

Galan-Mascaros, Jose Ramon

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• EDUCATION

- 1999 PhD, Chemistry, Department of Inorganic Chemistry, University of Valencia, Spain
PhD Supervisors: Eugenio Coronado & Carlos J. Gómez
- 1993 Bachelor of Science, Chemistry, Faculty of Chemistry, University de Valencia, Spain.
- 1993 International Diploma on Chemistry, Imperial College of Science, Technology & Medicine, UK

• CURRENT POSITION

2009–present ICREA Professor at the Institute of Chemical Research of Catalonia (ICIQ), Spain

• PREVIOUS POSITIONS

- 2002–2009 Research Scientist. *Institute of Molecular Science (ICMol), University of Valencia, Spain*
- 1999–2001 Postdoctoral Research Associate. *Department of Chemistry, Texas A&M University, USA*

• PUBLICATIONS

I am author of over **230 publications** in peer reviewed international journals including ten book chapters:
Total citations = 13614; 58.94 average citations/article; h index = 63¹

• FELLOWSHIPS AND AWARDS

- 2019 “Excellence in Research Award”, Spanish Royal Society of Chemistry (RSEQ), Spain
- 2011-2015 ERC Stg Grant, European Research Council
- 2008 “Olivier Kahn International Award”, European Institute of Molecular Magnetism.
- 2006 “Technology IDEA Award”, Ciudad de las artes y las ciencias (CAC) Fund, Spain
- 2006–2009 “I3 fellowship” as senior researcher, Spanish Ministry of Science and Technology, Spain
- 2002–2006 “Ramon y Cajal” fellowship, Spanish Ministry of Science and Technology, Spain
- 2002 “Young Researcher Award”, Spanish Royal Society of Chemistry (RSEQ), Spain
- 2000–2001 Postdoctoral fellowship, Spanish Ministry of Science and Technology, Spain
- 1999–1999 Research fellowship, Department of Chemistry, University of Valencia, Spain
- 1995–1998 Doctorate fellowship, Generalitat Valenciana, Spain
- 1992–1993 Erasmus Fellowship at Imperial College of Science & Technology, UK.

• SUPERVISION OF GRADUATE STUDENTS AND POSTDOCTORAL FELLOWS

- 2009–present 20 Postdocs/ 18 PhD/ 5 Master Students
Institute of Chemical Research of Catalonia (ICIQ), Spain
- 2002–2009 1 Postdocs/ 4 PhD/ 4 Master Students
Institute of Molecular Science (ICMol), University of Valencia, Spain

• ORGANISATION OF SCIENTIFIC MEETINGS

- 2023 Organising committee for the “Frontiers in Metal Oxide Cluster Science” FMOCS VII (> 80 participants), April 11-15, Tarragona, Spain.
- 2019 Organising committee for the “Fundamentals and Applications of (Photo)Electrolysis for Efficient Energy Storage” International Bunsen-Discussion-Meeting (> 100 participants), April 1-5, Italy.
- 2019 Int. scientific advisory committee: “Electrolysis and fuel cell discussions: Towards catalysts free of critical raw materials for fuel cells and electrolyses” EFCD 2019, September 15-18, France.
- 2016 Organising committee for the “Nanomaterials in Biology & Medicine” Symposium, at the 252nd ACS Meeting, August 21-25, USA.
- 2015 Organising committee for the “Lights on Chemistry” symposium (> 100 participants), October 1-2, Institute of Chemical Research of Catalonia (ICIQ), Spain
- 2002 Local organising committee: International Conference on Molecule-Based Magnets (ICMM 2002) October 5-10, 2002. Valencia (SPAIN).

• INSTITUTIONAL RESPONSIBILITIES

- 2020–Present Head of the Technology Transfer Committee, Institute of Chemical Research of Catalonia (ICIQ), Spain

• REVIEWING ACTIVITIES

- 2018–present Editorial Board, *Frontiers in Chemistry*, Frontiers Media SA, Switzerland
- 2018–present Editorial Advisory Board, *ChemElectroChem*, Wiley-VCH, Germany
- 2018–2023 Editorial Advisory Board, *Magnetochemistry*, MDPI, Switzerland
- 2018 Guest editor of “Special issue on Polyoxometalates” in *Acta Crystallogr., Sect. C: Struct. Chem.* **2018**, Vol. 74, num. 11.
- 2016–2019 Scientific Subcommittee Panel member, Institute Laue-Langevin, France

