

CONTRATOS PREDOCTORALES 2022 SEVERO OCHOA

PROJECT TITLE / JOB POSITION TITLE:

Enhancing charge transport using enantiomerically pure materials

JOB POSITION RESEARCH LINE:

RL1.- Sustainable Energy Conversion and Storage Systems

RESEARCH PROJECT / RESEARCH GROUP DESCRIPTION:

The research project is focussed on the preparation of sustainable materials that will help convert solar energy to electricity. It comprises the synthesis and study of chiral, enantiomerically pure organic dyes that can be applied to energy capture and storage systems. The structural and optical consequences of chirality mean that these new compounds have quite unique properties as materials, the wave of recent interest in the area supporting this idea. The specific aim here is to make highly efficient, stable and sustainable solar cells

This particular part of the wider project will involve making a variety of new chiral dyes with absorption spanning the visible spectrum. The preparative routes chosen will be based on full analysis of the sustainability of the synthetic methods and purification steps. The properties of the new dyes will be established using spectroscopic methods, their phase behaviour will be studied using a variety of spectroscopic, optical, diffraction and surface characterisation techniques, and their behaviour as materials in optoelectronic devices will be explored.

The Amabilino Research Team is historically an inclusive and diverse assembly of people, now in the Sustainable Molecular Systems (SusMoSys) group, that enthusiastically tackle challenges in molecular materials chemistry, especially focussed on energy capture and storage. Our approach is to design and synthesise new compounds that have unique and useful properties. David Amabilino is an expert in molecular materials in general and especially chiral ones, that are the topic of this proposal. His group working in the ICMAB are making chiral molecules that self-assemble into helical morphologies. The interdisciplinary work that he carries out enjoys many fruitful collaborations with groups with complementary skills, and he has mentored twenty doctoral researchers as well as approximately the same number of postdoctoral researchers.

JOB POSITION DESCRIPTION:

This predoctoral position will involve the preparation of new sustainable organic materials for incorporation into organic solar cells, with the goal of enhancing charge transport and stability in photovoltaic systems, principally. The heart of the work is the synthesis of new chiral organic dyes, their rigorous purification and characterization, and the study of their properties.

The doctoral candidate, preferably a chemist with some acquired knowledge of synthesis and photochemistry, will be trained in the synthetic chemistry of dye chemistry, especially state of the art aryl coupling synthesis and the use of naturally occurring starting materials. They will also be shown the many tools available for the purification and characterization of the compounds, and the ways in which these dyes can be incorporated into devices. The transversal skill training they receive will be determined by their career development plan, including for presentations, innovation, outreach and project management. It is expected that the results will be presented in international meetings of high standing, giving experience and exposure to the candidate to help in their career.

The new materials will be made using the tenets of green chemistry, with sources of starting materials and reagents analyzed in detail, and the processing performed using the same guiding principles. This totally holistic approach to creating the active layer materials of solar cells could also potentially give a boost to the already rapidly increasing efficiencies of organic devices. The aim is to show that using enantiomerically pure materials that can form nanoscale chiral morphologies, the interface area between materials in bulk heterojunction systems will be optimized, and that this can be achieved sustainably, adapting concepts that are evident in Nature's solutions to light harvesting.

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