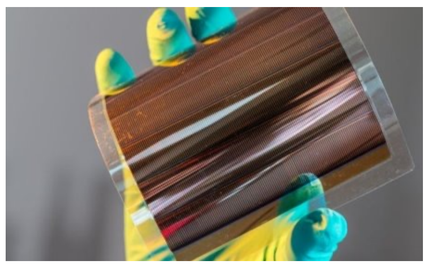
Effect of Aggregation on Energy Transfer in Copper Phthalocyanine Thin Films

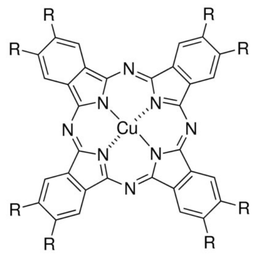
Mrinalni Iyer, Andrew Healy, David Blank

Organic Photovoltaics



- Flexible
- Lower efficiency than silicon solar panels
- Printed

Copper Phthalocyanine



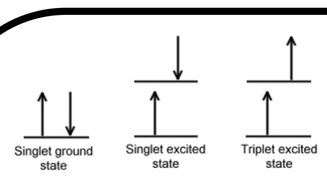
Copper (II) Octyloxy Phthalocyanine

R = $OCH_2(CH_2)_6CH_3$

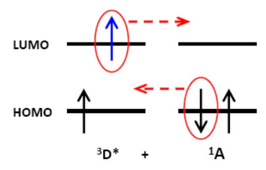
- Used in cloth dying
- Inexpensive
- Chemically stable in light
- Used in solar cells

Develop efficient, accessible, organic photovoltaics

Energy Transfer



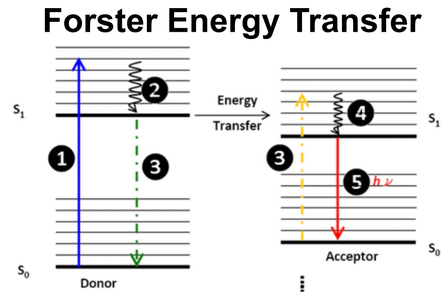
Dexter Energy Transfer



vs

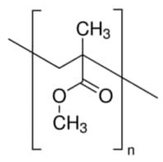
Distance
Lifetime
Speed

Forster Energy Transfer



- Balance Forster and Dexter Energy Transfer
- Influence of copper proximity on intersystem crossing

→ <u>Aggregation</u> vary ratio of CuPc to PMMA



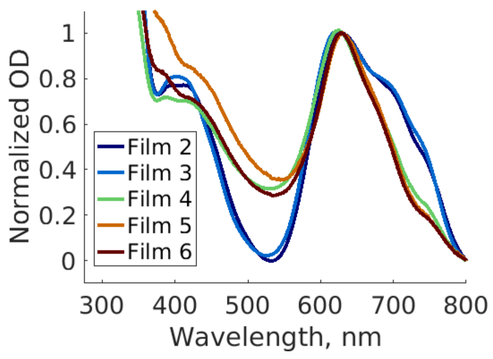
Poly(methyl methacrylate)

