

Exploiting Controlled Reaction-Diffusion Conditions for the Engineering of Functional Matter

Josep Puigmartí-Luis^{1,2}

¹University of Barcelona, Spain

²ICREA, Spain

Self-assembly has long been used to control covalent and non-covalent interactions where molecular design has been the major driving force to achieve a desired outcome. Like in nature, a full control over self-assembly processes could lead to rationalized structure-property correlations, a long-time sought in chemistry, physics and materials science. However, the pathways followed and the mechanisms underlying the formation of supramolecular aggregates are still largely unknown and unresolved. Accordingly, the elucidation of nucleation and growth mechanisms will be highly required to push supramolecular chemistry to the next level, where access to nature inspired functions will be accomplished.

In this contribution, I will present how reaction-diffusion (RD) conditions established within microfluidic devices can be used to uncover pathway complexity as well as to trigger pathway selection. Specifically, I will show that microfluidic RD conditions provide an unprecedented kinetic control over self-assembly processes; for example, enabling the isolation of well-defined kinetically trapped states as well as unprecedented metastable intermediates. This research provides a new tool to study and understand supramolecular chemistry and opens up new avenues for the engineering of advanced functional assemblies and systems.

Biography:

Josep Puigmartí-Luis is a chemist who completed a master in Chemistry and Food Engineering at “Institut Químic de Serrià (IQS)” (2003) and did a PhD in materials science at Institut de Ciència de Materials de Barcelona (ICMAB). His work in supramolecular and flow chemistry, has been awarded with “Premi Antoni de Martí i Franquès de Ciències Químiques”, award from the Institut d’Estudis Catalans (2009), St. Jordi award from the Institut d’Estudis Catalans and the Societat Catalana de Química (2006) and an ETH fellowship in 2008. In 2012, he was appointed as Ramon Y Cajal (RyC) researcher, but after two years as a RyC, he decided to move back to Switzerland where in 2015 was awarded an ERC starting grant to study and control self-assembly processes of metal-organic based crystalline materials. In 2019, he was appointed as an ICREA Research Professor and since 2020, his group is located at the University of Barcelona (UB). His research interests include the synthesis and controlled design of functional materials in solution and on surfaces, as well as the development of microfluidic technologies to command and understand the formation and function of unprecedented out-of-equilibrium assemblies (a key aspect to unveil structure-properties correlations of new functional matter).