Building a Photoactive Material That Generates Mechanical Work When Exposed To Light

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Introduction

Current methods of extracting work from light energy are complex and slow. This project aims to generate work from light energy using photo-switches, molecules that change their structure when exposed to specific wavelengths of light. Specifically, the goal of this project is to incorporate photo-switches into elastomers in order to produce a materials system capable of generating mechanical work. This material could be used to create devices such as actuators, which convert signals into mechanical motion.

Photo-Switch

• The photo-switch allows the polymer to generate work

Liquid Crystal

• The liquid crystal structure provides a method of alignment

DASA

The photo-switches used in this project are donor-acceptor Stenhouse adducts (DASAs). DASAs offer several advantages to azobenzenes, the only other photo-switch successfully incorporated into a polymer. DASAs switch at wavelengths of visible light, not UV radiation, eliminating UV degradation. DASAs are also negative photochromes and have different absorption wavelengths in their open and closed forms, which maximizes switching between forms.

Methods

Silica coated glass plates are spotted with two or more reference materials for comparison and exposed to a less polar mobile phase. The reference materials will travel at different rates based on their unique polarity (affinity for mobile phase) and can be examined under UV light or stain to determine the status of the reaction of interest.

Characterization

A prepared sample is suspended in a deuterated solvent and is placed inside of a magnetic field. In this field each unique hydrogen environment will require different amounts of energy to reach an excited state. As the resonant energy of the electron relaxation is measured the NMR imaging software generates a wave form for characterization analysis.

Future Plans

• Finish photo-switch synthesis
• Test and compare photo-switch switching responses
• Create polymer using Diels-Alder reactions

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