Rossella Petruzzelli

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Gender: Female **Date of birth:** 23/06/1992 **Nationality:** Italian

WORK EXPERIENCE

[01/11/2023 – Current] **Research fellow**

University of Bologna - Department of Chemistry "Giacomo Ciamician"

Project: BIONIC (BInders with high iONIc Conductivity for fully sustainable Li-ion cells)PRIN [2023-2025]

Activities: Selection of water-processable binders and characterization by conventional techniques: thermogravimetric analysis (TGA) to evaluate thermal stability, FourierTransformation Infrared Spectroscopy (FTIR) to evidence the possible interactions between the binder and the carboxylic acids functional groups. Electrodes with the best formulations for each binder (including graphite, carbonblack and binder selected) are prepared and the cells are tested by galvanostatic charge/discharge cycles to compare the specific capacity, the stability, the rate capability. Updating of the Project Web Page.

[01/09/2023 – 01/11/2023] **Research fellow**

University of Bologna - Department of Chemistry "Giacomo Ciamician"

CO2Carbon (project No. 21081) Sustainable carbons for green batteries- EIT Raw Materials – KAVA8

Activities: Application of carbon allotropes as active material and/or conductive additive in the preparation of electrodes tested as anode in lithium-ion batteries.

[01/09/2021 – 01/09/2023] **Research fellow**

University of Bologna - Department of Chemistry "Giacomo Ciamician"

CUBER (GA. 875605) - Copper-Based Flow Battery for Energy storage Renewables Integration H2020 - LC - BAT_2019 [2020-2024]

Activities: Electrochemical characterization and optimization of materials and components (electrodes, electrolytes and separators) tested in a redox flow cell. Electrodes were modified and characterized by electrochemical techniques (voltametric techniques, impedance spectroscopy, galvanostatic techniques). Electrolytes were evaluated by voltametric techniques, spectroelectrochemical measurements and test with the rotating disk electrode for the determination of diffusion coefficients and kinetic parameters. Membrane characterization consisted of permeability test and a new methodologies to study the permeability by Scanning ElectroChemical Microscopy. Additionally, the activities regarded the development of Near-infrared sensors for the determination of the state of charge in all-copper redox flow batteries. Report and Deliverable writing.

RESEARCH EXPERIENCE

BIONIC (BInders with high iONIc Conductivity for fully sustainable Li-ion cells) PRIN [2023-2025]

The project aims at the following main objectives: 1) computational study of different self-healing binders leading to an in-deep understanding of the structural

and chemical mechanisms involved in the self-healing process; 2) theoretical and experimental comparison of the relevant properties of different binders; 3) identification of binder modifications that could lead to a better performance; 4) Test and characterization of the resulting electrodes and cells; 5) test of the predictive capability of the simulations. The calculated properties (stability, adhesion to anode surfaces, ionic diffusion, rheological properties) will be compared to the experimental results of physicochemical analysis (adhesion and cohesion tests, rheological tests, scanning electron microscopy, different kind of spectroscopies, thermogravimetric and differential calorimetry analyses, etc.), and electrochemical characterization (cyclic voltammetry, galvanostatic charge/discharge cycles, impedance spectroscopy) of the binder and of the electrode.

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CO2Carbon (project No. 21081) Sustainable carbons for green batteries- EIT Raw Materials – KAVA8

CO2Carbon was a 2-year European project aimed to upscale the innovative technology that turns industrial exhaust CO2 into sustainable carbon nanomaterials and graphite for the electric vehicle batteries. The activities regarded the application of such carbon allotropes as active material and/or conductive additive in the preparation of electrodes tested as anode in lithium-ion batteries.

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CUBER (GA. 875605) - Copper-Based Flow Battery for Energy storage Renewables Integration H2020 - LC - BAT_2019 [2020-2024]

The CUBER project intends to optimize an all-copper redox flow battery (CuRFB), that highlights simplicity, modularity, environmental safety, and market appealing. Firstly, the study focuses on the electrochemical characterization and optimization of the materials and the compositions of the core components of the CuRFB system: the electrodes, the electrolytes, and the separators. Electrodes were modified and characterized by electrochemical techniques (voltametric techniques, impedance spectroscopy, galvanostatic techniques), by Raman spectroscopy and, by X-ray Photoelectron Spectroscopy (XPS). Electrolytes were evaluated by voltametric techniques as well as spectroelectrochemical measurements and test with the rotating disk electrode for the diffusion coefficient evaluation. Separator characterization consist of permeability test and a new design method with Scanning ElectroChemical Microscopy.

