

Journal of Electroanalytical Chemistry – Virtual Special Issue (VSI) ‘Iberoamerican Applications of Electrochemistry across the World (IAEW)’

FOREWORD

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Scientific progress, at an individual and institutional level, often requires a trade-off between cooperation and competition, and success is frequently limited by secrecy and unshared scientific advances. If properly managed, national, and transnational scientific and/or technological networks, may be remarkably effective tools for establishing a competitive edge through cooperation. The recent Excellence Networks in Spain, COST (Cooperation in Science and Technology) actions at a European level, and CYTED (*Programa Iberoamericano de Ciencia y Tecnología para el Desarrollo*) projects to promote the harmonic Iberoamerican development of science and technology, are exemplary of win-win initiatives.

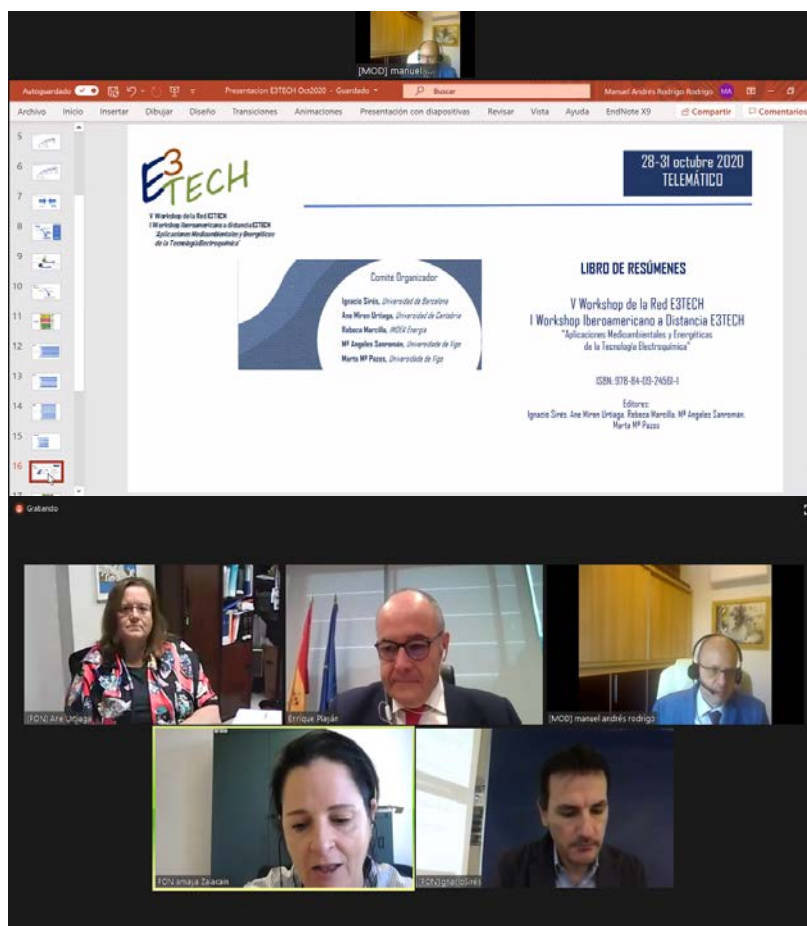
The Spanish Network of Excellence on Environmental and Energy Applications of Electrochemical Technology ([E3TECH](#)), funded by the Spanish Ministry of Science and Innovation through the projects CTQ2015-71650-REDT and CTQ2017-90659-REDT, was created following the initiative of the Specialized Electrochemistry Group of the Spanish Royal Society of Chemistry (GEE-RSEQ). [E3TECH](#)'s far-reaching ambition is to foster Research, Development and Innovation (R & D & I) within electrochemical science and technology, and to establish effective and fruitful synergies between academics and industry. E3TECH's specific objectives are set in the context of two relevant applications of Electrochemistry, i.e., Environment and Energy, thus aiming to contribute to the sustainable development of society, in agreement with the Sustainable Development Goals (SDGs) established by the United Nations General Assembly in its 2030 Agenda. The 21 groups currently forming the Network have undertaken numerous actions together over the last 7 years, including the organization of online

and live events for young students and senior researchers, as well as the publication of numerous specialized issues on different subtopics related to the aforementioned core topics.

The VSI entitled “Iberoamerican Applications of Electrochemistry across the World (**IAEW**)” consists of selected papers from oral and poster contributors presented at the [V Workshop of the E3TECH Network / I Online E3TECH Iberoamerican Workshop](#) “Environmental and Energy Applications of the Electrochemical Technology” (**V E3TECH**). The Organizing Committee included five members from different Spanish institutions: Ignasi Sirés, (Universitat de Barcelona), Ane M. Urriaga (Universidad de Cantabria), M. Ángeles Sanromán (Universidade de Vigo), Marta Pazos (Universidade de Vigo) and Rebeca Marcilla (IMDEA Energía). The Committee enjoyed the support of the GEE-RSEQ and the E3TECH Network members. The international event (28-31 October 2020) was held online due to the COVID-19 pandemic and was deemed a success, with 377 attendants and 160 oral/poster contributions (84 oral and 76 posters). The main objective of the workshop was to promote the work carried out by Spanish, Portuguese and Latin American researchers and companies, around the world, on the two rising applications of Electrochemistry. Hence, it was planned to serve as a fountainhead that could initiate potentially solid research collaborations between groups or offer an additional platform to exchange meaningful and fruitful experiences that could inspire other amidst such challenging circumstances prompted by the global pandemic.

