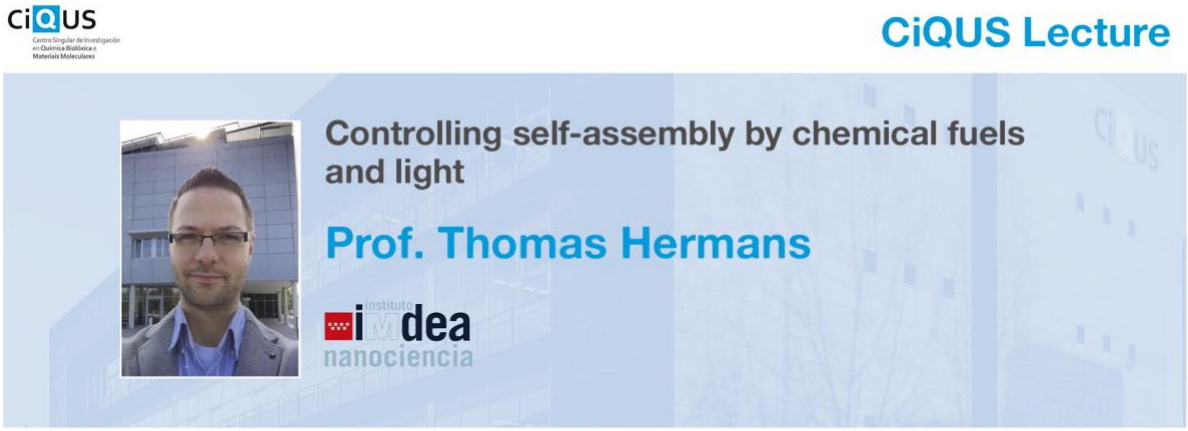

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Abstract

Actin or microtubule (MT) cytoskeletal networks, achieve dynamics as well as supramolecular structures with the same protein building blocks. In other words, the components can assemble, but also react (i.e., tubulin is also an enzyme that hydrolyses guanosine triphosphate GTP), which in turn affects the assemblies. In this way, living systems use chemical fuels (e.g., GTP) and self-assembly to create a built-in chemomechanical interaction. Moreover, such networks operate in sustained out-of-equilibrium states at the onset of oscillations,[1–3] which results in rapid response and adaptivity. Here, I present recent[4–9] chemical reaction networks in solution and gels, where interesting new behaviors were found, such as supramolecular size oscillations, traveling polymerization, or transient assembly. We hope such reaction cycles form the basis of new life-like materials where material properties are fuel (and waste) dependent.

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Biosketch

Thomas Hermans is Senior Research Professor at IMDEA Nanociencia (Madrid) and group leader of the Systems Chemistry Laboratory (www.hermanslab.com) since December 2023. He studied Chemical Engineering and Chemistry at the Eindhoven University of Technology (2000-2006), followed by a PhD at the faculty of Biomedical Engineering under the supervision of Prof. E.W. (Bert) Meijer (2006-2010). Next, he joined the

group of Prof. Bartosz Grzybowski at Northwestern University as a postdoctoral fellow (2010-2013). He started his independent research group in 2013 at ISIS (Institut de Science et d'Ingénierie Supramoléculaires, Strasbourg, France) and was promoted to full professor in 2019.

Recent distinctions include: Prix Guy Ourrison (2018), ERC Starting grant (2018), World Economic Forum ("young scientist" 2019), IUPAC Periodic Table of Younger Chemists (element "Francium" 2019), Mercator fellow (DFG, 2020-2024), i-Lab 'Grand Prix' with start-up Qfluidics (highest French start-up prize, 2020), Prix Forscheurs Jean-Marie Lehn (2022), Prix Christiane Dietrich-Buchecker (2022), Institut Universitaire de France (IUF)–Junior chair (2022), ERC Consolidator grant (2023), The Netherlands Scholar Award for Supramolecular Chemistry (2023).

The main goal of the research group is obtaining adaptive, self-healing, self-replicating and ultimately living materials using molecular self-assembly under far-from-equilibrium conditions. Prof. Hermans is also co-founder and CSO of Qfluidics, a company working on wall-less fluidics for flow chemistry and low-shear magnetostaltic pumping for transport of delicate biologicals.