



Institut de Materials Avançats
Universitat Jaume I
Castelló
www.inam.uji.es

2 POSTDOCTORAL RESEARCH POSITION
2 PhD SCHOLARSHIP

Job Description

Universitat Jaume I, Institut de Materials Avançats (INAM)

Location: Edifici d'Investigació

Gross Salary: 32.000 € for Postdoc 23.000€ for Ph.D student

Working hours: Full Time

Closing Date: March 31st 2017

Hours of work: Full-time

Interview: Date to be confirmed

Information enquiries to: LolesMerchan (inamadmin@uji.es) including as a subject of your E-mail "No-Limit job offer"

How to apply

Applications should be completed following the instructions given in our website.

For Predoctoral positions, please check the following link:

<http://www.inam.uji.es/predoctoral-NOLIMIT>

For Postdoctoral positions, please check the following link:

<http://www.inam.uji.es/postdoctoral-NOLIMIT>

THE POST

The Project

The post is available as part of the No-LIMIT European Research Council Consolidator Grant project, with Ass. Prof. Iván Mora-Seró as Principal Investigator. The objective of the project is boosting photovoltaic performance by the synergistic interaction of halide perovskites and semiconductor quantum dots. Photovoltaic conversion has the extraordinary property of transforming the solar energy directly into electric power. However, the available electrical power is known to be severely limited by the so-called Shockley-Queisser (SQ) photoconversion limit. The maximum efficiency for a single absorber is limited as photons with energy lower than the bandgap (BG) cannot be absorbed, and just an energy equivalent to the BG can be used for photons with higher energy than the BG, due to thermalization. No-LIMIT will exploit the interaction between halide perovskite and semiconductor colloidal quantum dots and the resulting synergies in order to break the SQ limit. The achievement of this ambitious final objective, together with the intermediate steps, will have a colossal impact on photovoltaics.

This post will build on recent publications from the team on the interaction between perovskite and quantum dots as *Science Advances* **2**, e1501104, 2016 and *Nanoscale* **8**, 14379, 2016. However it is based on an important understanding of perovskite solar cells (i.e. *Nature Communications* **4**, 2242, 2013; *Journal of Physical Chemistry Letters* **5**, 680–685, 2014; *Journal of Physical Chemistry Letters* **5**, 2390–2394, 2014) and LEDs (i.e. *Journal of Physical Chemistry Letters* **6**, 1883–1890, 2015; *Advanced Materials* DOI: 10.1002/adma.201604056, 2016); and on quantum dot optoelectronic devices (*ACS Nano* **4**, 5783–5790, 2010; *Nature Communications* **4**, 2272, 2013; *Nanoscale* **6**, 8551–8555, 2014). The group is devoted to the study of non-conventional semiconductors and their applications on optoelectronic devices, taking special attention to the synergies that could arise from the interaction between materials of different nature. This is an opportunity for an ambitious scientist with a strong track record of excellence to work in a multi-skilled team to develop a new class of solar cells.

The Principal Investigator is Ass. Prof. Iván Mora-Seró (1974, M. Sc. Physics 1997, Ph. D. Physics 2004) is researcher at Universitat Jaume I de Castelló (Spain). His research during the Ph.D. at Universitat de València (Spain) was centered in the crystal growth of semiconductors II-VI with narrow gap. On February 2002 he joined the University Jaume I (UJI). At 2006 he started his own research line on quantum dot sensitized solar cells. Currently he is leading the Research Division F4 at Institute of Advanced Materials (INAM) of UJI. He has been granted with a 'Juan de la Cierva' and 'Ramon y Cajal' Fellowship both from the Spanish government and 'Idea Award' (2011) in the category of physico-chemical sciences, awarded by the Foundation of the city of Arts and Sciences and the Valencia government. He had been granted with a fellowship at Weizmann Institute, Israel (2016). His research has been focused on crystal growth, nanostructured devices, transport and recombination properties, photocatalysis, electrical characterization of photovoltaic, electrochromic, and water splitting systems, making both experimental and theoretical work. Recent research activity is focused on new concepts for photovoltaic conversion and light emission (LEDs and optical amplifiers) based on nanoscaled devices and semiconductor materials following two main lines: semiconductor quantum dots and lead halide perovskites, been this last line probably the current hottest topic in the development of new optoelectronic devices. He has published more than 130 papers. He is included in the 2016 list of Highly Cited Researchers of the Web of Science, list that just includes the 3000 highly cited researchers, in last 11 years, around the whole world in all the Science categories.