- 2009–present Reviewer for the following publishers: *Springer Nature*; *American Chemical Society (ACS)*; *Royal Society of Chemistry (RSC)*; *Wiley-VCH*; *Elsevier*; *Pergamon Press*; *Frontiers Media*; *Multidisciplinary Digital Publishing Institute (MDPI)*.
- 2009-present Reviewer for the following agencies: *European Research Council (ERC-European Union)*; *Agencia Nacional de Evaluación y Prospectiva (ANEP-Spain)*; *Agència de Gestió d'Ajuts Universitaris i de Recerca (AGAUR-Catalonia)*; *Agence National de la Recherche (ANR-France)*; *Register of Expert Peer Reviewers for Italian Scientific Evaluation (REPRISE, Italy)*; *Israel Science Foundation (ISF)*; *Alexander von Humboldt Foundation*; *Agencia Nacional de Promoción Científica y Tecnológica (ANPCyT-Argentina)*; *Comisión Nacional Investigación Científica y Tecnológica (CONICYT-Chile)*.

- **MEMBERSHIPS OF SCIENTIFIC SOCIETIES**

- 2002 – present Member, Spanish Royal Society of Chemistry (RSEQ), Spain
2010 – present Member, American Chemical Society (ACS), USA

- **MAJOR COLLABORATIONS**

Nuria López – Computational modeling of heterogeneous catalysts, ICIQ, Spain
David Écija – Microscopic analysis (STM) of catalytic surfaces, IMDEA Nanociencia, Spain
Jordi Arbiol – E-microscopy(HRTEM). Inst. Nanoscience and Nanotechnology (ICN2), Spain.
Sixto Giménez – Photo-electrochemical characterization, Inst. Advanced Materials (INAM), Spain
Sara Barja – Spectroscopic (XPS) characterization, Donostia International Physics Center, Spain
Magali Lingenfelder – Surface electrochemical characterization, BCMaterials, Spain
James Durrant – Spectro-photo-electrochemistry, Imperial College London, UK
Sofia Calero – Molecular dynamics, Eindhoven Univ. of Technology, The Netherlands
Siglinda Perathoner – Photoelectrocatalytic devices, INSTM-University of Messina, Italy

- **TRANSFER OF KNOWLEDGE**

Founder and scientific advisor of **ORCHESTRA Scientific S.L.** (www.orchestrasci.com), a start-up company aiming to bring to market the patent inventions by ICIQ's Galan-Mascaros group. In 2017, the company was selected as one of the six CleanTech Camp finalists and joined the acceleration programme. Since then, Orchestra Scientific S.L. has participated in different programs to refine its business model (Tarragona Open Future, EMPENTA, Barcelona Activa) and received several awards, including: Emergent Award “Categoría Llabor” from the Catalan Efficient Energy Cluster (CEEC); Barcelona Activa Pre-acceleration Award; Reus “Pitch and Win” award; and Tarragona Open Future Accessit. Orchestra Scientific S.L. has also participated in the Fondo Emprendedores Repsol acceleration program (2018-2020).

