Light Powered Artificial Molecular Pumps

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Molecular machines and motors in Nature are able to perform many functions by continuously working far from equilibrium, dissipating the energy provided by an external source, and with a precise control on the directionality of the motion. The dissipative behaviour is nowadays one of the most ambitious goals in the field of artificial molecular machines.[1]

Here we report a pseudorotaxane based on a crown ether ring and a non-symmetrical dialkylammonium axle[2], the latter functionalized with an azobenzene derivative, known for photoswitching between the two isomers *E*- and *Z*-, and a pseudostopper unit, whose steric hindrance is intermediate between the two forms of the azobenzene.[3]

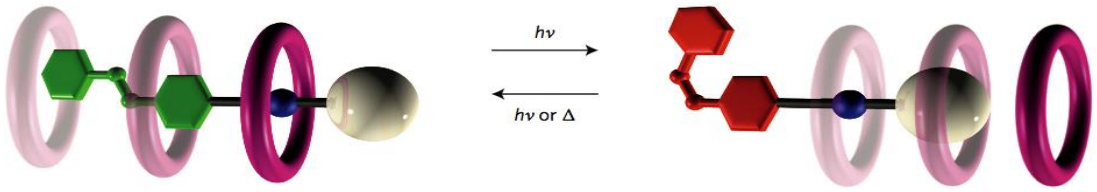

Figure 1. The working path of the molecular pump

The two main features of this system are the controlled directionality of the motion of the axle through the macrocycle (Fig.1), and the autonomy, i.e. the capability to operate cyclically under a constant light stimulus, which can be obtained by tuning kinetic and thermodynamic parameters. In fact, when the photostationary state is reached, Brownian motion is rectified by energy or information ratchet[4] and the detailed balance is not fulfilled. Regarding the action performed, this system is, as a matter of fact, an artificial photoactivated molecular pump, with potential applications in catalysis, materials science and medicine, but also discloses unconventional routes for the conversion of light energy into chemical energy.

Funding: European Research Council – Advanced Grant (692981)

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