PCAM SEMINAR 11 MAY

We look forward to **two** presentations from UAM within this hour:

Optical Trapping of Rare-earth doped Microparticles: Applications of a rotating particle, nanoBIG group
Elisa Ortiz Rivero, Departamento de Física de Materiales, Universidad Autónoma de Madrid,
Supervisor: Patricia Haro González.

OPEN POSITIONS

University of Southern Denmark:

Assistant Professor 'Advanced thin films for next-generation photovoltaics'

University of Southern Denmark:

PhD position: Advanced thin films for scalable energy conversion and storage devices

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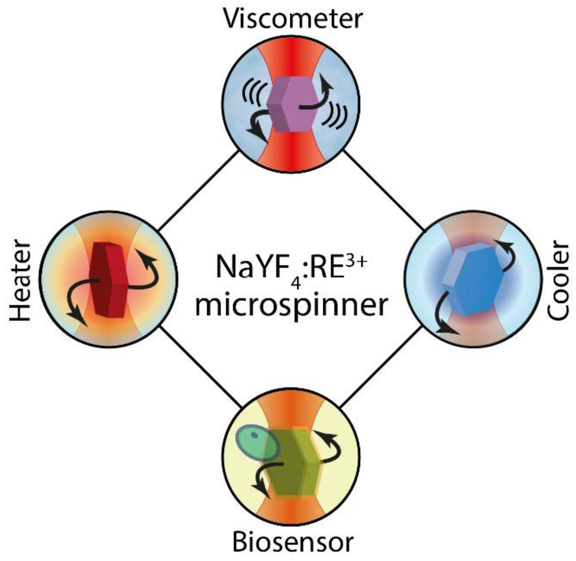

Nanomaterials for bioimaging group (nanoBIG), Departamento de Física de Materiales, Universidad Autónoma de Madrid

Precise and non-invasive control over single particles is key for a range of physical and bio-medical applications, such as microfluidics and biophysics. The three-dimensional optical trapping of a microparticle provides information of small-sized systems, from photonic devices to cells in a contactless way. In particular, the manipulation of single rare-earth-doped luminescent particles is of great interest due to their biocompatibility and the sensitivity of their luminescent properties to environmental conditions which stand out among other dielectric luminescent particles. [1] The induced rotation of an optically trapped microparticle is highly affected by the medium properties, such as temperature, viscosity or elasticity. [2] By selecting the trapping laser and an appropriate rare earth ions doping, a ß-NaYF4:RE3+ microparticle can additionally cool or heat the medium, simultaneously controlling and monitoring the temperature of its surrounding liquid. [3] The dynamics of the spinning microparticle are also affected by its volume or any change in its surface. This feature allows the development of a Protein G-coated NaYF4: Yb3+, Er3+ microparticle as a biosensor capable of detecting single cells and bacteria. Contrary to current biosensors, this novel method only requires a small among of sample and a few seconds to detect. [4]

In conclusion, the analysis of the rotation dynamics of an optically trapped microparticle is a novel and powerful tool that will allow not only the controlled and remote manipulation of the sensor, but also an improved characterization of the medium and fast recording of its content.

[1] E. Ortiz-Rivero et al., Front. Chem., 8, 593398 (2020)
[2] P. Rodríguez-Sevilla et al., Adv. Opt. Mater., 6 (12), 1800161 (2018)
[3] E. Ortiz-Rivero et al., Small, 2103122 (2021)
[4] E. Ortiz-Rivero, et al., Small, 15, 1904154 (2019)

The physics behind hydrogen production from water

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Supervisors: Fabrice Leardini and Isabel Jiménez Ferrer

The current climate situa□on is becoming increasingly alarming due to rising temperatures, mainly caused by the emission of greenhouse gases due to the use of fossil fuel-based energy sources [1]. To address this problem, an energy transi□on towards renewable energy sources, which have the disadvantage of being intermitent, has been proposed. In this situa□on, hydrogen has become a promising strategy as an energy carrier, as it allows renewable energy to be stored and transported [2].

Clean hydrogen is the one obtained a□er its produc□on from water using green energy sources. Two ways of water spli□ng stand out: electrolysis, in which electrical energy is used, and photoelectrolysis, in which light and electricity are applied [3].

In this seminar, the physics behind this chemical reac□on is introduced. The mechanisms of the water spli□ng reac□on and the electrode-electrolyte junc□on are explained. In addi□on, the main criteria that materials must meet to be used as electrodes, the state of the art of the subject and the challenges that s□ll have to be overcome for the real implementa□on of this technology will be presented.

This talk aims to provide the audience with the basic knowledge to understand and follow future seminars and research about hydrogen produc□on from water and approach PhD students and other atendees to the fascina□ng world of (photo)electrochemistry.

[1] C. F. Schleussner et al., ‘Differential climate impacts for policy-relevant limits to global warming: The case of 1.5 °C and 2 °C’, Earth System Dynamics, vol. 7, pp. 327–351, 2016, doi: 10.5194/esd-7-327-2016.
[2] Andreas Züttel, Andreas Borgschulte, and Louis Schlapbach, Hydrogen as a Future Energy Carrier.

Wiley-VCH, vol.7, no.3, pp. 343-344, 2008. doi: 10.1002/9783527622894.
[3] Craig A. Grimes, Oomman K. Varghese, and Sudhir Ranjan, Light, Water, Hydrogen. The Solar Generation of Hydrogen by Water Photoelectrolysis, vol. 546. New York: Springer, 2008.