- **CURRENT POSITION OF SUPERVISED POSTDOCS (PD) AND PhD STUDENTS**

Santiago Reinoso Crespo (PD 2006-2010) Assistant Professor, Public University of Navarra.
Verónica Gómez Piedrafita (PD 2012-2014) R+D+i Manager at BADRINAS SAU.
Yong Sung Koo (PD 2013-1015) R+D Manager at Samsung Medical Rubber CO., LTD.
Neus Corella Ochoa (PD 2013-2017) Chemistry High-School Teacher at IES Enric Borrás, Badalona.
Cristina Sáenz de Pipaón Soba (PD 2013-2017) Manager at S2B Tech4Climate.
Álvaro Reyes Carmona (PD 2016-2020) R+D+i Manager at ARCAMO GROUP®.
Breogan Pato Doldan (PD 2018-2019) Head Department, Iberian Energy Storage Res. Center, Spain.
Irene Sánchez (PD 2018-2021) Publishing Editor at Royal Society of Chemistry, UK.
Scott Folkman (PD 2020-2023) Assistant Professor, University of New Mexico, USA.
Dolores Jurado Fuentes (PD 2022-2023) Research Assistant ICMS-CSIC, Sevilla
Eugenia Martínez Ferrero (PhD in 2003) Scientific Coordinator at ICIQ (Prof. Palomares group).
Carlos Martí Gastaldo (PhD in 2009) ERC CoG Grant Fellow at ICMOL, University of Valencia.
Maria Monrabal Capilla (PhD in 2011) Research Laboratory Technician at ICMOL, University of Valencia.
Sara Goberna Ferrón (PhD in 2013) MSCF Postdoctoral Researcher at ITQ-CSIC, Valencia.
Joaquín Soriano López (PhD in 2016) CDEIGENT Researcher at ICMOL, University of Valencia.
Nelson Gimenez Agulló (PhD in 2016) R+D+i Manager at Promopastor S. L.
Marta Blasco Ahicart (PhD in 2017) Chemistry High-School Teacher at IES La Plana, Castellon.
Franziska Simone Hegner (PhD in 2019) Postdoctoral Researcher at Technical University Munich.
Andrea Moneo Corcuera (PhD in 2019) Postdoctoral Researcher at BCMaterials, Bilbao.
David Nieto Castro (PhD in 2021) R+D Researcher at CIDETEC, San Sebastián.

Section c: Ten years track-record (2013-2022)

c1. Research outlook

During the last 10 years, my research group has focused on the discovery and development of electrochemical oxidation catalysts for the oxygen evolution reaction (OER), and their exploitation for the production of solar fuels. Our most significant contributions are:

Water oxidation catalysis in acidic media with stable, Earth-abundant

metals: The instability of transition metal oxides under oxidation potentials in low pH electrolytes was supposed to be unavoidable, since these oxides are thermodynamically unstable. We implemented a novel strategy to avoid their total dissolution in water by their incorporation into partially hydrophobic solid supports. With this approach, we demonstrated that cobalt-based polyoxometalates, (*Nat. Chem.* **2018**, *10*, 243), were competitive with that of noble metal catalysts. Our results were highlighted by *Chemistry World* “Cheap water splitting catalysts takes on precious peers” (12/2017). More recently we have demonstrated this same approach is valid to stabilise common transition metal oxides (*Nat. Commun.* **2022**, *13*, 4341).

Water oxidation catalysis with Prussian blue analogues: Looking for alternatives to OER catalysts in acidic media, we searched for non-oxide materials resistant and stable at very low pH (pH < 1). We found excellent acidic stability, and high OER activity in the family of Prussian blue materials (*J. Am. Chem. Soc.* **2013**, *135*, 13270; *J. Am. Chem. Soc.* **2016**, *138*, 16037). This discovery was highlighted by *Chemistry World* “Water-splitting catalyst based on Prussian blue” (9/2013). We were able to demonstrate their viability as low-cost substitutes for IrO₂ in PEM electrolyzers (*Sustainable Energy Fuels* **2018**, *2*, 589) and their versatility as co-catalysts to significantly enhance the photocurrent of light-harvesting semiconductors for solar fuels production (*ACS Appl. Mater. Int.* **2017**, *9*, 37671; *Energy Environ. Sci.* **2017**, *10*, 2124).

Magnetic enhancement of water splitting: We discovered how the use of weak magnetic fields, generated by permanent magnets, can enhance the kinetics of OER electrocatalysts, doubling the current density at constant applied potential (*Nat. Energy* **2019**, *4*, 519). This discovery was highlighted by *Chemistry World* “Magnets double the efficiency of water splitting” (08/2019) and *C&E News* “Magnet doubles hydrogen yield from splitting water” (06/2019): TOP READ 2019 News Story of the year (C&E News 09/12/2019).

c2. Ten most relevant publications as corresponding author:

