Rotaxane- or Cyclophane-based Supramolecular Mechanophores

Yoshimitsu Sagara

Department of Materials Science and Engineering, Tokyo Institute of Technology
2-12-1 Ookayama, Meguro-ku, Tokyo 152-8552, Japan

E-mail: sagara.y.aa@m.titech.ac.jp

Mechanochromic mechanophores are reporter molecules that indicate mechanical events through changes in their photophysical properties.[1] Most mechanophores rely on the scission of covalent bonds. In contrast, our group have developed several supramolecular mechanophores that never require breakage of covalent bonds. As the first example, we have developed “rotaxane-based supramolecular mechanophores”.[2] The activation process relies simply on the spatial separation of the luminophore and the quencher. In the unactivated state, the luminophores are located close to the quencher, and therefore, their photoluminescence is suppressed, while upon application of mechanical force, they are drawn away from the center of the axle, and strong photoluminescence of the luminophores is turned on.

Recently, we have developed rotaxane-based supramolecular mechanophores that exhibit reversible and irreversible changes in the photoluminescent properties.[3] These responses are triggered by different forces and are achieved by exploiting the molecular shuttling function and force-induced dethreading of rotaxanes, respectively. Cyclophane-based supramolecular mechanophores that exhibit ratiometric emission color change have been also prepared.[4]

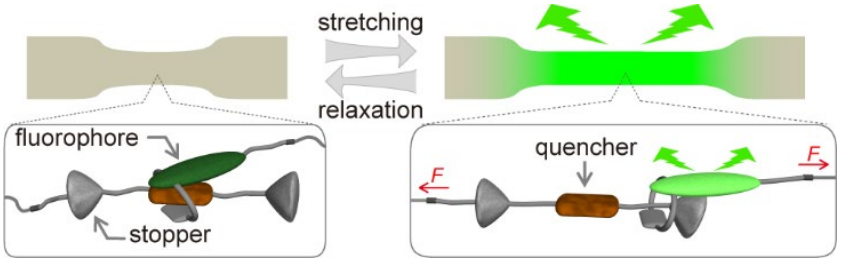

Fig. 1. Schematic illustrations of a rotaxane-based supramolecular mechanophore.

References

1. Y. Chen, G. Mellot, D. van Luijk, C. Creton, R. P. Sijbesma, *Chem. Soc. Rev.*, **2021**, *50*, 4100–4140.
2. Y. Sagara, M. Karman, E. Verde-Sesto, K. Matsuo, Y. Kim, N. Tamaoki, C. Weder, *J. Am. Chem. Soc.*, **2018**, *140*, 1584–1587.
3. T. Muramatsu, Y. Okado, H. Traeger, S. Schrettl, N. Tamaoki, C. Weder, Y. Sagara, *J. Am. Chem. Soc.*, **2021**, *143*, 9884–9892.
4. Y. Sagara, H. Traeger, J. Li, Y. Okado, S. Schrettl, N. Tamaoki, C. Weder, *J. Am. Chem. Soc.*, **2021**, *143*, 5519–5525.