

## Expression of Interest



### Contact Person/Scientist in Charge

- **Name and surname:** Ivan Mora Seró
- **Email:** sero@uji.es

### Universitat Jaume I de Castellón (UJI)

#### Department / Institute / Centre

- **Name:** Institute of Advanced Materials (INAM) / Universitat Jaume I de Castellón (UJI)
- **Address:** Av. de Vicent Sos Baynat, s/n 12006
- **Province:** Castellón

#### Research Area

- Chemistry (CHE)

### Brief description of the institution:

Universitat Jaume I de Castellón (UJI), is the public university in the north of the Valencian Community, created on 1991. It has obtained the 500+ Golden Seal of European Excellence by the Excellence in Management Club.

The UJI offers 31 undergraduate degrees, 19 postgraduate studies, 43 official postgraduate master's degrees, 15 UJI-specific master's degrees and has 14,000 students. It counts on about 1000 researchers distributed in 27 university departments and 12 research institutes.

The UJI is the third University and fifth entity of the Valencian Community, including companies and other research institutes, which have obtained more money from the European Research and Innovation Framework Programmes. Currently it is involved in 26 ongoing European research actions, including several European programmes (such as H2020, FP7, Interreg, SUDOE, LIFE, etc.).

The UJI offers modern research facilities among which stand out the different scientific structures that support research, such as the Central Scientific Instrumentation Service, the Animal Experimentation

Service (SEA) or its prestigious Library.

A specific program for newcomers helps researchers with the administrative procedures in order to become familiar with the facilities and standard practices, as well as an accurate integration. Moreover researchers can access additional services such as Sports Service, The University Residence, the Language Learning Centre (CAL) that offers an annual program of languages for foreigner researchers and the health centre available to the University community.

**Brief description of the Centre/Research Group (including URL if applicable):**

The Research Institute of Advanced Materials at the University Jaume I (Institute of Advanced Materials, INAM) created by Generalitat Valenciana on May, 4th 2015, is conceived as a centre of interdisciplinary science and technology in the fields of physics, chemistry, and related fields, applied to advanced materials, with vocation towards the progress of the socioeconomic environment and scientific excellence with international influence and impact.

**A. Materials and devices**

Applications related with the project are:

1. Advanced materials for energy conversion focuses on the development of materials for photovoltaic conversion in which the absorbed light is transformed into electricity or chemical fuel efficiently.
2. Advanced materials for light emission includes the study of materials with luminescent properties, both photoluminescence and electroluminescence.

**B. Tools and fundamentals**

- Models and simulation of materials and devices: Studies will be carried out from first principles to establish the physical properties of materials and interfaces.
- Design and optimization of interfaces, morphologies, nanostructures consists study of the combination and morphologies of materials that can lead to the desired functionality.
- Structural characterization of materials, interfaces and devices will allow a complete structural characterization of materials and interfaces.
- Optoelectronic characterization of materials, interfaces and devices will develop a complete electrical, optical and physical-chemical characterization of materials and devices.

**Project description:**

The project will focus on the preparation of high efficiency solar cells, LEDs and laser based on halide perovskites thin films and nanoparticles.

Moreover the interaction among materials of different nature can produce interesting synergies that might be beneficial, not simply by improving a feature, but also giving rise to new properties or phenomena that do not exist for the single materials. Interaction between QDs and perovskite has enormous potentialities. We have recently studied the interaction between hybrid lead halide perovskite (CH<sub>3</sub>NH<sub>3</sub>PbI<sub>3</sub>) and quantum dots (core/shell PbS/CdS).<sup>1</sup> Exciplex emission at lower energies than the band gap of both PS and QD has been detected. We report for the first time the observation of exciplex state electroluminescence from the combination of both materials. Light Emitting Devices (LEDs) can be fabricated using those configurations, which provide light emission with considerably low turn-on potential. Interestingly the color of the LED can also be tuned by controlling the applied bias and perovskite and QD materials. The presence of the exciplex state PS and QDs opens up a broad range of possibilities with important implications in tunable LEDs but also in the preparation of intermediate band gap photovoltaic devices with the potentiality of surpassing the Shockley-Queisser (SQ) limit, that will be explored in the project.

<sup>1</sup> Sanchez, R. S.; de la Fuente, M. S.; Suarez, I.; Muñoz-Matutano, G.; Martinez-Pastor, J. P.; Mora-Sero, I. Tunable light emission by exciplex state formation between hybrid halide perovskite and core/shell quantum dots: Implications in advanced LEDs and photovoltaics. *Science Advances* 2016, 2 (1), e1501104.

## Applications

Please, submit the next documentation:

- CV
- 2 reference letters

**Deadline: 30/06/2016**