- 1) Moneo-Corcuera, Nieto-Castro, Cirera, Gómez, Sanjosé-Orduna, Casadevall, Molnar, Bousseksou, Azzedine, Parella, Martínez-Agudo, Lloret-Fillol, Pérez-Temprano, Ruiz, Galan-Mascaros. Molecular memory near room temperature in an iron polyanionic complex. *Chem* **2023**, *9*, 377–393. **3 citations** (<http://hdl.handle.net/2072/532935>)
- 2) Yu, Garcés-Pineda, González-Cobos, Peña-Díaz, Rogero, Giménez, Spadaro, Arbiol, Barja, Galan-Mascaros. Sustainable oxygen evolution electrocatalysis in aqueous 1M H₂SO₄ with Earth abundant Co₃O₄. *Nat. Commun.* **2022**, *13*, 4341. **12 citations** (<https://doi.org/10.1038/s41467-022-32024-6>)
- 3) Garcés-Pineda, Blasco-Ahicart, Nieto-Castro, López, Galan-Mascaros. Direct magnetic enhancement of electrocatalytic water oxidation in alkaline media. *Nat. Energy* **2019**, *4*, 519–525. **329 citations** (<http://hdl.handle.net/2072/368596>)
- 4) Corella-Ochoa, Tapia, Rubin, Lillo, González-Cobos, Núñez-Rico, Balestra, Almora-Barrios, Lledós, Güell-Bara, Cabezas-Giménez, Escudero-Adán, Vidal-Ferran, Calero, Reynolds, Martí-Gastaldo, Galan-Mascaros. Homochiral metal-organic frameworks for enantioselective separations in liquid chromatography *J. Am. Chem. Soc.* **2019**, *141*, 14306–14316. **83 citations** (<http://hdl.handle.net/2072/365658>)
- 5) Blasco-Ahicart, Soriano-López, Carbó, Poblet, Galan-Mascaros. Polyoxometalate electrocatalysts based on earth-abundant metals for efficient water oxidation in acidic media” *Nat. Chem.* **2018**, *10*, 24–30. **315 citations** (<http://hdl.handle.net/2072/374603>)
- 6) Han, Tang, Reyes-Carmona, Rodríguez-García, Torréns, Morante, Arbiol, Galan-Mascaros. Enhanced activity and acid pH stability of Prussian blue-type oxygen evolution electrocatalysts processed by chemical etching. *J. Am. Chem. Soc.* **2016**, *138*, 16037–16045. **191 citations** (<https://recercat.cat/handle/2072/498238>)
- 7) Gómez, Sáenz de Pipaón, Maldonado-Illescas, Waerenborgh, Martin, Benet-Buchholz, Galan-Mascaros. Easy excited-state trapping and record high T_{TIESTT} in a spin-crossover polyanionic Fe^{II} trimer” *J. Am. Chem. Soc.* **2015**, *137*, 11924–11927. **70 citations** (<http://hdl.handle.net/2072/534562>)
- 8) Galan-Mascaros. Water oxidation at electrodes modified with Earth-abundant transition-metal catalysts. *ChemElectroChem* **2015**, *2*, 37–50. **252 citations** (<http://hdl.handle.net/2072/534561>)
- 9) Goberna-Ferron, Hernandez, Rodriguez-Garcia, Galan-Mascaros. Light-driven water oxidation with metalhexacyanometallate heterogeneous catalysts. *ACS Catal.* **2014**, *4*, 1637–1641. **95 citations** (<http://hdl.handle.net/2072/534563>)

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MAGNET DOUBLES WATER SPLITTING'S HYDROGEN YIELD



Using a \$10 neodymium magnet, researchers doubled the hydrogen output of an alkaline water electrolyzer. If the process can be scaled up, it would decrease the costs of generating hydrogen from water.

10) Pintado, Goberna-Ferrón, Escudero-Adán, Galan-Mascaros. Fast and persistent electrocatalytic water oxidation by Co–Fe Prussian blue coordination polymers. *J. Am. Chem. Soc.* **2013**, *135*, 13270–13273. **344 citations** (<http://hdl.handle.net/2072/534564>)

c3. Patents:

“A crystalline metal-organic framework”. Inventors: Galan-Mascaros, Corella-Ochoa, Lillo. Application No.: EP16382480.8. Country: European Union and associated countries. Priority date: 21/10/2016. *Licensed to Orchestra Scientific since 2017*.

“Non-magnetic insertion probe for spectroscopic measurements”. Inventors: Galan-Mascaros, Sáenz de Pipaón Soba, León, Camón, Pérez. Application No.: EP15382481.8. Country: European Union and associated countries. Priority date: 2/10/2015.

