REACTION-DIFFUSION MICROSYSTEMS FOR ENGINEERING NEW MATERIALS AND DEVICES (IN GELS AND MOFS)

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The talk focuses on using spontaneous chemical reactions in microscopic confinements for building micro/nanostructures and for the amplification of molecular-scale events. The lecture is intended to demonstrate that spatially continuous chemical reactions driven by diffusion can – if properly "programmed" – build discrete architectures with resolution down to 5 nm, and can amplify into macroscopic patterns processes as subtle as macromolecular phase transitions or protein-ligand binding. The role of nonlinear kinetics, feedback and stochastic processes occurring at such small scales is discussed and modeled within the framework of reaction-diffusion equations. While many of these systems are based on gel media, new applications based on metal-organic frameworks (MOFs) will also be discussed. When applied to MOFs, reaction-diffusion can give rise to world's most effective chromatographic columns, new types of porous photoconductors, as well as RRAM non-volatile memories and even new types of batteries.

Key References:

1. B.A. Grzybowski "Chemistry in Motion: Reaction-Diffusion Systems for Micro- and Nanotechnology" Wiley, 2009, ISBN: 978-0-470-03043-1).

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