

大きな動きと熱安定性を兼ね備えた分子スイッチによる光駆動アクチュエーターの開発検討

(広島大工¹・広島大院先進理工²・JST さきがけ³) ○辻井 雄大¹・今任 景一^{2,3}・石井 祥²・今榮 一郎²・大山 陽介²

Development of Photoactuators Based on Molecular Switches that Combine Both Large Movement and High Thermal Stability (¹*School of Engineering, Hiroshima University*, ²*Graduate School of Advanced Science and Engineering, Hiroshima University*, ³*PRESTO, JST*) ○Yuta Tsujii,¹ Keiichi Imato,^{2,3} Akira Ishii,² Ichiro Imae,² Yousuke Ooyama²

Reversibly photoisomerizable molecular switches have been widely used as molecular machines due to the small structures and simple movement. However, previous photoswitches cannot combine both large movement and high thermal stability, limiting their applications particularly in soft materials. Recently, we have found that hindered stiff stilbene (HSS), a new photoswitch, generates the largest movement in existence, shows significantly high thermal stability, and therefore, promises its use in various fields, where previous photoswitches are unavailable. In this study, we incorporated HSS into cross-linked polymer gels and investigated their macroscopic actuation in response to the photoisomerization of HSS. HSS was incorporated as a cross-link or between cross-links in gels by polyaddition of hydroxy groups and isocyanate groups. Photoisomerization of HSS in gels was confirmed by UV-vis spectra, and volume changes of gels upon the photoisomerization were visually evaluated.

Keywords : Gel; Actuator; Molecular Switch; Molecular Machine

光可逆的に異性化する分子スイッチは小さな構造とシンプルな動きから分子マシンとして広く利用されている。しかし、既存の分子スイッチは大きな動きと高い熱安定性を両立できず、特に高分子材料への応用は限られた。一方、演者らは新たな分子スイッチのヒンダードスティッフスチルベン（HSS）が大きな動きと高い熱安定を示すことを見出した。本研究では HSS を高分子ゲルに導入し、光異性化に伴う変化について調査した。HSS はポリエチレングリコールを主鎖とするゲルの架橋点あるいは架橋点間に水酸基とイソシアネート基の重付加によって導入した。ゲル中の HSS の光異性化は UV-vis 吸収測定から確認し、体積変化を目視にて評価した。

