DEVELOPMENT OF CHEMICAL STRATEGIES TO COVALENTLY LINK MOF NANOPARTICLES INTO

Company Description

BCMaterials is looking for a motivated PhD student to work in the area of metal-organic framework (MOF) superlattices. The approach to structurally align nanoparticles that has emerged over the last years is the formation of superlattices, that are highly ordered 3D structures with periodic assemblies of nanoparticles. The fundamental advantage of assembling superlattices is the possibility to create materials with emergent and enhanced properties, which are determined by nanocrystal connectivity, interparticle interactions, various superstructure geometries, crystal symmetry, and composition. However, the superlattice synthesis with a high degree of periodical order, desirable superlattice geometry, and large crystalline areas is challenging. Slow solvent evaporation is one of the most common approaches to assemble nanoparticles into superlattices, driven by thermodynamic control to reach high-packing density structures by maximizing the free volume entropy and minimizing the high surface energy. To achieve higher control over the assembly process, the assistance of functional moieties attached to the nanoparticle surface (e.g. DNA, proteins, polymers, dendrimers) has been also employed to facilitate interparticle interactions. So far, nearly all the reported superlattices rely on weak intermolecular forces among nanoparticles and thus, resulting in materials with limited mechanical, thermal, and chemical stability.

Information

- Deadline: 2023-05-31
- Category: Academia
- Province: Bizkaia
- Country: Basque Country
- City: Leioa

Company

BCMaterials

Main functions, requisites & benefits

Main functions

The plan is to assemble MOF nanoparticles into robust crystalline lattices using covalent bonds. The working hypothesis is that the control over the nanoparticle organization is achievable via interface-mediated assembly. First we will develop reliable synthetic protocols for MOF nanoparticles with monodisperse size and shape, characterize the nanoparticles' physicochemical properties, and determine the type and quantity of accessible uncoordinated surface sites that can be used for nanoparticle connection. Then we will covlently link those MOF nanoparticles into superlattices by employing common crystallization techniques reported in literature, such as solvent evaporation and solvent-antisolvent layering to assemble nanoparticles.

Requisites

- Master in chemistry, material science, chemical engineering already finished or to be finsihed in this academic year. - Fluent in oral and written English is mandatory. - Experience in the synthesis of MOF materials and/or nanoparticles is an asset. - Experience in material and nanoparticle characterization techniques is an asset.