Abstract/Introduction

Organic semiconductors are the subject of much study, especially for organic light emitting diodes and photovoltaics. Charge transfer and transport processes are important in this context, and optical spectroscopy on molecular aggregates can yield important information. We will study self-assembly of discotic organic molecules, through the process of aggregation in solution. These assemble into fibrous morphologies via π-π interaction, which allow for conductive planar alignment. Observations of structure and properties will be made via UV-vis spectroscopy and photoluminescence. The growth patterns of the molecules will be studied over varying temperatures and conditions and will be correlated with spectroscopic results.

Materials/Methods

The objectives are: first to determine conditions for nanostructure assembly from solution. This assembly is dependent upon solvent, concentration, and rate of temperature increase/decrease. Then spectroscopy of the solution suspended and surface deposited will be performed. SEM measurements will be made to study surface structure. UV-VIS and photoluminescence studies will tell us about the nature of charge transfer between the donor and acceptor materials.

The two materials chosen for the solute:
Donor: Phthalocyanine (H2Pc-OC8)
Accepter: Perylene diimide (PTCBI-C13)

Four solvents were tested:
1. Chloroform (CHCl3)
2. Toluene (C7H8)
3. Chlorobenzene (C6H5Cl)
4. Di-Chlorobenzene (C6H4Cl2)

Results and Analysis

Fig. 1: UV-VIS optical absorption of H2Pc-OC8 in various concentrations of toluene. see ref. 1

Fig. 2: Multiple concentrations using Carian spectrophotometer

Fig. 3: Multiple concentrations absorbance using Ocean Optics spectrophotometer

Fig. 4: Temperature dependence on absorption for 5e-SM

Conclusions/Future Work

-Crystals were formed in all four solvents
-Found temperature and concentration dependence on size of crystals
-Spectrophotometry was done on solutions of Phthalocyanine in Toluene at various concentrations

From the spectrophotometric data we find a shift in the peaks that correspond to aggregation in solution. At higher temperatures, higher concentrations resemble that of the lower concentrations.

Future work would be to do UV-VIS on the Perylene diimide as well. From these measurements we may be able to determine the temperature and concentrations at which they both start to aggregate. Finally, create a solution of the combined donor and acceptor and study its spectra.

Acknowledgements/References

The researcher would like to thank the following for their help on this project:
Nicholas Lind - Department of Physics
Michael Patrick - Department of Physics
Dr. Kenneth Singer – Professor Department of Physics
Dr. Ina Martin – MORE Center Director of Operations

Self-Assembled Fibers of a Discotic Phthalocyanine Derivative
Volodimir Duzhko, Kenneth Singer
Self-Assembled Solar Cells with Nanostructured Architectures
Michael Usowicz