EChemCONSTORE

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I Meeting on Electrochemical Energy Conversion and Storage Devices

A meeting sponsored by the International Society of Electrochemistry

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Report of ISE sponsored meeting
I Meeting on Electrochemical Energy Conversion and Storage Electrochemical Devices

Pablo A. García-Salaberri[1], M. Teresa Pérez-Prior[2]

1 Department of Thermal and Fluids Engineering, University Carlos III of Madrid, Leganés, 28911, Spain

2 Department of Materials Science and Engineering and Chemical Engineering, University Carlos III of Madrid, Leganés, 28911, Spain

The "I Meeting on Electrochemical Energy Conversion and Storage Electrochemical Devices" was held online at University Carlos III of Madrid (UC3M) on January 28th-29th, 2021. The program was divided into two main blocks:

1. Energy conversion devices: fuel cells, electrolyzers, and components.
2. Energy storage devices: redox flow batteries, lithium and post-lithium batteries, and components.

The scientific program was composed of 37 talks, 17 devoted to block 1 (46 %) and 20 devoted to block 2 (54 %). In the first block, 16 talks were focused on fuel cells and 1 talk on electrolyzers. In the second block, 11 talks were focused on redox flow batteries, 9 talks on lithium and post-lithium batteries, and 1 talk on liquid metal batteries. In terms of affiliation, 23 talks were from universities (62 %), 10 from research centers (27 %), and 4 from companies (11 %).

In the opening ceremony, an overview of the meeting was presented by Pablo A. García-Salaberri, which was followed by an opening talk of Sonia Dsoke, vice-chair of ISE D3 and leader of the "Material Synthesis" group at Karlsruher Institut für Technologie (KIT). In the closing ceremony, Teresa Pérez-Prior presented a summary of the meeting and next steps for the next edition, such as the creation of the "Best Bachelor's & Master's Theses Awards". This inititative aims to recognize top-level students around the world, whose work focuses on electrochemical devices and components.

Videos of the sessions and abstracts can be found at the meeting website. In the near term, a book of abstracts will be edited by UC3M and published electronically at the UC3M institutional repository. In addition, special issues of interest for the audience of this meeting has been promoted, as is the case of the special issue "Modelling and Experimental of Polymeric Materials for Electrochemical Energy Conversion and Storage Systems", edited by Pablo A. García-Salaberri and Teresa Pérez-Prior in "Polymers". Related events organized by collaborating societies, such as the "International Association for Porous Media (InterPore)", have also been disseminated among colleagues and participants.

PRoGRAM

Day 1 (January, 28th 2021)

Opening ceremony (10:15–11:00): EChemCONSTORE I, The I Meeting on Electrochemical Energy Conversion and Storage Devices at UC3M.

Chairs: Pablo A. García-Salaberri & María Teresa Pérez-Prior

- 10:15–10:35. **Pablo A. García-Salaberri, University Carlos III of Madrid, Spain.** *EChemCONSTORE I: An overview.*
- 10:35–10:50. **Sonia Dsoke, vice-chair of ISE D3.** *International Society of Electrochemistry, Division 3. Electrochemical energy conversion and storage.*

Morning (11:00–13:55): Fuel cells, electrolyzers and components I.

Chairs: María Teresa Pérez-Prior & Nieves Ureña

- 11:00–11:25. **PEM4Energy, University Carlos III of Madrid, Spain (Pablo A. García-Salaberri)**. *Modeling and characterization of the conductivity of proton-exchange membranes based on multiblock copolymers of sulfonated polysulfone and polyphenylsulfone.* (abstract)
- 11:25–11:50. **Javier Arboleda, Hyundai, Spain.** *Hyundai Nexo: The most advanced fuel cell vehicle.* (abstract)
- 11:50–12:15. **S. Majid Hassanizadeh, Utrecht University, The Netherlands.** *A new approach to modelling water flooding in a polymer electrolyte fuel cell.* (abstract)
- 12:15–12:40. **Steven B. Beale, Forschungszentrum Jülich, Germany.** *A discussion of two-phase flow in the gas channel and porous transport layer regions of polymer electrolyte cells.* (abstract)
- 12:40–13:05. **Alfredo Iranzo, University of Seville, Spain.** *Research on PEM fuel cells using computational fluid dynamics and experimental techniques.* (abstract)
- 13:05–13:30 **Jens Eller, Paul Scherrer Institute, Switzerland.** *Insights into capillary pressure in operating polymer electrolyte fuel cells.* (abstract)
- 13:30-13:55. **Pablo A. García-Salaberri, University Carlos III of Madrid, Spain.** *Modeling transport in gas diffusion layers using a composite continuum-pore network formulation.* (abstract)

Afternoon (16:00–20:10): Fuel cells, electrolyzers and components II.

