Photomechanical Responses in Polymerized Azobenzene

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Background

Polymerized azobenzene exhibit photo-responsive properties, converting light energy to mechanical energy when exposed to UV light or light of certain wavelengths within the visible spectrum. [1] These large-scale changes may translate to applications in heliotropic solar cells, micro-air vehicles, muscles in robotic limbs, or data storage for quantum computing. [2]

Azobenzene holds two structural states: the rod-like cis and the kinked trans; these states transition from one to the other as a result of light absorption. Our experiments explore the response of azobenzene to laser light for various wavelengths and polarizations.

Experimental Setup

The experiment was aligned along the beam of an argon laser using the following:

- load cell with clamp
- clamp fixed to translating stage
- polymerized azobenzene
- polarization rotator
- power meter

Data

Wavelength experiments compared the laser at wavelength of 488 nm and 514 nm. The sample for these plots has a thickness of 30 µm and width 0.8 mm

The intensity of the beam at each wavelength was held approximately constant, measuring 11.62 mW/cm² and 11.64 mW/cm² respectively.

The sample is stressed along the horizontal axis, as shown in the image at left; wavelengths were tested polarized either parallel and perpendicular to this axis.

Conclusion

It appears that azobenzene absorbs laser light at wavelengths of 488 nm more fully than 514 nm; this agrees with similar experiments exploring wavelength absorption. [1] Light polarized parallel to the axis of the azobenzene appears to cause more stress on the sample, a phenomenon most likely due to directionally dependent light absorption and trans-cis-trans photoisomerization.

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References