

Physics Society Seminar

Speaker	Dr. Puneet Mishra
Affiliation	Research Associate, Institute of Multidisciplinary Research for Advanced Materials, Tohoku University, Sendai, Japan
Title	Supramolecular rotary motors driven by tunneling current
Date	2 nd March 2016
Time	3.00 PM
Venue	R104 in Tutorial block

Abstract

Molecular motors are nanomachines inspired by biological motors such as F1-ATPase, kinesin, and myosin etc., which are essential for numerous processes of life. Surface-mounted molecular motors are of particular interest in terms of nanotechnology-based device applications, and they have been shown to be driven by current, light and chemical energy. However unlike the biological motors, artificial molecular motors realized so far are composed of covalently-bonded groups where any molecular reorganization is an irreversible change.

Here, we show that supramolecular dimers, consisting of two non-covalently bonded asymmetric Pt-porphyrin molecules, can be rotated with high directionality using current injection from a scanning tunneling microscope (STM) tip [1]. The axle of the motor is provided by an atomic-scale defect bound at the elbow of Au(111) herringbone reconstruction and the central Pt atom in one of the porphyrin molecules. The direction of rotation is determined by the chirality of the dimer, which can be switched between the two enantiomers (RR and LL) by choosing an appropriate bias voltage for current injection. Thus, we have realized current-driven supramolecular motors with *reversible rotary motion*. Our findings will further accelerate the development of complex molecular nanomachines that can be operated on solid surfaces.

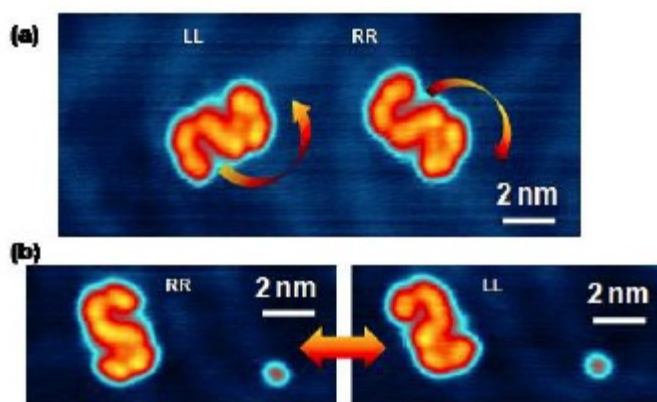


Figure 1. (a) STM image of the two conformational enantiomers of the Pt-porphyrin dimer. Preferential direction of rotation induced by tunneling current injection for both the dimers is indicated by the arrows. (b) STM images showing chirality switching by current injection at negative applied bias voltage.

[1] P. Mishra *et al.*, Nano Lett. **15**, 4793 (2015).

Email puneet.physics@gmail.com