Oral Contributions

[MS37-02] Solar-Powered Nano-mechanical Molecular Transduction in Molecular Rotors

Jacqueline M. Cole, Sven O. Sylvester

Cavendish Laboratory, University of Cambridge, Cambridge, UK
Email: jmc61@cam.ac.uk

This presentation will feature the materials discovery of a series of solar-powered molecular motors via time-resolved in-situ photo-crystallography. These represent emergent materials for next-generation solar-powered molecular machines. Converting solar energy into controlled mechanical motion at the molecular scale can operate individual components within molecular machines. Such machines have been elusive in the solid state since large structural rearrangements associated with photo-induced mechanical motion are inhibited by photo-excited state lifetimes and induced lattice strain; where it does occur, it frequently affords uncontrolled molecular rotation. Here, we present a broadband light-powered multicomponent molecular rotor within a solid-state crystalline architecture [1]. The rotor is encapsulated within a [Ru(SO2)(NH3)4(3-Cl-pyridine)]Y2 single-crystal; a photo-induced SO2 isomerism drives a larger mechanical change in the benzene ring of the anion Y, i.e. the system acts as a controllable solar-powered crystalline transducer. The benzene ring rotation and associated SO2 photo-isomerisation are directly observed using in-situ X-ray crystallography [2,3] and are repeatable, reproducible and metastable at low temperatures. This result opens up a new range of suitable materials that can be used as solar-energy based solid-state molecular transducers. These findings are presented in the context of the need for solid-state materials that exhibit controllable molecular motors that act as energy sources for next-generation nanotechnology.

[1] S. O. Sylvester, J. M. Cole, Advanced Materials, 2013, published on-line 18th March 2013: http://dx.doi.org/10.1002/adma.201300478 .
[2] J. M. Cole, Chem. Soc. Rev. 2004, 33, 501-513.
[3] J. M. Cole, Acta Crystallogr. A64 2008, 259-271

Keywords: photostimulated processes; molecular transduction; solar energy.