Photo-thermally induced photoisomerization profile of azobenzene in liquid crystal elastomer

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Azobenzene liquid crystal elastomers (LCE) is well known for its high contraction under UV (365nm) light and goes back to original shape when visible light (400nm) is added. The main reason for this photo deformation of the azobenzene LCE is due to the photo-isomerization of the azobenzene, which turns from trans to cis state in 300 nm light, and return back to original trans state when 400nm light is exposed. As trans to cis transform ratio of the azobenzene is proportional to the actual induced strain profile in LCE structure, estimating trans-cis isomerization profile of the azobenzene is essential factor in predicting photo deformation of the LCE. We calculate trans-cis photo-isomerization profile of the azobenzene in LCE structure by connecting Stimulated Ramann Adiabatic Passage (STIRAP) calculation and Stateman's non-linear Beer's law. In addition, introducing cis to trans thermal backward reaction rate (calculated by Density Functional Theory, Gaussian 09) into our calculation, we suggest different photo-isomerization profile according to the various temperature and light input condition.

Keywords: Azobenzene, Photo-isomerization, Liquid Crystal Elastomer, STIRAP, Non-liear Beer's law

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