Novel amphiphilic polymer for single step solar cell synthesis

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Introduction

It is inevitable: Fossil fuels will run out, and we will all die.

Unfortunately, both fossil fuels and people have limited lifetimes. However, recent research into solar power has given us an alternative to fossil fuels (but not yet to death.). One type of cell, the excitonic polymer solar cell, has the promise to provide cheap, flexible, environmentally friendly solar power. We contain the polymer in a mesoporous titania network to minimize the distance the exciton must diffuse and maximize the internal surface avrea. Traditionally the creation of the titania and the insertion of polymer are separate steps . However, our polymer, poly(fluorene-co-thiophene) (PFO-PT), acts both as a structure directing agent for the evaporation induced self assembly and as the active layer for the completed solar cell, allowing for a one-step synthesis, which lowers complexity and cost (Fig 1). Our current work has focused on characterizing PFO-PT and determining its applicability to solar cells, with future work in creating the titania composites.

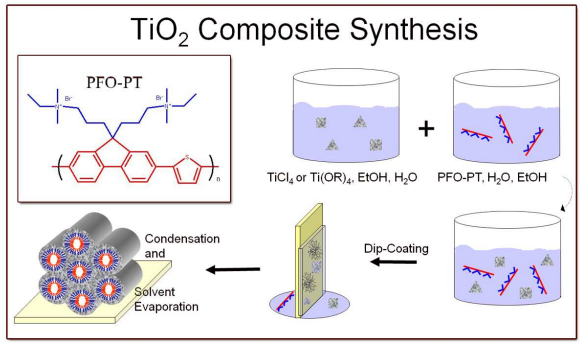

Fig 1. PFO-PT Titania Creation

Materials and Methods

- Vary water-ethanol solvent ratios, polymer concentrations, and acid or ionic strengths for DLS and SAXS measurements
- Spin-cast onto two types of glass, silicon, and quartz to take absorption, fluorescence, optical density, and AFM measurements.

Results

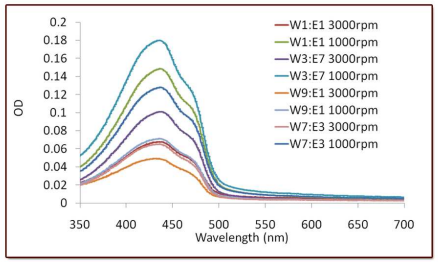

Fig 2. Absorption Spectra of PFO-PT, with strong peak at ~435nm

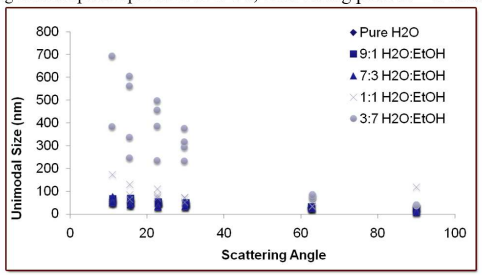

Fig 3. DLS of PFO-PT displays cylindrical patterning, but shows large growth in aggregates with increasing ion conc.

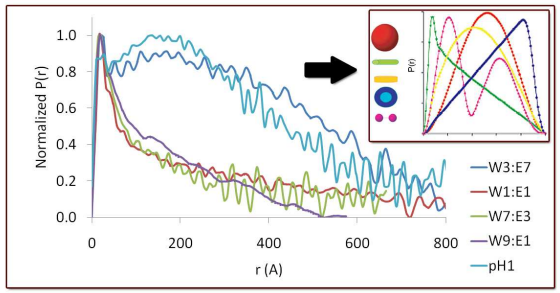

Fig 4. SAXS of PFO-PT shows cylinders and subsequent loss at low pH

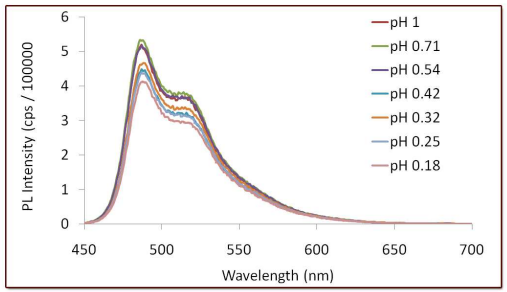

Fig 3. Fluorescence of polymer unchanged at low pH (10mg/mL, 5:5 EtOH:H2O)

Conclusions

THE GOOD:

- the absorption of the polymer is acceptably in the visible spectrum
- the backbone is not affected by the high acid concentrations
- undergoing self assembly into well ordered aggregates

THE BAD T_T:

- absorption of PFO-PT is in the blue range of the visible spectrum
- cylindrical aggregates become disordered at high ionic strengths

THE FUTURE:

- modifying the quaternary charge groups to a PEG chain
- attempting to find a pH-neutral titania synthesis

Cited Works

D. I. Svergun and M. H J Koch, Rep. Prog. Phys., 2003, 66, 1735-1782

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