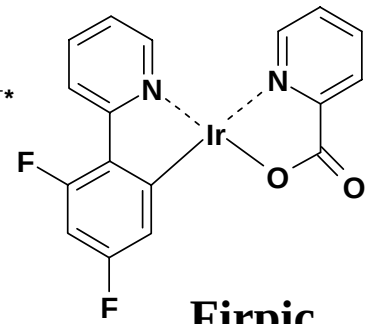




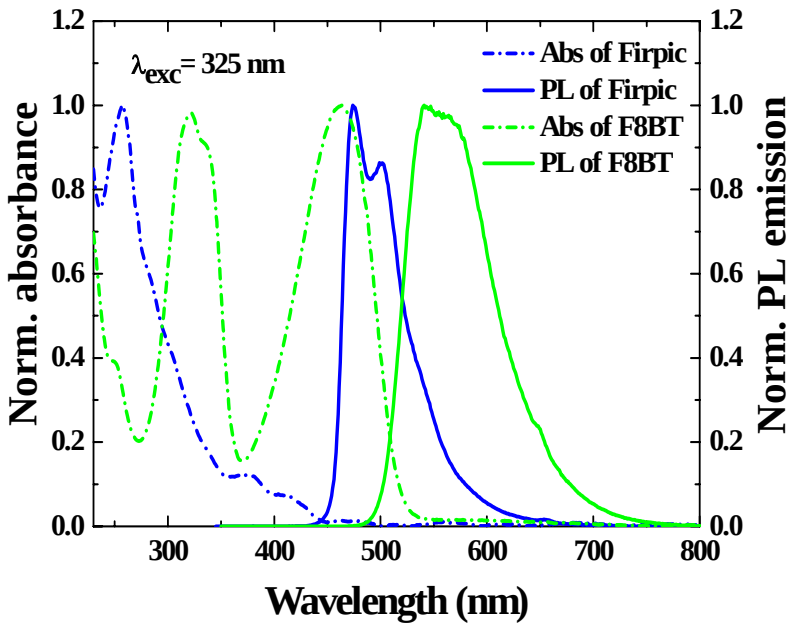
Characteristics of materials



F8BT



Firpic



- **Polyfluorenes :** Most promising materials for polymer electronics. High luminous efficiencies **(19lm/W for green emission)** and low operation voltage **(2.1V for 100cd/m^2).**[1] Blends of electron- and hole-accepting derivatives F8BT is used in polymeric PV

- **Firpic** is well known triplet blue emitter. High quantum and power efficiencies **(10.4% and 10.5 lm/W for blue emission)**[2,3]

Reference

[1] A.C. Morteani *et al*. *Adv. Mater. 15,* 1709, **2003**

[2] R. J. Holmes *et al*. *App. Phys. Lett. 82*, 2422, **2003**

[3] S. Tokito *et al*. *App. Phys. Lett. 83*, 569, **2003**

PL spectra of Firpic doped F8BT films with different concentration