

PhD Position: Advanced Electrocatalysts for CO₂ Conversion into High-Value Multicarbon Products

Why this research matters

The rising concentration of CO₂ in our atmosphere is one of the most pressing challenges of our time. Transforming CO₂ into valuable chemicals offers a dual benefit: mitigating greenhouse gas emissions while creating sustainable alternatives to fossil-derived products. Among these, multicarbon compounds (C₂+), such as ethylene, ethanol, and propanol, stand out as critical building blocks for fuels and industrial feedstocks.

This PhD project aims to push the boundaries of electrochemical CO₂ conversion by developing next-generation electrocatalysts that enable selective and efficient production of these multicarbon products. The research combines materials innovation, advanced characterization, and electrochemical engineering, contributing to a transformative approach in green chemistry and energy transition.

Scientific objectives

- Design and synthesize hybrid electrocatalysts based on copper and heteroatom-doped carbon, using sustainable and scalable routes.
- Unravel reaction mechanisms through in-depth electrochemical studies and in situ characterization.
- Optimize selectivity and efficiency for C₂+ products by correlating structure-activity relationships.
- Integrate catalysts into advanced electrochemical devices, paving the way for real-world applications.

Your role and training

As a PhD candidate, you will join a dynamic, internationally collaborative research group with expertise in electrocatalysis, materials science, and sustainable chemistry. You will gain hands-on experience in:

- Advanced synthesis techniques.
- State-of-the-art characterization (XRD, SEM/TEM, XPS, spectroscopy, and in situ/operando methods).
- Electrochemical testing in three-electrode systems and electrolyzers under realistic conditions.
- Product analysis via gas and liquid chromatography.
- Data interpretation and modeling, supported by computational tools.

Mobility opportunities

- Attending international conferences and workshops.
- Opportunities for short-term research stays at partner institutions in Europe and beyond.
- Support for career development, including training in transferable skills and networking with industry.

Why join us?

- Access to cutting-edge facilities for materials characterization and electrochemical testing.
- Collaboration opportunities with leading international research centers.
- Training in high-impact research areas aligned with global sustainability goals.
- A stimulating environment fostering innovation, creativity, and career development.

This project offers a unique opportunity to contribute to climate change mitigation and sustainable chemical production, while building expertise at the forefront of energy and environmental research.

Summary of the PI's CV

M^a Victoria Martínez Huerta earned her PhD in Chemistry in 2001 from the UAM. She is a Research Scientist and Head of the Electrocatalysis for Energy and Environment (E3Cat) group since 2018 at the ICP-CSIC. Her research focuses on the preparation, structural characterization, and activity of electrocatalysts for energy and environmental applications, fostering the transition to sustainable and low-impact technologies, such as electrolyzers, fuel cells and unitized regenerative fuel cells (URFCs).

Main research lines:

- Development of innovative, low-cost, eco-friendly synthetic strategies for advanced electrocatalyst production, including agro-industrial waste as precursors.
- Methodology development for the analysis of key electrochemical reactions, such as CO₂ reduction (CO₂RR), oxygen reduction (ORR), oxygen evolution (OER), hydrogen evolution (HER), and alcohol oxidation.
- Use of advanced in situ and operando characterization techniques to understand electrochemical mechanisms and the activity/selectivity/stability relationship of electrocatalysts.

M^a Victoria Martínez Huerta has published 108 scientific publications (105 peer-reviewed journal papers JCR and 3 book chapters) with an h-index of 40 and 4,495 citations. She has been the principal investigator for 11 of 41 national and international research projects. M^a Victoria Martínez Huerta has translated her research into impactful societal and technological advancements. She has been involved in the research and development of 7 industrial contracts. Holder of three patents and two industrial secrets, including patent licensing to Repsol. She has also conducted research stays at Universidad de La Laguna (Spain), the Hong Kong University of Science and Technology (HKUST), the CNR-Institute for Advanced Energy Technologies (Italy), and the Fritz Haber Institute of the Max Planck Society (Germany).

M^a Victoria Martínez Huerta has played a significant role in training and mentoring early-career researchers. She has supervised 7 PhD theses (one awarded with an Extraordinary Doctorate Award), one ongoing PhD thesis, 4 postdoctoral researchers, 2 JAE-Intro CSIC students, 5 undergraduate theses, and 12 Master's theses (two awarded with Accésit Prizes at the Arquímedes University Competition in 2012 and 2016, and one awarded with Santander Open Academy in 2024). Supervised predoctoral and postdoctoral researchers from Hong Kong, Iran and Tunisia.