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International symposium on enhanced electrochemical capacitors, ISEECap 2022 foreword

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International Symposium on Enhanced Electrochemical Capacitors, ISEECap 2022

Foreword

This special issue of *Electrochimica Acta* is a selection of papers presented at the International Symposium on Enhanced Electrochemical Capacitors - ISEECap 2022 that was held from July 11st to 15th, 2022, in Bologna, Italy

The series of ISEECap Meetings, since 2009, has a great tradition and unique style of blending fundamental research with practical applications in the field of electrochemical capacitors and related devices. This 7th Edition of ISEECap in 2022 was Chaired by Prof. Francesca Soavi in collaboration with the Local Organizing Committee that was composed by Prof. C. Arbizzani, Prof. B. Ballarin, Prof. M. Giorgetti, Prof. A. Morandi, Dr. F. Poli, and E. Petri and an outstanding International Advisory Board.

Committee <i>Conference Chair</i> Francesca Soavi (University of Bologna, Italy)	Daniel Bélanger (Université du Québec à Montréal, Canada) Sebastian Pohlmann (Skeleton Technologies, Estonia) Volker Presser (Saarland University, Germany) Scott Donne (Newcastle University, Australia)
Local Organizing Committee Catia Arbizzani (University of Bologna, Italy) Barbara Ballarin (University of Bologna, Italy) Marco Giorgetti (University of Bologna, Italy) Antonio Morandi (University of Bologna, Italy) Federico Poli (University of Bologna, Italy) Elisabetta Petri (University of Bologna, Italy)	Katsuhiko Naoi (University of Agriculture and Technology, Japan) Krzysztof Fic (Poznan University of Technology, Poland) Kwang Bum Kim (Yonsei University, Korea) Chi-Chang Hu (National Tsing Hua University, Taiwan) George Zheng Chen (University of Nottingham Ningbo, China) Masashi Ishikawa (Kansai University, Japan) Alessandro Lampasi (ENEA, Italy) Francesco Lufano (CNR, Italy)
International advisory board Andrea Balducci (Friedrich-Schiller-University Jena, Germany) Thierry Brousse (Université de Nantes, France) Elzbieta Frackowiak (Poznan University of Technology, Poland) Patrice Simon (Université Paul Sabatier, France) Jon Ajouria (Centre for Cooperative Research on Alternative Energies, Spain) John Miller (Case Western Reserve University, USA) Veronica Augustyn (University of California Los Angeles, USA) Wataru Sugimoto (Shinshu University, Japan) Yury Gogotsi (Drexel University, USA) Frédéric Favier (Institut Charles Gerhardt Montpellier, France)	Andrea Lamberti (Politecnico di Torino, Italy) Roberto Torresi (Universidade de São Paulo, Brazil) Ho Seok Park (Center for 2D Redox Energy Storage 2DRES, Korea)
	Assistant staff <i>University of Bologna:</i> Federico Poli, Elisabetta Petri, Alessandro Brilloni, Mariam Maisuradze, Min Li, Luca Bargnesi, Valentina di Matteo <i>Friedrich-Schiller-University Jena:</i> Lukas Köps, Annika Bothe, Timo Stettner
Organizing secretariat <i>Fondazione Alma Mater</i>	

Figure 1. ISEECAP 2022 Organizers

This ISEECap 2022 Meeting has followed the tradition to line up a strong assembly of plenary, keynote and invited speakers to present and discuss topics such as:

- Electrochemical Double Layer Capacitors, carbon electrodes and mechanisms
- Pseudocapacitive materials and related mechanisms
- Electrolytes and interfaces
- Characterization techniques, in-situ and operando methods
- Modelling of phenomena and systems
- New concepts, new devices and new fabrication processes in supercapacitors
- Microsupercapacitors and related components
- Fast charging battery electrodes for asymmetric and hybrid devices
- Devices and/or systems integration and applications
- Sustainable materials, production processes and devices.

A tutorial session, with the following four classes dedicated to young researchers, was also organized during the first day, sponsored by the IMMOCAP project (PI: Prof. K. Fic, Poznan University of Technology), which is funded by the European Research Council (ERC) under the European Union's Horizon 2020 research and innovation programme (grant agreement No 759603).

