Functional coordination polymers at the nanoscale: old materials new tricks

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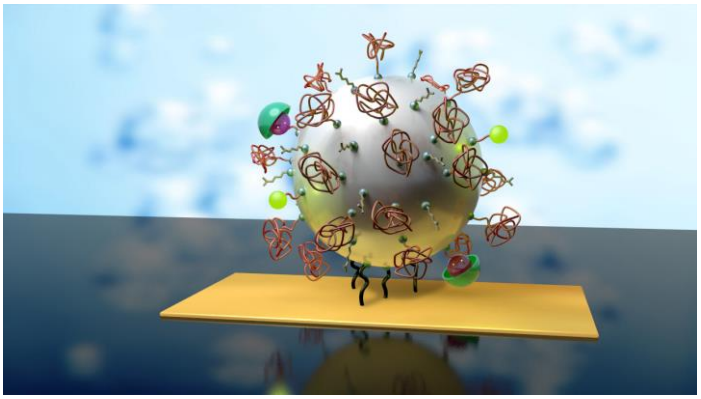
Abstract

Miniaturization of coordination polymers to the nanoscale represents a unique opportunity to amass a novel class of highly customizable functional materials that marry the rich diversity, chemistry and properties of coordination complexes to the advantages of nanomaterials. The new structures, which exhibit well-defined and dispersed morphologies, can allow for a proper correlation with their functionality, and therefore, enable the rational design of new generations of these nanostructures targeting specific desired properties.

In this presentation I will give a brief introduction to the rational designed developed in our group for the fabrication of such functional nanostructures through a simple precipitation/coordination polymerization mechanism. Following this approach, we have reported the fabrication of "smart" nanoscale coordination polymer particles (NCPs) whose properties and functions can be significantly changed in a controlled manner by external stimuli, or shown how NCPs can be used for encapsulating and delivering drugs with anticancer efficacy.

In addition, the same NCPs have been directly synthesized on surfaces. For this, AFM tips have been used to directly deliver less than femptoliter droplets of precursor solutions containing the organic bridging ligands and the metal ion building blocks to a given surface. Delivered droplets act as nanoreactors that confine the coordination polymerization and/or crystallization process to yield the desired coordination based nanoarchitectures on surfaces. Upon controlling the incubation conditions, control over their size and morphology is modulated. These results open new avenues for all the possible applications that can be derived from the implications of CPPs on surfaces. Finally, a brief introduction to the new research line on 2D-coordiantion polymers will be outlined.



Recent Publications

1. D. Ruiz-Molina *et al.*, ACS Nano 2016, 10(3), 3206.
2. Chemical Commun. 2016, 52(78), 11617-11626.
3. ACS Appl. Mater. Interfaces 2018, 10(45), 38819-38832.
4. ACS Applied Nano Mater. 2018, 1(6), 2662-2668
5. Biomaterials Science 2019, 7(1), 178-186

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Biography

Daniel Ruiz-Molina earned his PhD in polyradical dendrimers at the Institut de Ciència de Materials de Barcelona (ICMAB-CSIC) under Prof. Jaume Veciana. He then took a postdoctoral position at the University of California San Diego (USA), where he spent three years working on single molecule magnets and molecular switches.

Since 2001 he has held a permanent position as a Spanish National Research Council (CSIC) researcher, most recently at the ICN2, where he is the leader of the ICN2 Nanostructured Functional Materials Group also known as NanosFun. His main research areas include the fabrication of hybrid colloids and surfaces, biomimetic functional nanostructures, and micro- or nanoparticles for smart applications and encapsulation and delivery systems. H-index : 41 (Google Scholar)

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