Photoelectrochemical Oxidative Homocoupling of 1-(2-thienyl)pyrene

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Abstract:

In this project the goal is to begin research on a more sustainable form of energy. The sun's energy is harnessed in many different ways, and we are trying to use this energy to synthesize a storable fuel. Using the sun's energy, we can make a monomer dimerize, then this product can be collected, and is stable. This dimer can then be reacted to produce the monomer, and the reaction energy can be harnessed. Then the reaction scheme can begin again. This reaction is all done with a transparent semiconductor, a fluid containing the monomer, and light. The valence electrons are absorbed by the transparent semiconductor's conduction band, and thus radicalizes the pyrene-1-thiophene. This radical pyrene-1-thiophene then dimerizes producing our desired product.

Introduction:

The scheme is to use light energy to excite a valence electron from the homo to lumo state in order to then oxidize pyrene-1-thiophene. Then the oxidized pyrene-1-thiophene dimerizes.

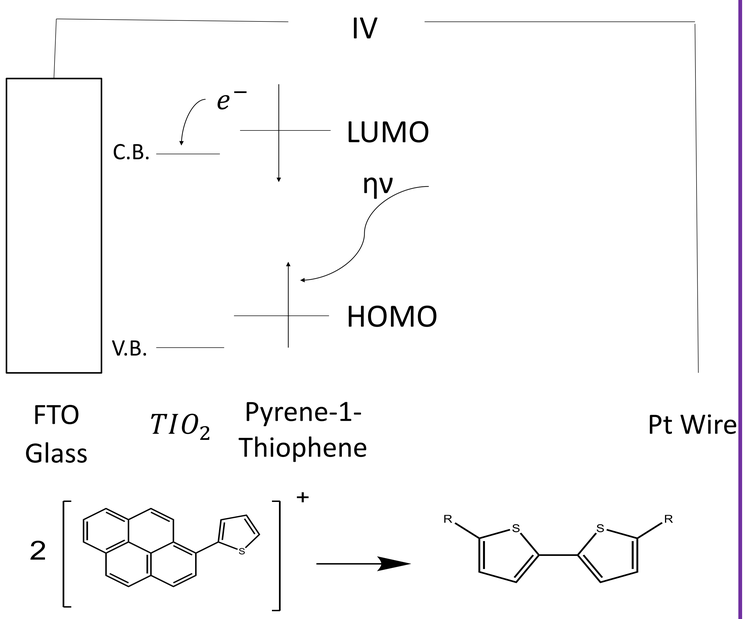

Figure 1. Scheme Showing Molecular Sensitized Solar Scheme That Allows for the Dimerization of Pyrene-1-Thiophene.

Results:

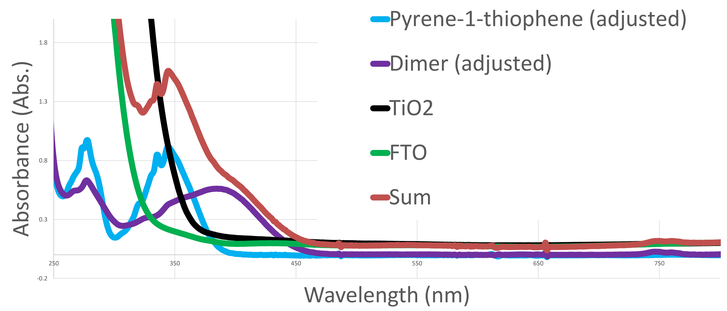

Figure 2. Spectra of a simulation of absorbance changes before and after photo electrolysis of pyrene-1-thiophene.

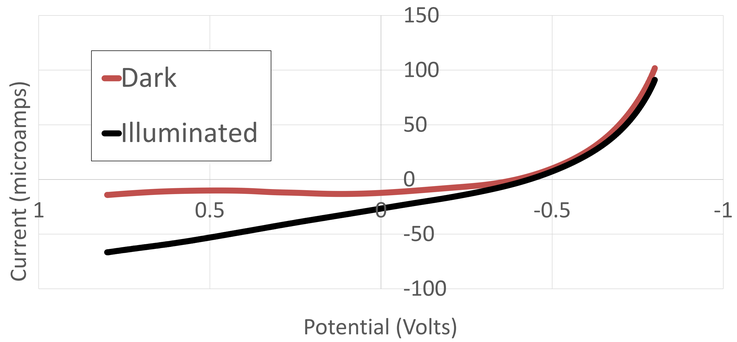

Figure 3. Curves Representing a Current-Voltage Test. This data was collected using a potentiostat and running a cyclic voltammetry test. The black curve represents the cell when it was illuminated using a light projector with a *Eiko* 82 V 360 W bulb.

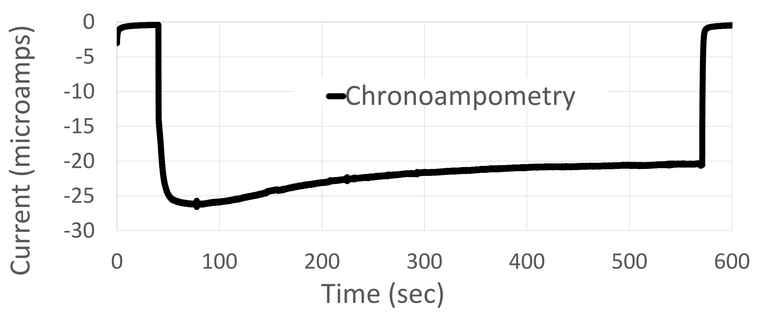

Figure 4. Curve Representing a Chronoampometry Test. This data was collected using a potentiostat. The depression in the curve represents a photocurrent being conducted

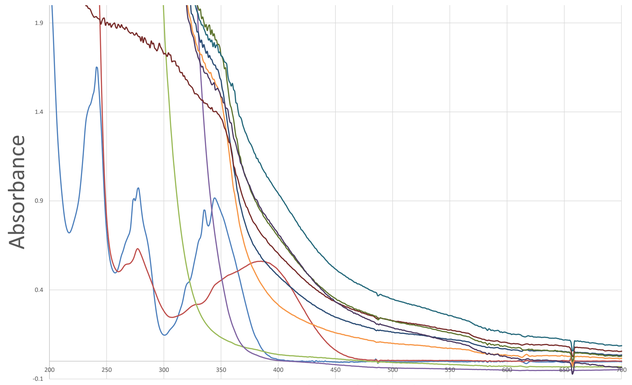

Figure 2. Spectra of absorbance changes as a mesoporous semiconductor was illuminated for longer durations of time.

Pictures:

Picture 1. Titanium Oxide and Zirconium Oxide Semiconductors before and after photo electrolysis. In this experiment, the cell under white light illumination. This resulted in a what is suspected to be polymerization of Pyrene-1-Thiophene.

Future Directions:

- Cyanine dye
- Zirconium Oxide semiconductor
- Different cell construction

Acknowledgements:

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