

Molecular Switchable Architectures for sensing, capturing and storing greenhouse gases

IMDEA - Nanociencia Institute

www.nanociencia.imdea.org

CENTRE DESCRIPTION

IMDEA Nanociencia is a young interdisciplinary research centre dedicated to the exploration of basic nanoscience and the development of applications of nanotechnology in connection with innovative industries.

Our purpose-built building was inaugurated in 2014 and features state-of-the-art facilities for 21st century science, where the frontiers between fields disappear and Physics, Chemistry, Biology, Engineering, and Medicine merge. It features more than 30 operative laboratories with over € 16 M worth of equipment -including the Centre for Micro and Nanofabrication. We are located at the UAM Campus, with access to all the facilities of one of Spain's largest and most prestigious Universities. The UAM Campus is just a few minutes away from Madrid's lively city centre, connected by "cercanías" trains and several bus lines.

We are over 150 scientists, with different professional and personal backgrounds. Approximately 40% of our PhD and postdocs come from outside Spain, representing every corner of the world, from Germany to China, from the USA to Singapore –a true international environment in which to develop your scientific career. Women make up 36% of our scientific and 62% of our management staff. No matter who you are or where you come from, you will feel welcome from the very first minute.

We take science seriously and value quality over quantity. Our scientists enjoy tackling complex multidisciplinary problems, often within in-house collaborations, so all of our students receive truly interdisciplinary training. We also enjoy publishing in the very best journals, with >200 publications a year, and an institutional h index of 79. Check out our webpage <http://nanociencia.imdea.org/>, facebook @IMDEANanociencia or twitter @IMDEA_Nano for more information.

So if you are a talented, hard-working individual with a real interest in Science, IMDEA Nanociencia is the right place for you! Come work with us!

ADDRESS

Faraday 9, 28049 Madrid, Madrid

AREA OF KNOWLEDGE

Physical Sciences, Mathematics and Engineering

GROUP OF DISCIPLINES

Chemistry and Chemical Engineering

GROUP LEADER

Prof. Jose Sanchez Costa

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Research Group Website: <http://nanociencia.imdea.org/switchable-nanomaterials-group/group-home>

Research project/ Research Group description

Today, we know that VOCs are important precursors of climbing levels of greenhouse gases in the atmosphere that are widely recognized to be responsible for the dramatic effects of climate change. Many gases and VOCs have also been identified as highly toxic or carcinogenic and may cause impacts on human health as well as on natural ecosystems, even at low concentrations. Thus, their emissions are now of major global concern and are limited by legislation in many regions. Despite this, poor air quality is still linked to over 3 million deaths worldwide each year and 96% of people in large cities are exposed to pollutant levels.

To address these challenges, the fellow will construct unique, innovative molecular-based coordination complexes that will permit to explore new detection concept and develop simple, low-cost, robust, exceptionally sensitive and selective single-molecule gas sensing devices able to work at room temperature.

To this aim 3D coordination complexes formed by switchable iron-based spin crossover (SCO) centers (providing great sensitivity through signal transduction) and modified organic ligands (providing exceptional selectivity through the introduction of unique and tailored receptors) will be synthesized and fully characterized by the fellow. The organic ligands will simultaneously include both highly selective receptors and the functional groups to coordinate the metals unveiling the switchable property. SCO are materials able to reversibly switch their spin state upon external stimuli (T, p, light or the inclusion of analytes) to led to dramatic changes in the physical properties (magnetic, optical, electrical and/or mechanical). Those compounds are exceptionally attractive as molecular sensors.

The results of this multidisciplinary proposal will address the key limitations identified in the detection, storage and selective separation of gases and VOCs and will permit to lead to advances in multiple priority issues confronting our society.

Job position description

To achieve the objectives of this research project the student will perform the synthesis and of the selected coordination iron-based materials, the morphological and structural characterization of the 3D architectures obtained, and to study of their physico-chemical properties (including the sensing response of these materials).

Thus, the student will learn modern coordination chemistry methods, will get advanced training on state-of-the art characterization techniques specific for this molecular-based systems with emphasis on X-ray single crystal diffraction through direct collaboration with XALOC beamline (Synchrotron ALBA) and the Advanced Light Source (Berkeley Lab in California). Besides, they will acquire valuable expertise

in other classical characterization physico-chemical techniques such as NMR, HPLC, optical spectroscopy (IR, RAMAN, UV-vis), etc. The group has capability for training research personnel on these aspects.

Besides, they will also acquire a deep multidisciplinary understanding on the technological possibilities of the developed sensing materials have, on their potential and limitations for the development of future industrial practical applications, etc.

Simultaneously, they will be trained to supervise master and bachelor students, this will develop their organizational and management skills (e.g. writing reports, envisaging risks and preparing contingency plans, etc.) as well as their communication abilities, thus acquiring the necessary competences to develop a successful public or private career.

This pre-doctoral student will likewise benefit of a multidisciplinary scientific environment provided by the research group at IMDEA Nanociencia. Altogether, their incorporation to this research project would be highly appreciated and would be translated in a higher impact of the project for the scientific community, for several industrial sectors and for the wider society.

OTHER RELEVANT WEBSITES

Jose Sanchez Costa – Google Scholar

<https://scholar.google.es/citations?user=HgzyQdMAAAJ&hl=en>