

# Chemical Engineering: From Materials Engineering to Nanotechnology

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## Photoinduced bending of azobenzene-based [2] pseudorotaxane crystals

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This study presents photoresponsive dynamic pseudorotaxane crystals comprising of azobenzene and ferrocenyl groups in an axle component threaded through dibenzo [24] crown-8 ether rings. These pseudorotaxanes are synthesized by mixing dialkylammonium axle molecule tethered with azobenzene with/without methyl-substituent and the ring molecule with/without bromo-substituents in dichloromethane. Single crystals of the pseudorotaxane exhibit bending motions caused by cis-trans photoisomerization of the azobenzene group using alternating 360 nm and 445 nm lasers. These bending motions are reversible and repeated more than 200 times. The bending motions of the crystals are significantly varied by the substituents. Single-crystal X-ray crystallography of the pseudorotaxanes reveals the details of the initial molecular structures. A crystal of pseudorotaxane without substituents exhibits small degree of bending within 0.3 second by 360 nm

irradiation, because of multiple  $\pi$ - $\pi$  interactions in azobenzene groups. Contrary, the crystals of pseudorotaxanes with bulky substituents show large displacement in bending within 7-30 seconds induced by 360 nm irradiation. Distorted  $\pi$ - $\pi$  interactions of the azobenzene groups facilitate twisting of the axle molecule. In addition, all crystals exhibited very fast cis-to-trans backward process within 0.3 second, which is much faster than typical azobenzene crystals.

### Speaker Biography

Shao-Chi Cheng joined Dr. Horie's materials synthesis group in 2013 when he was an undergraduate student at Department of Chemical Engineering, National Tsing-Hua University, Taiwan. He is now a PhD student and his research interest is synthesis of azobenzene-containing supramolecular pseudorotaxane crystals for potential use in microscale molecular machines.

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