VNIVERSITAT D VALÈNCIA

ICMOL Instituto de Ciencia Molecular

JOB POSITION

Interfacing 2D materials with smart magnetic molecules for the design of new hybrid electronic devices

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2D materials provides a very versatile platform to develop novel physics and electronic nanodevices. Thus, single-layers of transition metal dichalchogenides or metal halides have shown to exhibit a wide range of electronic and magnetic properties, including superconductivity and ferromagnetism in the 2D limit.

In this project we intend to go a step forward by interfacing these 2D materials with molecular systems. In particular, we intend to use as molecular component bistable magnetic molecules able to switch between two spin states upon the application of an external stimulus (temperature, light, pressure, electric field etc.).

The driving idea is to tune the properties of the “all surface” 2D material via an active control of the hybrid interface. This concept will provide an entire new class of smart molecular/2D heterostructures, which may be at the origin of a novel generation of hybrid materials of direct application in highly topical fields like electronics and spintronics.

INPhINIT "la Caixa" Fellowship Programme

Objectives of this project

First, we will investigate the properties of the hybrid heterostructures following a stepwise procedure in which ultra-thin films of the various molecular systems (molecules, nanoparticles and extended networks (MOFs)) will be grown initially over large crystals of the layered materials, then over interconnected 2D networks and finally over single flakes. Second, these 2D heterostructures will beintegrated into multilayered electronic/spintronic devices and their properties investigated. Through this molecular approach, we will address major challenges in different areas of the 2D research as for example the possibility of tuning the properties of the 2D material by applying an external stimulus (light for example), or to design smart electronic/spintronic devices able to respond to physical (light, magnetic field, etc.) or chemical stimuli (trapping of molecules).

Job description

To reach the challenging goals proposed in this Project an integrative and multidisciplinary approach is proposed in which materials chemistry is coupled with physics, materials science and nanotechnology. This project will be developed in the frame of the ERC Advanced Grant MOL-2D (Molecule-induced control over 2D materials).

Training

The PhD candidate will receive training in materials chemistry (including coordination chemistry for the synthesis of the magnetic molecular systems and solid state chemistry for the synthesis of crystals of TMDCs), materials science (exfoliation of the 2D materials, preparation of ultrathin molecular films deposited on 2D materials using both solution and evaporation techniques, physical and structural characterization of the hybrid heterostructures) and device fabrication (preparation of vertical and horizontal devices in a clean room, study of their optical and electrical properties, study of their opto-electronic and magneto-optical properties). The candidate will also develop transferable skills like reporting of results orally and in writing, time management, project planning and management. The PhD will be integrated in a multidisciplinary group leaded by Prof. E. Coronado and will have access to all the chemical, physical and engineering facilities required to perform the proposed project .

Qualification

The applicant should hold a degree in Physics, Chemistry, Engineering or Materials Science with excellent qualifications (honors degree preferable for international students). Research experience will be considered favourably. The call is open for all nationalities.

Work environment

ICMol is an attractive destination for top talent PhD students. It currently hosts 8 ERC grantees at different stages of theircareers (Advanced, Consolidator and Starting) and Marie Curie Fellows, andsince 2016 has been awarded the seal of excellence “Maria de Maeztu” by the Spanish Government, which recognises top research institutions in Spain.