The project requires a multidisciplinary approach from the syntheses of quantum dots and perovskite with tailored properties to the structural, chemical and optoelectronic characterization of materials and final devices, including also an important feedback from

theoretical analysis of materials and interfaces. We encourage applications from researchers with high-level skills directly relevant to the synthesis and characterization of these kind of materials and optoelectronic devices prepared with them who can make a strong contribution to the project. Specific skills required for each of the postdoc positions are:

Postdoc 1:

- Synthesis of materials (especially colloidal semiconductor quantum dots).
- Experience in thin film deposition by different techniques (especially evaporation).
- Fabrication of optoelectronic devices (specially on solution deposition methods).

Postdoc 2:

- Experience in optical characterization of solutions and thin films (absorption, photoluminescence, time resolved photoluminescence, transient photocurrent and photovoltage decay, photothermal deflection spectroscopy...).
- Experience in structural characterization of thin films (XRD, SEM, EDX, AFM, KPFM...)

General skills and characteristics for both postdocs are:

- Capability for autonomous elaboration of scientific manuscripts.
- Capability of supervision of PhD students.
- Demonstrated ability to take ownership and responsibility for projects
- High scientific motivation.
- Excellent publication record.
- Excellent interpersonal and communication skills
- Proven teamwork experience and efficient collaboration skills
- Fluent in English

Both Postdocs will directly supervise at least one Ph.D student and advise the rest of group members, take part in discussions to agree targets for their work, and supervise their day-to-day laboratory activity under risk assessments agreed with Ass. Prof. Mora-Seró. Your work will be directly supervised by Ass. Prof. Mora-Seró.

PhD student 1:

The Ph.D.student will develop a theoretical work on the characterization of perovskite and colloidal quantum dots, their interaction and interface. No-LIMIT plans a theoretical analysis at various levels including first principle computational methods, as Density Functional Theory (DFT) and k-p method for the analysis of embedded QDs will be carried out. The candidate will require excellent results obtained during the studies graduated, especially on Quantum Mechanics, Electromagnetism, Solid State Physics and Mathematics and good computer skills (programming in fortran, matlab and/or mathematica is an added value).This work will allow the PhD student to defend a Doctoral Thesis at the end of her/his contract.

PhD student2:

The Ph.D. student will develop an experimental work under the supervision of Postdoc 1 or 2. Experience with some of the preparation and characterization techniques above described for the postdoc profile will be important.This work will allow the Ph.D student to defend a Doctoral Thesis at the end of her/his contract.

General skills and characteristics for both PhD. are:

- Strongly motivated to develop a scientific research career.
- Excellent results obtained during the studies graduated.
- Excellent interpersonal and communication skills.
- Fluent in English.

It is important to note that this is not an exclusive list. If you have relevant experience and a strong track record (*e.g.*, publications and/or patents) in a related area, you are encouraged to apply and state how you would contribute to the project. Expertise in more than one area is desirable. ***However, we are looking for a team of the best people who can apply their skills to the project, not to fill a restrictive skills list.***

In all the cases, you will pro-actively progress your project, using your own initiative, knowledge and extensive discussion with the group members. You will be responsible for day-to-day decisions regarding the project. It is expected that you will be an innovative individual with an interest in applying your research skills to a challenging project – this will require daily decision making in terms of determining the best approaches to solve a particular research problem. There is a specific requirement to work closely with other researchers with different skills to yours. There are project meetings about every 1-2 weeks at which presentations concerning recent results and future plans are made. The role may require work off-site (*e.g.*, at international or national facilities, or at collaborator sites).



HOSTING ARRANGEMENTS

Training and career development at **Institute of Advanced Materials (INAM)** as part of the University Jaume I (Castellón, Spain) is central to its culture of encouraging both learning and knowledge transfer to its user communities. Over the last 5 years (2015) **INAM** there has trained over *48 people* including *9 PhD* and *31 Post Docs*. Undergraduate training by teaching an official course entitled “*An introduction to the research*” at the **Universitat Jaume I**, for chemical undergraduate students. This initiative is intended to give the opportunity to undergraduate students to participate in basic work carried out in research laboratories. After graduation doctoral research started with a master course. As a complement to the training activities regulated by master's and doctoral studies, the members of the unit have organized courses of specialization in specific subjects that could have impact in scientific and technological fields, or in the training of experts. On the other hand our groups have been organizing numerous international schools and workshops. After the University Master's Degree,

the students can entry in the *doctoral program* in Science at **UJI**. This *PhD Program* is aimed at graduates in the field of physics, chemistry, biology, mathematics, geology and agricultural sciences. Its purpose is to provide doctoral students the capacity for autonomous research in the above mentioned fields, for which it is required to perform first a series of training tasks aimed at enhancing the capabilities required for the realization of the doctoral thesis. Achieving the doctoral degree ensures adequate training to carry out research in the public sector and private industry. In the period 2011-2015, *9 PhD theses*, with at least one PI of the unit as supervisor, were defended. Most of these Doctors continue nowadays a research carrier. Their training during their PhD allows them to obtain postdoctoral positions in important international labs around the world.