Collaboration with National Research Centre Inorganic Chemistry Department (Cairo, Egypt)

Nickel cobalt aluminum oxide (NCA) active materials has been studied with different metal substitution (Ag, Mo, W, V) as cathodic materials for lithium ion batteries. Electrodes were prepared and coin cells tested by cyclic voltammetry and galvanostatic charge/discharge cycles to compare the effect of the metal substitution on the specific capacity, the stability, the rate capability.

EDUCATION

[2021] **Chemistry (LM-54) 2nd level-cycle degree/Master of Science**

Department of Chemistry "G. Ciamician" - Alma Mater Studiorum - Università di Bologna.

Thesis topic: Tecniche di 'Green Chemistry' finalizzate a reazioni di accoppiamento peptidico ad elevata 'Atom economy'

Supervisor: Prof. Luca Gentilucci

Final mark: 106/110

Activity: Peptide bond formation reactions from N-carboxy anhydrides (NCAs) and amino partners by minimal liquid-assisted grinding (LAG) in amalgam with nanocrystalline hydroxyapatite (HAp) powder as a bio-compatible, reusable inorganic base. The experiments supported the combination of nanocrystalline hydroxyapatite (HAp) and the green solvent γ-valerolactone, and highlighted the importance of NCAs' purity and crystallinity, as studied by NMR, SEM, and XRD.

[2017] **Pharmacy (LM-13) single cycle degree/Combined Bachelor and Master**

Università degli studi di Bari 'Aldo Moro'

Teshis topic: Effetto del riscaldamento mediante microonde sulle proprietà nutraceutiche del pomodoro

Supervisor: Prof. Filomena Corbo

Final mark: 110/110

Activity: use of innovative technologies, such as microwave heating, for the pasteurization of tomato sauce and for the extraction of bioactive compounds such as polyphenols and lycopenes from food matrices; evaluation of the antioxidant capacities of bioactive compounds using the DPPH test and spectrophotometric reading.

[2011] **Scientific high school diploma**

Liceo Scientifico 'Pietro Sette', Santeramo in Colle

Final mark: 100/100

MENTORING ACTIVITIES

[2022] **Co-supervisor of an MSc student**

Co-supervisor of an MSc student (Cecilia Marchi) of Photochemistry and Molecular Materials courses during thesis traineeship: "Electrochemical Investigation of components for copper based Redox Flow Cells."

[2022] **Laborartory assistant**

Laborartory assistant for the course of "Electrochemical Systems for Energy Storage and Conversion", MSc Photochemistry and Molecular Materials, University of Bologna [cod. 91238] - [Modulo 2]. The activity consisted in carrying out the laboratory activities for one of the students'groups.

TRAINING

[29/11/2023 – 30/11/2023] **Workshop BatSynch - The Battery Challenge at Synchrotron, ICTP, Trieste, Italy**

AFFILIATION

[2024 – Current] **Member of the International Society of Electrochemistry (ISE)**

[2023 – Current] **Member of the Division of Electrochemistry of the Italian Chemical Society - SCI**

PUBLICATIONS

• **F. Santino, R. Petruzzelli, J. Zhao, E. Boanini, L. Gentilucci; Peptide bond formation using unprotected N-carboxyanhydrides under green chemistry conditions; Sustainable Chemistry and Pharmacy, 24, 2021, 100540.**

Papers in preparation

•D. Casey, R. Petruzzelli, G. Lacarbonara, C. Arbizzani, J. Rohan, "The use of bismuth additive to improve copper redox flow battery characteristics"

•R. Petruzzelli, C. Arbizzani, G. Lacarbonara, "Near-infrared State of Charge determination sensors for reliable all-copper Redox Flow Batteries"