Tutorial session | Chair: M.Giorgetti, K Fic, C. Arbizzani

T1. John Miller (JME Inc., USA) "EC fabrication, measurement and testing"

T2. Masashi Ishikawa (Kansai University, Department of Chemistry and Materials Engineering, Faculty of Chemistry, Materials and Bioengineering, Suita, Japan) "Redox-based electrolytes, hybrid systems"

T3. Catia Arbizzani (University of Bologna, Italy) "Capacitive and redox-based metrics"

T4. Marco Giorgetti (University of Bologna, Italy) "Operando vs. ex situ techniques"


Figure 2. Tutorial Sessions at ISEECap 2022



The scientific program included one Opening lecture 4 Plenary lectures, 8 Keynote lectures, 15 Invited lectures, 22 Regular orals. To promote young researchers, the program featured 3 sessions dedicated to Young Scientists oral presentations (23 presentations) and a poster session with 50 posters that were displayed for the entire duration of the Conference. 145 world-class researchers, technologists, and industrial participants, representing the best laboratories in the field, attended ISEECap 2022 and communicated their latest advances and breakthroughs. Up to 127 presentations were delivered, the 57% from young researchers and 30 % from female scientists. Participants represented 23 Countries all around the world, including Italy, France, Germany, Poland, Spain, Portugal, Belgium, Switzerland, Bulgaria, Ukraine, United Kingdom, Ireland, Estonia, USA, Canada, Australia, Thailand, Tunisia, South Africa, Chile, Iran, Korea, Japan.


<p>Opening Lecture <i>Supercapacitors since the early nineties of the last century</i> Prof. Marina Mastragostino, Accademia delle Scienze dell'Istituto di Bologna, Italy</p> <p>Plenary Lectures Prof. Thierry Brousse, Université de Nantes, France Prof. Elzbieta Frackowiak, Poznan University of Technology, Poland Prof. Yury Gogotsi, Drexel University, USA Prof. Patrice Simon, Université Paul Sabatier, France</p> <p>Keynote Lectures Prof. Andrea Balducci, Friedrich-Schiller-University Jena, Germany Prof. Wataru Sugimoto, Shinshu University, Japan Prof. Valeria Nicolosi, Trinity College Dublin, Ireland Prof. Mathieu Salanne, Sorbonne Université, France Prof. Clara Santato, Polytechnique Montreal, Canada Prof. Katsuhiko Naoi, University of Agriculture & Technology, Japan Prof. Volker Presser, Saarland University and INM - Leibniz Institute for New Materials, Germany Dr. Sebastian Pohlmann, Skeleton Technologies, Estonia</p>	<p>Invited Lectures Prof. Krzysztof Fic, Poznan University of Technology, Poland Prof. John Miller, Case Western Reserve University, USA Prof. Jon Ajuria, Centre for Cooperative Research on Alternative Energies, Spain Prof. Andrea Lamberti, Politecnico di Torino, Italy Prof. Karl-Heinz Pettinger, University of Applied Sciences Landshut, Germany Prof. Celine Merlet, Université Paul Sabatier Toulouse, France Prof. Ncholu Manyala, University of Pretoria, South Africa Prof. Frédéric Favier, Institut Charles Gerhardt Montpellier, France Prof. Olivier Fontaine, Université de Montpellier, France Prof. George Zheng Chen, University of Nottingham Ningbo, China Prof. Francois Béguin, Poznan University of Technology, Poland Prof. Masashi Ishikawa, Kansai University, Japan Prof. Dominic Rochefort, Université de Montréal, Canada Prof. Volodymyr Khomenko, Kyiv National University of Technologies and Design, Kyiv Prof. Simon Fleischmann, Karlsruhe Institute of Technology (KIT)/ Helmholtz Institute, Ulm</p>
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Figure 3. Opening, Plenary, Keynote and Invited Lectures at ISEECap 2022



2 best Young Scientist Oral presentations and 4 best Poster Presentations, sponsored by **The International Society of Electrochemistry (ISE)** and the Italian Interuniversity Consortium for Materials Science and Technology (**Consorzio Interuniversitario Nazionale per la Scienza e Tecnologia dei Materiali - INSTM**) were awarded to the following recipients:

- **Best ISEECAP22 - Young Scientist Oral presentation – ISE Award** 

Maria Arnaiz (Centre for Cooperative Research on Alternative Energies CIC energiGUNE, Basque Research and Technology Alliance BRTA, Alava Technology Park, Vitoria-Gasteiz, Spain), Jon Ajuria “Pre-lithiated TiSb_2 alloy-based lithium-ion capacitor exceeding 20000 cycles and standing for more than 1000 hours of float time”
- **Best ISEECap22 - Young Scientist Oral presentation – INSTM - GISEL Award**  

Etienne Le Calvez (Nantes Université, CNRS, Institut des Matériaux de Nantes Jean Rouxel, IMN, Nantes, France; Réseau sur le Stockage Electrochimique de l’Energie (RS2E), CNRS, Amiens, France), Jeronimo Miranda, Yucheng Zhou, Eric Gautron, Nicolas Dupré, Laurent Pilon, Bruce Dunn, Olivier Crosnier, Thierry Brousse “Revisiting old structure for developing high-power battery: The case of KTiNbO_6 family.”
- **Best ISEECAP22 - Poster Presentations – ISE Awards** 

Sandesh Magar (Institute for Technical Chemistry and Environmental Chemistry and Center for Energy and Environmental Chemistry, Jena, Germany), Andrea Balducci, “Brewers’ Spent Grains derived activated carbons for high performance electrochemical capacitor”

Andrés Camilo Parejo Tovar (Institute of Chemistry and Technical Electrochemistry, Poznan, Poland), François Béguin, Paula Ratajczak, “Assessment of Electrodes Operation in Carbon-based Na-ion Capacitors by Potentiostatic Electrochemical Impedance Spectroscopy”
- **Best ISEECap22 - Poster Presentations- – INSTM – GISEL Awards**  

Alessandro Brilloni (Department of Chemistry “Giacomo Ciamician”, Alma Mater Studiorum – Università di Bologna, Via Selmi 2, 40126, Bologna, Italy), Elisabetta Petri, Federico Poli, Francesca Soavi, “Application of Water in Salt electrolytes for low environmental impact supercapacitors”

Luisa Baudino (DISAT Dipartimento di Scienza Applicata e Tecnologia, Politecnico di Torino, Italy), Pietro Zaccagnini, Nadia Garino, Mara Serrapede, Marco Laurenti, Alessandro Pedico, Andrea Lamberti, C. Fabrizio Pirri, “ TiO_2 nanotubes-based electrodes for hybrid lithium-ion capacitor and for desalination purposes”

Figure 4. ISEECap 2022 Awards

ISEECap2019 was supported by 10 industrial and academic sponsors, including the International Society of Electrochemistry, Consorzio Interuniversitario Nazionale per la Scienza e Tecnologia dei Materiali – INSTM (GISEL Reference Center), The Departments of

Chemistry „Giacomo Ciamician” and of Industrial Chemistry „Toso Montanari” of the University of Bologna, Skeleton, Mista, MARPOSS, CapTop and Integrated Graphene (more information about the ISEECap2022 is available on the website <https://eventi.unibo.it/iseecap-2022>)

On behalf of the organizers, we would like to thank all these institutions and companies for their great support to the conference. We also would like to express our sincere gratitude to the Local Organizing Committee and to the International Advisory Board. Sincere gratitude is addressed to everyone who has been involved in the ISEECap2022 organization.

The manuscripts included in this special issue are original research papers and were reviewed and edited according to the same procedures and required scientific standards as for regular *Electrochimica Acta* papers. The Guest Editors would like to thank all the authors who contributed to this special issue and especially Professor Sotiris Sotiropoulos, Special Issues Editor of *Electrochimica Acta*, for his editorial work.

A final thank to all the ISEECap2022 attendees who made this event such a success. We are looking forward to seeing you for the next ISEECap meeting, which will take place in 2024 in Vitoria-Gasteiz, Spain.



Figure 5. Group picture of the ISEECap 2022 participants

Francesca Soavi^{a,b,c*}, Catia Arbizzani^{a,c}, Barbara Ballarin^{c,d,e}, Marco Giorgetti^{c,d}

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