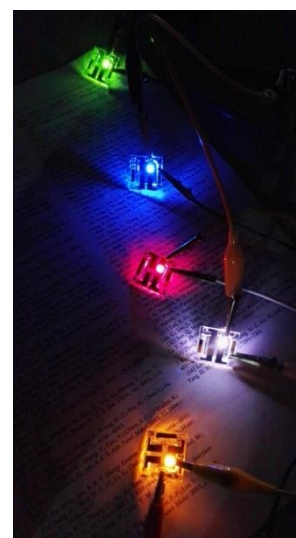
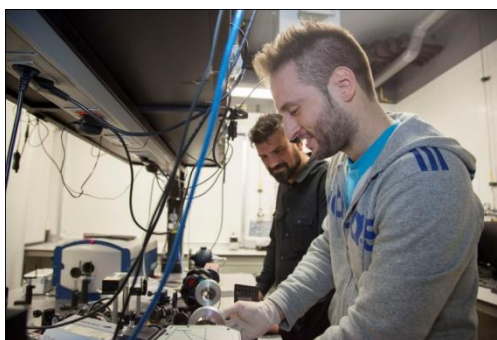
Dr. Iván Mora Seró

FACILITIES

INAM main equipment comprises the required facilities for the fabrication and characterization of the novel materials and devices, including a Kelvin Probe, six potentiostats with impedance analyzers, two solar simulators, a climatic chamber, two UV/VIS spectrometers, two fluorimeters and two IPCE systems. Moreover, two gas chromatographs, one of them fitted with a mass spectrometer to carry out the analysis of products of catalytic reactions. The UJI central research services also provides of further equipment to analyze the structure of the materials: a BET porosimeter, two scanning electron microscopes (SEM) and a transmission electron microscope (TEM), all of them fitted with Energy Dispersive Spectrometers (EDS) for chemical analysis, an atomic force microscope (AFM), an optical microscope (OM), X-Ray diffractometers for polycrystalline and monocrystalline samples (XRD), mechanical and optical

perfilometers, temperature controlled impedance spectroscopy analyzer, two nuclear magnetic resonance devices (300 and 500 MHz), Raman and infrared spectrometers, an ICP-MS equipment for elemental and isotopic analysis, and a nanosecond laser for transient spectroscopy. All the equipment above described is used by the experienced researcher on his own, with help from his supervisor or by technicians in charge. It stands out, the experienced researcher is familiar with the vast majority of the equipment.

The UJI also counts on transversal infrastructures such as UJI prestigious library, which manages specialized library collections and it makes great emphasis of the use of "**open access**". The host institution aims to give an unbeatable deal to the researcher, therefore the UJI supports the general principles specified in both the European Charter for Researchers and the Code of Conduct for the Recruitment of Researcher. The Human Resources Service helps to the researcher to settle into their new host country by providing advice on issues such as salaries and taxation, social security, work permits and health care.



CITY OF CASTELLÓN

In Castellón, everything is nearby. In our city, the smell of oranges still surrounds the city streets and the orchards are still present in the settlement. Castellón is the capital city of la Plana Alta and stills preserves the quiet and friendly character of working environments. The urban has around 180.000 inhabitants and it is possible to distinguish between the historic centre, the new neighborhoods, and the maritime district known as el Grao or the port.

The climate is generally excellent that is always an advantage. In the city centre the cultural and commercial life – completely Mediterranean – allows seeing a joyful and lively city. The historic centre which still conserves the shape of a Roman camp houses the city's emblematic monuments. This primitive core rose from the ancient Arab farms after the Town Charter provided by Jaume I in the XIII century. On the city's outskirts, cultural and sports facilities have been developed. Between the primitive core and the sea stands the maritime district, El Grao where all the nautical activities take place.

The urban ensemble from Castellón is only understood considering the modern mentality and international outlook of its inhabitants. There is, and there has always been a continue desire of being updated and open to visitors. And that is what is offered along with other variety of attractions such as the sea, orchards, monuments, culture, nature, festivals, and so on.