On 28th October, Prof. Enrique Playán, current Head of the Spanish Research Agency (AEI, MICINN) and Prof. Amaya Zalacain, Vicedean of Research at the University of Castilla-La Mancha, opened the workshop. It consisted of several sessions focused on the description of: (i) the most recent innovations in the lines of research of the E3TECH Network group members; (ii) innovations in Iberoamerican industrial electrochemistry, with contributions from both relevant academics with particularly outstanding technological profiles, such as Gerardine Botte (Texas Tech University, USA), Ignacio

González (Universidad Autónoma de México) or Yunny Meas (CIDETEC, Mexico), and delegates from companies, like B5Tec, Electrozemper, Aragon Hydrogen Foundation, GS Inima Environment, Apria Systems, Inovyn Spain; (iii) the most interesting state-of-the-art research conducted by Iberoamerican electrochemists settled in Europe and Latin America; (iv) promising projects from PhD students and postdoctoral researchers working within the groups belonging to the E3TECH Network.



In the image, commencement of the online V E3TECH and panel to the V E3TECH held online and panel. From left to right: Prof. Ane M. Urteaga, Prof. Enrique Playán, Prof. Manuel A. Rodrigo, Prof. A. Zalacain and Prof. I. Sirés.

It is therefore a great pleasure for us, as Guest Editors, to introduce this VSI, which contains 26 articles on different aspects of Electrochemistry. These presentations come from the most renowned research

groups within the Iberoamerican region. Several articles report advances on electrochemical advanced oxidation processes (EAOPs) for water treatment. For example, on the electro-oxidation process using carbon surface-modified textile electrodes for azo dye treatment, as described by the Cases group. Nava et al. report the experimental characterization and modelling of a filter-press cell serving as an electrochlorinator, whereas Urriaga and her team also address the electrochemical production of chlorine but for further applications in ammonia removal within marine aquaculture. The group of García-Antón contributes with two articles on nanostructured ZnO and WO₃ photoanodes for pesticide removal by means of photoelectrocatalysis. The role of the cathode as the main source of oxidants is also explored: peroxydisulfate activation to sulfate radical is demonstrated by Sirés and co-workers employing Fe(II) sites of magnetite-decorated carbon; the electro-Fenton process, one of the best performing EAOPs for degradation of organic pollutants, has been employed to oxidise ibuprofen with an air-diffusion cathode synthesized by wet-spinning, as reported by Han's group, as well as for the regeneration of carbon adsorbents (Sanromán et al.), for coupling with adsorption in fluidized bed reactor (Godínez et al.) or for heterogeneous reactions (Pazos et al.). Soil remediation based on soil washing with a very reactive liquid solution is addressed by the group of Martínez-Huitle, which produces persulfates on a BDD anode, and by Hui et al. who electro-enhanced the persulfate/Fe²⁺ process for diesel removal. The laboratory led by Bustos reports the electrofarming technique using dimensionally stable anodes for improving soil properties and the germination and growth of a given plant. Gas treatment is also feasible employing electrochemical setups, as demonstrated for perchloroethylene by Sáez's group using electroscrubbers, as well as by the teams of Guirado for CO₂ electroreduction in different solvents and Solla for CO₂ conversion to formate using supported Sb₂O₃/Sb nanoparticles.

Different energy applications are also described: the topic of the oxygen reduction reaction (ORR) in alkaline electrolyzers is addressed by the researchers led by Cabrera, who uses Ag-modified carbons, and García, who focuses on transition metal carbides as non-noble electrocatalyst for hydrogen

production. The group of Fernández-Romero synthesizes Cr₂O₃-modified carbons as cathodes in a Zn/PVA-KOH/air battery, whereas Lobato et al. investigate the stability of chloralkaline high-temperature PEMFCs. Coordination polymers may be employed as electrolytes in slurry-based aqueous batteries, as reported by the laboratory of Carretero, whereas Álvarez-Gallegos assesses the optimization of power production of a microbial fuel cell, a promising technology in the cutting edge between electrochemistry and biotechnology.

More fundamental and transversal electrochemical studies are presented by other relevant teams of researchers: (i) Batanero investigates the electroreduction and electro-oxidation of organic molecules; (ii) Dávila-Jiménez characterizes the oxidation of benzothiophenes on a BDD anode, a work with potential impact in the petrochemical industry; (iii) García-Jareño, informs about the synthesis and characterization of PEDOT films; and (iv) Lanzalaco, who suggests a very interesting approach in the context of circular economy by recycling polyethylene to further produce a glucose sensor.

It is worth mentioning that all these electrochemical systems may be coupled with renewable energy sources, eventually making the resulting devices viable off the grid.

In summary, this VSI offers a holistic view of the latest advances from expert researchers in environmental and energy applications within the increasingly important field of Electrochemistry, which is expected to contribute decisively toward the progress of Iberoamerican countries in the near future, having already been verified by the intense electrification and decarbonization strategies that are being promoted at a global scale. These are immense challenges that will require the coordination of many public and private stakeholders, and initiatives like the [E3TECH](#) Network will contribute to ease the discernment of regulations and technologies maintaining a scientific approach that ensures the viability and equity of all final decisions, ensuring that the benefits are far-reaching with regard to society and environmentally sustainable.

All the manuscripts underwent a peer review process by at least two external referees. As Guest Editors, we are especially thankful to all authors and reviewers who put their efforts and expertise at the service of this special initiative that unites researchers who share many common cultural backgrounds and languages. We would like to acknowledge all participants of the V E3TECH for their contributions or attendance to the workshop and, in particular, the contributors to this VSI of the Journal of Electroanalytical Chemistry and the Editor-in-Chief of the Journal, Prof. Dr. Juan M. Feliu, for his great support in all the initiatives that enhance the strength of electrochemistry research.