Chairs: Pablo A. García-Salaberri & Vanesa Muñoz-Perales

- 16:00–16:25. **Laura González-Morán, University of Seville, Spain.** *Computational fluid dynamics modelling and simulation of a fuel cell: Influence of the gas diffusion layer design on the water management and cell performance.* (abstract)
- 16:25–16:50. **Antonio M. Chaparro, Centro de Investigaciones Energéticas, Medioambientales y Tecnológicas, Spain.** *New electrodes for improving the water transport in proton exchange membrane fuel cells.* (abstract)
- 16:50–17:15 **Pedro García-Ybarra, Universidad Nacional de Educación a Distancia, Spain.** *Reaction-diffusion modelling of a PEM fuel cell catalytic layer with adsorption-desorption kinetics.* (abstract)
- 17:15–17:40. **Juan Sánchez-Monreal, German Aerospace Center, Germany.** *Hybrid operation strategy as a path to mitigate degradation in PEMFC based power sources.* (abstract)
- 17:40–18:05. **Miguel Ángel Laguna-Bercero, University of Zaragoza, Spain.** *Microtubular solid oxide fuel cell based systems for their integration in portable appliances.* (abstract)
- 18:05–18:30. **María Barragán, Complutense University of Madrid, Spain.** *Alcohol diffusion in alkali-metal doped polymeric membranes with application in alkaline direct fuel cells.* (abstract)
- 18:30–18:55. **María Teresa Pérez-Prior, University Carlos III of Madrid, Spain.** *Anion-exchange membranes based on functionalized polysulfone for fuel cell applications.* (abstract)
- 18:55–19:20. **Nieves Ureña, University Carlos III of Madrid, Spain.** *Synthetic routes of aromatic ionomers for anion exchange membranes.* (abstract)
- 19:20–19:45. **Mahmoud Gomaa, Minia University, Egypt.** *Positron based techniques as effective tools for the development and characterization of proton exchange membranes.* (abstract)
- 19:45-20:10 **Jiangjin Liu, Lawrence Berkeley National Lab, USA.** *Modeling study of the functionality of hydroxide electrolyte in hydroxide-exchange-membrane water electrolyzer.* (abstract)

Day 2 (January, 29th 2021)

Morning (10:00–14:10): Redox flow batteries, lithium and post-lithium batteries and components I.

Chair: María Teresa Pérez-Prior & Nieves Ureña

- 10:00–10:25. **Jesús Palma, IMDEA Energy Institute, Spain.** *A strategy to increase the volumetric storage capacity of redox flow batteries.* (abstract)
- 10:25–10:50. **Javier Carretero-González, CSIC Institute of Polymer Science and Technology, Spain.** *Polymers for sustainable energy storage.* (abstract)
- 10:50–11:15. **Antoni Forner-Cuenca, Eindhoven University of Technology, The Netherlands.** *Engineering porous electrode microstructures for redox flow batteries.* (abstract)
- 11:15–11:40. **Matteo Gigli, University of Venice, Italy.** *Sulfonated poly(phenylene sulfide sulfone)-based membranes for vanadium redox flow batteries.* (abstract)
- 11:40–12:05. **José Francisco Vivo, University Carlos III of Madrid, Spain.** *LFP and ferri/ferrocyanide as posolyte for a redox targeting based RFB.* (abstract)
- 12:05–12:30. **Vanesa Muñoz-Perales, University Carlos III of Madrid, Spain.** *Performance modeling of a vanadium redox flow battery.* (abstract)
- 12:30–12:55. **Beatriz Oraá/Alberto Quintero, B5tec, Spain.** *Membraneless micro flow batteries: A disruptive technology.* (abstract)
- 12:55–13:20. **Desirée Ruiz, University Carlos III of Madrid, Spain.** *Mathematical modelling of a membrane-less redox flow battery.* (abstract)
- 13:20–13:45. **Santiago E. Ibáñez-León, IMDEA Energy Institute, Spain.** *Self-discharge reactions in membraneless redox flow batteries.* (abstract)
- 13:45–14:10. **Remi Blanc, Thermo Fisher Scientific, France.** *Multiscale image-based control and characterization of lithium-ion batteries.* (abstract)

Afternoon (16:00–20:10): Redox flow batteries, lithium and post-lithium batteries and components II.

Chair: Pablo A. García-Salaberri & Vanesa Muñoz-Perales

- 16:00–16:25. **Ertan Agar, University of Massachusetts Lowell, USA.** *Toward high-performance non-aqueous redox flow batteries with mushroom-inspired electrolytes.* (abstract)
- 16:25–16:50. **Jean-Yves Sánchez, University Carlos III of Madrid, Spain.** *From salts and ionic monomers to ionomers for Li and post-Li batteries.* (abstract)
- 16:50–17:15. **José Alberto Blázquez, Cidetec, Spain.** *Demonstrating the feasibility of magnesium secondary batteries at pouch cell level.* (abstract)
- 17:15–17:40. **Vito Di Noto, University of Padova, italy.** *Effects of high-valence transition metal doping on the performance of olivine cathodes for high voltage lithium batteries.*

- 17:40–18:05. **Rebeca Marcilla, IMDEA Energy Institute, Spain.** *Redox- active conjugated microporous polymer based on anthraquinone for high-performance lithium-ion batteries.* (abstract)
- 18:05–18:30. **Jeff T. Gostick, University of Waterloo, Canada.** *Incorporating structural heterogeneities of lithium ion battery cathodes using pore network modelling framework.* (abstract)
- 18:30–18:55. **Flaviano García-Alvarado, San Pablo CEU University, Spain.** *On the mechanism of lithium insertion in TiO2 nanorutile.* (abstract)
- 18:55–19:20. **Carmen de la Torre, University Carlos III of Madrid, Spain.** *High energy density lithium-ion battery using LTO and LFP electrodes of 500 μm thickness.* (abstract)
- 19:20–19:45. **Cynthia Martínez-Cisneros, University Carlos III of Madrid, Spain.** *Hybrid sodium electrolytes based on porous NASICON materials and ionic liquids for Na-batteries.* (abstract)
- 19:45–20:10. **Norbert Weber, Helmholtz-Zentrum Dresden-Rossendorf, Germany.** *Liquid metal batteries for cheap stationary electricity storage.* (abstract)

Closing ceremony (20:10–20:30): Summary of EChemCONSTORE I and presentation of EChemCONSTORE II.

Chairs: Pablo A. García-Salaberri & María Teresa Pérez-Prior

- 20:10–20:30. **María Teresa Pérez-Prior, University Carlos III of Madrid, Spain.** *EChemCONSTORE: Summary and next steps*

Observations:

- The program is indicated in CET (i.e., Madrid time zone).
- Talks are 20 min long, followed by 5 min for questions and debate.