

Institute for Functional Materials and Catalysis Institut für Funktionelle Materialien und Katalyse

SUPRAMOLECULAR ASSEMBLIES FOR THE MIMICKING OF COMPLEX LIFE-LIKE BEHAVIORS

Lecture by Manuel Antuch, PHD

Date & Time: Wednesday, June 11, 11:00 AM - 12:30 PM Place: Kleiner Hörsaal 4 (HS4), Währinger Straße 42 (Halbstock) Host: Univ.-Prof. Dr. Freddy Kleitz

Manuel Antuch^{a,b}: SUPRAMOLECULAR ASSEMBLIES FOR THE MIMICKING OF COMPLEX LIFE-LIKE BEHAVIORS^{*}

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The development of artificial systems that mimic life-like behaviors represents a frontier in materials science and nanotechnology.¹ This seminar will explore the design and construction of supramolecular assemblies based on polymer networks and photocatalytic perovskite oxides (referred to as protocells²), which offer unique opportunities to emulate biological processes through advanced materials engineering. In this context, perovskite oxides offer tunable electronic structures due to their compositional versatility, permitting to drive a broad range of photocatalytic reactions. By integrating these materials into supramolecular assemblies, it is possible to achieve emergent properties that resemble the complexity and responsiveness of living systems.³ This seminar will explore the construction of supramolecular assemblies using photocatalytic perovskite oxides embedded in polymer networks, which provide a versatile platform for emulating biological processes, including directed movement in response to environmental stimuli (taxis). Certainly, by tailoring the surface chemistry and integrating stimuli-responsive components, these supramolecular assemblies exhibit phototaxis, where the system moves directionally in response to light perturbation, similar to microbial navigation. By bridging materials science, photochemistry, and bottom-up synthetic biology, this seminar will offer a vision to pave the way for innovative technologies that emulate life-like functionalities,³ offering eventual solutions for energy, health, and environmental challenges.



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SUPRAMOLECULAR ASSEMBLY

References

1. P. Gobbo et al. ; Nat Commun, **2020**, 11, 41.

2. I. Gözen et al.; Small, **2022**, 18, 2106624.

3. A. Rebasa-Vallverdu, M. Antuch et al.; ChemSystemsChem, 2024, e202400014.

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BIOGRAPHY: Dr. Manuel Antuch holds a Chair of Junior Professor at Centrale Lille Institut, where his research interests comprise the preparation of advanced materials (photo)electrocatalytic applications. The international experience of Dr. Antuch spans multiple topics and research institutions in Cuba, France, and Italy. His research activities at the University of Havana dealt with the electrochemistry of self-assembled monolayers for molecular recognition (2013), along with their subsequent use as biocathodes capable of reducing O_2 at low overpotentials (2015). The Ph.D. of Manuel Antuch was prepared at Université Paris-Saclay, France (2018), dealing with the theoretical study of homogeneous electrocatalysts along with the electrochemical characterization of multiple semiconducting materials for visible-light-driven reactions. Dr. Antuch then carried postdoctoral research at École Nationale Supérieure de Techniques Avancées, Institut Polytechnique de Paris (2019) in the field of synthetic inorganic chemistry, prior to returning to Cuba (2020-2023) to lead led a research group (5 members). He was then involved in projects associated with the Cuban Biotechnological Industry; namely, the development of fluorescent nanomaterials bound to antibodies and proteins for biolabeling. In 2023, Dr. Antuch was awarded the highly-prestigious Marie Skłodowska Curie Postdoctoral fellowship at Università degli Studi di Trieste (Italy) to work on the supramolecular interfacing of photoactive perovskites within protocells



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and proto-tissues, aiming at the mimicking of life-like behaviors. Dr. Antuch is currently an independent group leader carrying an innovative research line associated to the development of materials endowed with emergent properties in the domain of energy applications. Dr. Antuch was recognized in 2022 with the Young Researcher Award by the Cuban Society of Chemistry (National Award, Cuba) and was co-recipient in 2015 of a National Award by the Cuban Academy of Sciences. So far, Dr. Antuch has published 41 articles and 3 book chapters (citations: 825; H-index: 15) and has been Keynote Speaker in SUPRAMOL2024 (University of Pavia, Italy), Invited Speaker to Nanoseries2025 (University of Valencia, Spain) and Plenary Speaker in SaberUH-2025 (University of Havana, Cuba).