Séminaire

Jeudi 27 juin 2024 à 14h00

Amphithéâtre Henri Benoît

Yoshiyuki KAGEYAMA

Department of Chemistry, Hokkaido University, Japan

Towards molecular robots: self-sustaining mechanical motion of molecular assembly

The construction of life-like molecular-based robots is currently an attractive research target in supramolecular chemistry. For this purpose, "autonomy in chemical system" is a key concept. Similar to engines, which are self-sustaining energy converters that have replaced the work of humans and animals, molecular-based engines are expected to operate autonomously with an energy supply. However, it has not been established how to assemble molecular-based engines with practical functions. In general, a molecular system tends to be in equilibrium or a steady state, where we cannot observe any macroscopic changes. On the other hand, our group has reported a novel type of light-driven self-continuous motion of azobenzene crystals. In the crystals, the chemical component, specifically the isomer ratio, oscillated due to alteration in photoisomerization efficiencies triggered by isomerization-induced crystalline phase transition. [1] By breaking Purcell's scallop theorem, the tiny crystal exhibited self-propulsion with the powerful stroke in water, the direction of which was characterized by its flipping shape.[2] Furthermore, the speaker will address a recent challenge: describing the phenomenon in terms of reaction kinetics and translating it into a memory and processing device.[3] Additionally, the speaker will explore the possibility of generalizing the concept in which chemical reactions and the morphological changes behave synergistically to achieve far-from-equilibrium dynamics at micron-scale system level,[4] with introducing our study of vesicular self-reproduction[5] and the function of molecular motors.

[1] T. Ikegami, Y. Kageyama, *et al. Angew. Chem. Int. Ed.* **55**, 8239 (2016); Y. Kageyama *et al. Chem. Eur. J.* **26**, 10759 (2020).

[2] K. Obara, Y. Kageyama, *et al. Small* 18, 2105302 (2022).

[3] Y. Kageyama *et al. arXiv* 2301.0987 (2023).

[4] Y. Kageyama *ChemPhotoChem* **3**, 327 (2019); Y. Kageyama *Symmetry* **12**, 1688 (2020).

[5] H. Takahashi, Y. Kageyama, *et al. Chem. Commun.* **46**, 8791 (2010).

https://wwwchem.sci.hokudai.ac.jp/~ekitai/yk/index_en.html

Les personnes souhaitant rencontrer Y. Kageyama sont priées de prendre contact avec Rémi Plamont.