INSTITUT DE PHYSIQUE ET CHIMIE DES MATERIAUX DE STRASBOURG
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SEMINAIRE DMO-DCMI-Axe3
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Auditorium

"Responsive supramolecular materials with enzyme-like properties"

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Living systems are powered by multi-enzymatic tandem processes with unparalleled catalytic efficiencies utilizing biological reactors through compartmentalization, nano-confinement, and out-of-equilibrium dynamics. While the natural systems exhibit autonomous out-of-equilibrium characteristics, most of the synthetic bioinspired self-assembled systems operate in equilibrium. Inspired by nature's fuel-driven out-of-equilibrium systems, we report a supramolecular approach to introduce a novel metal coordination-based self-assembled nanoreactor that introduces catalytic activities similar to natural enzymes.[1] These enzyme nanoreactors catalytically generate nitric oxide molecules, enabling detection of hydroxyurea drug[2] and use as a therapeutic against bacteria.[3] Our supramolecular enzyme-equivalent shows superior activity both in physiological and harsh conditions, surpassing the native enzymes. Remarkably, supramolecular enzyme mimics composed of nucleotide and Pt(II) complex exhibit excellent nuclease resistance.[4] Notably, the active nanozyme displays dynamic laccase enzyme-mimetic activity in response to pH change. The enzyme mimic can switch between different assembled states by a simple acid/base trigger, which turns "on" and "off" the catalytic activity accordingly. These assemblies contain functionalizable groups that have been utilized to generate metallo-nanoreactor with superior catalytic activity in both hydrophobic and hydrophilic media, showing oscillatory behavior with varying fuel concentrations.[5] In all, I will discuss a novel class of tunable supramolecular soft nanoreactors with multiple enzymatic activities.

References

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4. A. Kamra, R. Kapila, A. Srivastava, B. Sen, S. Rana, *Angew. Chem. Int. Ed.* 2026, **65**, e22266.
5. M. Solra, R. Kapila, S. Das, P. Bhatt and S. Rana, *Angew. Chem. Int. Ed.*, 2024, **63**, e202400348.