“Process for water oxidation comprising the use of a polyoxometalate compound as water oxidation catalyst”. Inventors: Galan-Mascaros, Llobet, Vigara, Goberna-Ferrón, Soriano-López. Pub. N° = WO/2013/057079, Application No.: PCT/EP2012/070444. Country: European Union and associated countries. Priority date: 17/10/2011, EP11382322.3.

c4. Funding:

In these last ten years, I have received over 6 million € from competitive funds, being **coordinator** of the following international projects:

Sustainable photo-electrochemical valorization of flue gases (SUPERVAL). HORIZON-EIC-2022-PATHFINDERCHALLENGES-01-01 RIA (101115456) 2023–2026. Total budget:3,571,709€. Budget ICIQ: 650,750 €

Separation membranes for carbon dioxide removal from gas streams (MEMCARB). ERC Proof-of-Concept (780255) 2018–2019 Budget:150,000 €

An artificial leaf: a photo-electro-catalytic cell from Earth-abundant materials for sustainable solar production of CO₂-based chemicals and fuels(A-LEAF). H2020 FETPROACT-2016 RIA(732840) 2017–2021 Total budget:7,980,861€. Budget ICIQ:879,712.50 €

A novel platform for user-friendly spectroscopy at very low temperatures and under strong magnetic fields (U-SPEC). ERC Proof-of-Concept (713539). 2016–2018 Budget:150,000 €

A Solar-Powered Hydrolyzer(HYDRER). ERC Proof-of-Concept (664719) 2015–2016 Budget:150,000 €

Building-up Chemical Complexity into Multifunctional Molecule-Based Hybrid Materials (CHEMCOMP). ERC Starting Grant (279313) 2012–2016 Budget:1,940,394 €

And **participating** in the following international projects as partner:

Novel photo-assisted systems for direct solar-driven reduction of CO₂ to energy reach chemicals (SUN2CHEM). H2020-LC-SC3-RES-29-2019 (862030) 2020–2023 PI: M. Grätzel. Budget ICIQ: 323,750 €

Distributed chemicals and fuels production from CO₂ in photoelectrocatalytic devices(DECADE). H2020-NMBP-ST-IND-2019-RIA(862030) 2020–2024 PI: G. Centi. Budget ICIQ: 538,937 €

Critical Raw Materials Elimination by a Top-down Approach to Hydrogen and Electricity Generation(CREATE). H2020 NMBP-2016-RIA (2017–2020) PI: F. Jaouen. Budget ICIQ: 350,625€

c5. Invited presentations at international venues (2013-2022) Total = 51. The 10 most relevant:

1) Artificial photosynthesis: state-of-the-art, perspectives and catalysis 13/10/2022, SHIFT 2022 – Spectral sHaping For biomedical and energy applicaTions, LaLaguna, Spain.

2) Prussian blue-derivatives as robust, selective oxidation electro catalysts 29/09/2022, 44th International Conference on Coordination Chemistry, Rimini, Italy.

3) Sustainable and energy efficient (nano)structured oxidation electrocatalysts in acidic media from Earth abundant metals 23/09/2021 E-MRS2021 Fall Meeting, virtual conference.

4) Sustainable and energy efficient (nano)structured oxidation electrocatalysts in acidic media from Earth abundant metals 3/6/2021, 239th meeting of the Electrochemical Society, Digital meeting.

5) Oxygen evolution electrocatalysis with Earth-abundant metals 24/05/2019, Texas A&M University, USA

6) Novel strategies to enhance OER electro catalysis in alkaline media 25/11/2020, 71st annual meeting of the International Society of Electrochemistry, Belgrade & Online, Serbia.

7) Artificial photosynthesis: From basic principles to technological impact 15/03/2018 FET seminar organised by DG CNECT, DG RTD and DG ENER, Brussels, Belgium.

8) Adventures in spin crossover phenomena: From molecules with memory to multifunctional synergy 3/07/2017 Ecole Doctoral de Chimie Moléculaire, Université Pierre et Marie Curie, France

9) Water oxidation with all-inorganic Earth-abundant catalysts 31/03/2015 Beckman Institute, Caltech, USA.

10) Water oxidation catalysis with cost-effective molecule-based materials 15/05/2014 Department of Chemistry, Ben Gurion University of the Negev, Beersheba, Israel.

[1] Google Scholar accessed on May 14th 2022