Spin Coating

- Inexpensive
- Efficient

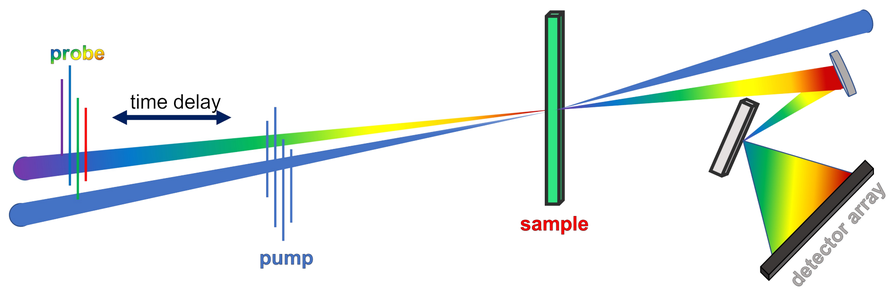
Vary:
- Acceleration
- Time
- Speed

Steady State UV-Vis Spectra



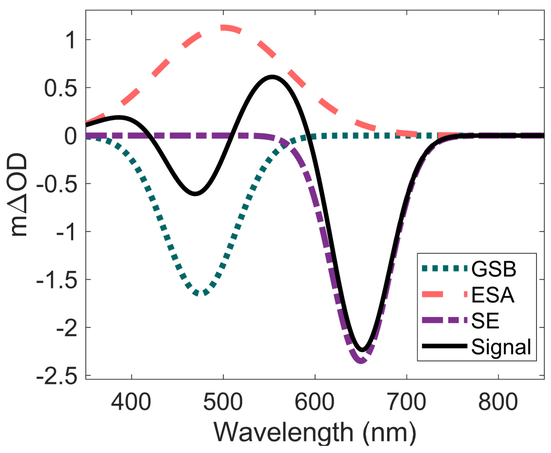
- No fluorescence
- Peak shift as dilution increased

Pump Probe Spectroscopy



No Pump

With Pump

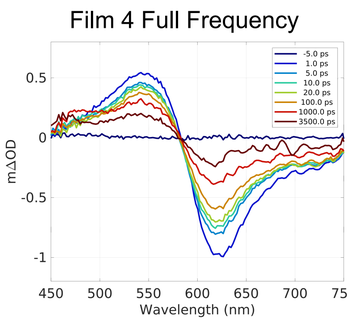


ΔOD > 0 → More Absorption ΔOD < 0 → Less Absorption

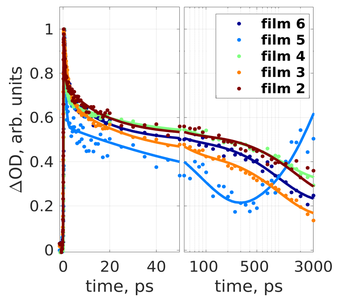
Changes in Absorption over time can correlate to:

Charge Injection
Chemical Reactions
Diffusion Dynamics
Intramolecular Interactions

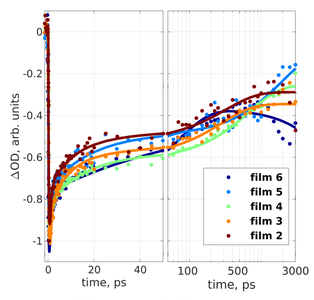
Ultrafast Data



Slices near ISC and ground state bleach



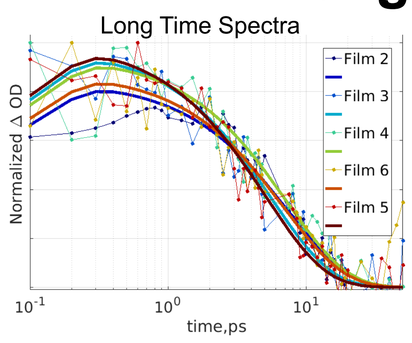
Slice at 550 nm



Slice at 620 nm

- Significant difference between film 2 and 5 magnitude
- Film 5 had longest ISC time
- Cannot determine if triplet lifetime is affected by change in ISC time

Long Time Data



Time Constants

	Film 2	Film 3	Film 4	Film 5	Film 6
Exp. Time Constant (ns)	7.42 ± 0.080	5.62 ± 1.34	7.26 ± 0.55	6.94 ± 0.97	5.10 ± 0.49
Error	0.84 ± 0.04	0.98 ± 0.10	0.95 ± 0.03	0.88 ± 0.05	1.01 ± 0.04

- No significant difference in lifetime
- Triplet lifetime is not affected by change in ISC time
- No indication of results for diffusion length
- Concentration of copper did not cause change in lifetimes

Conclusions and Future Work

- Run simulations and models to determine diffusion length
- Compare time constants to those in vapor deposited films