Substituent effects on rotary motion of molecular motor

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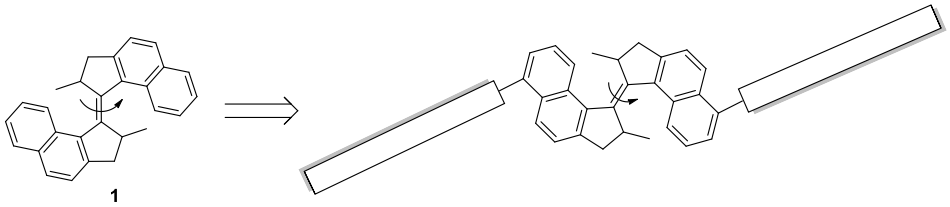
In nature, bio-molecular motors are used for a variety of tasks. Inspired by these biological motors, our group has developed light-driven molecular motors based on over-crowned alkenes.[1] The rotary motion of molecular motor **1** (Figure 1) is accomplished by a photochemical *tran/cis* isomerization (λ = 365 nm) which is followed by a rate limited thermal helix inversion step. Before designing a complex system to perform tasks such as rotating objects or carrying cargos, it is of great importance to understand the effect a covalently bound rigid rod might have on the rotary motion of the light-driven motors.

For this purpose, a class of molecular motors with rigid substituents of different length (Figure 1) has been synthesized. Their rotary motions from stable *trans*- to stable *cis*- isomer upon irradiation and subsequent warming have been studied by ^{1}H NMR and UV-vis spectroscopy. The experimental data shown that the rate of thermal helix inversion step is affected by the rigidity and length of the substituents and the viscosity of solvent as well.

Figure 1 Molecular motors



1. (a) Koumura, N.; Zijlstra, R. W. J.; van Delden, R. A.; Harada, N.; Feringa, B. L. *Nature* **1999**, *401*, 152-155. (b) ter Wiel, M. K. J.; van Delden, R. A.; Meetsma, A.; Feringa, B. L. *J. Am. Chem. Soc.* **2003**, *125*, 15076-15086.