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UNIVERSITÀ DEGLI STUDI DI MODENA E REGGIO EMILIA

Department of
Engineering "Enzo Ferrari"

UNIVERSIDAD NEBRIJA

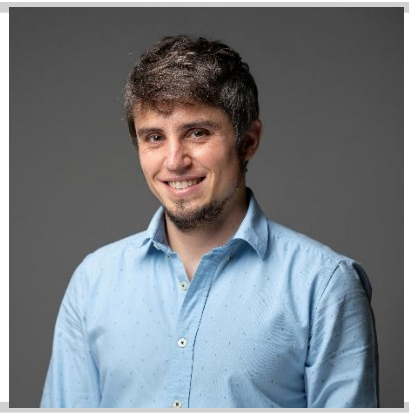
SEMINAR ANNOUNCEMENT

Sustainable processing for the obtaining of electroceramic thin films to be used in electronics: from sophistication to simplicity

10:00 – 11:00 Monday, 28th April 2025

Room MO27, Ground Floor – Walter Grilli Meeting Room

Speaker: **Dr. Carlos Gumiel Vindel**
Vicedecano de Investigación /
Vice-Dean for Research
Escuela Politécnica Superior
Universidad Nebrija



ABSTRACT

The obtaining of electroceramic oxides in the form of a thin film has aroused high interest in the past recent years since this geometry make them suitable to be integrated in microelectronic devices. There are several techniques for this purpose, from those involving sophisticated equipment which imply a high energy consumption in terms of temperature and pressure (high vacuum), to those involving simple equipment and a considerable reduction of the mentioned energy consumption. The first set of techniques would be included within the PVD or CVD techniques (for its acronym Physical Vapor Deposition and Chemical Vapor Deposition) and use a gas or plasma phase to transport the precursors to the substrate. The second set would be included within the CSD (Chemical Solution Deposition) techniques, where a liquid phase is the responsible for the transport of the precursors to the substrate. These CSD techniques use to be separated in two stages: firstly, the obtaining of the solution (precursor of the thin film) by Sol-Gel and, subsequently, its deposition onto a selected substrate by Deep-Coating, Spray-Coating or Spin-Coating. Despite the reduction of the energy consumption in comparison to the PVD/CVD techniques, organic and toxic solvents are typically used in the obtaining of the precursor solution. In this frame, a novel methodology based in aqueous solutions has recently demonstrated that leads to homogeneous and dense thin films efficiently, so further keeping an eye on the environmentally friendy conditions. However, a final sintering treatment for the crystallization of the film is required on an electric hot plate. In this context, an alternative sintering treatment is currently proposed using solar radiation instead of electrical energy, thus emphasizing in the reduction of the energy consumption and therefore, take care of the sustainability of the whole thin film fabrication process.

ABOUT THE PRESENTER

Professor Carlos Gumiel is currently the Vice-Dean for Research at the Higher Polytechnic School at Nebrija University, in Madrid (Spain). Simultaneosuly, he is part of the scientific committee of the Spanish Society of Ceramics and Glass. Particularly, he is the secretary of the section "Functional Ceramics for Electronics and Energy". Previously, he was the director of the Bachelor'sDegree in Industrial Technologies Engineering and Head of the Department of Chemistry at Nebrija University (until April 2024).

During his scientific career, Professor Gumiel has acquired experience on the synthesis, processing, and characterisation of diverse electroceramic materials with special emphasis in soft processing technologies leading to materials and/or devices with enhanced properties. The most relevant and innovative scientific developments along his scientific career can be summarised from two main points of view: alternative processes for the sustainable preparation of high-quality materials and better understanding of the physical and chemical phenomena involved during the fabrication of functional ceramics. The different projects and publications in top journals support this fact. Also, in the frame of those projects, he has acquired a deep knowledge about the interphase phenomena related to the nanostructure development and the functional response of different types of materials, primarily electroceramics. The synthesis of nanostructures from chemical routes, the functionalisation of particles and/or assemblies, and in particular the preparation of films, coatings, and homogeneous deposits onto selected substrates, are among the skills that have led him to succeed in the achievement of (micro) nanostructured materials and functional nanophases with scientific and industrial interest.