•S. De Zio, G. Lacarbonara, W. D. Badenhorst, R. Petruzzelli, M. Malferrari, L. Murtomäki, C. Arbizzani, S. Rapino, "Scanning electrochemical Microscopy method for Cu^{2+} permeability investigation on membranes for Redox Flow Battery"

•R. Petruzzelli, G. Lacarbonara , C. Arbizzani, "Evaluation of kinetic parameters of redox flow battery reactions by rotating disk electrode as a function of the state of charge"

CONFERENCES AND PRESENTATIONS

Attended conferences and presentations

(The presenting Author is underlined)

•**R. Petruzzelli**, G. Lacarbonara, C. Arbizzani, "Evaluation of kinetic parameters of redox flow battery reactions by rotating disk electrode as a function of the state of charge", 37th Topical Meeting of the International Society of Electrochemistry (Stresa, Italy), 24/06/09-12 (oral presentation)

•**R. Petruzzelli**, G. Lacarbonara, D. P. Casey, S. Porcu, P. C. Ricci, J. Rohan, "Electrolyte tuning for an effective copper deposition-stripping in all copper redox flow batteries", Giornate dell'Elettrochimica Italiana GEI 2023 (Cefalù, ITALY), 23/09/17-21 (oral presentation)

•G. Lacarbonara, **R. Petruzzelli**, S. De Zio, W. D. Badenhorst, M. Malferrari, L. Murtomäki, C. Arbizzani, S. Rapino, "Scanning ElectroChemical Microscopy method for Cu^{2+} permeability investigation on membranes for Redox Flow Battery", Giornate dell'Elettrochimica Italiana GEI 2022 (Orvieto, ITALY), 22/09/11-15 (oral presentation)

•**R. Petruzzelli**, G. Lacarbonara, S. De Zio, W. D. Badenhorst, M. Malferrari, L. Murtomäki, C. Arbizzani, S. Rapino, "SECM analysis to evaluate the Cu^{2+} ion permeability of different membranes for all copper redox flow battery", SYNC (Roma, Italy), 22/06/21-23 (oral presentation)

Unattended conferences and presentations

•**R. Petruzzelli**, G. Lacarbonara, C. Arbizzani, "Near-infrared sensors for the determination of the state of charge in all-copper redox flow batteries", SCI 20204 XXVIII National Congress (Milano, Italy), 24/08/26-30 (accepted oral presentation)

•G. Lacarbonara, **R. Petruzzelli**, C. Arbizzani, "Comparative rotating disk electrode analysis of copper-based redox flow batteries: unraveling the role of supporting electrolytes on the electrochemical kinetics", 75th International Society of Electrochemistry annual meeting, (Montreal, Canada), 2024/08/18-23 (accepted oral presentation)

DISSEMINATION

[29/09/2023] **Selected participants at the European Reseacher's Night 2023, "Unity is strength… and energy" (Bologna, Italy)**

SKILLS

Job-related skills

•Electrochemistry (voltametric techniques, impedance spectroscopy, galvanostatic techniques, spectroelectrochemistry, rotating disk electrode)
•Scanning electrochemical microscopy (SECM)

•Spectroscopy: UV-vis-NIr spectroscopy, NMR spectroscopy (1H, 13C, 19F, COSY, HSQC, HMBC, NOESY), FTIR spectroscopy
•Porosimetry and Calorimetry: DSC, TGA

•HPLC-MS spectrometry

•Expertise in the use of the dry-box for handling moisture sensitive reactants like lithium metal

•Expertise in material selection for electrode formulation and in the preparation by slurry-coating of electrode materials for Li-ion batteries
•Practical experience in assembly Li-ion batteries

•Expertise in the assembly and operation of a redox flow cell

•Practical experience in optimizing a synthetic process

•Ability to use scientific literature and database research

•Ability to prepare different pharmaceutical forms (solid, semi-solid, liquid)

•Writing project deliverables

•Web site

Communication and interpersonal skills

Mother language: Italian

Other languages: English (B2)

French (scolastic)

Team spirit, excellent communication and problem solving skills gained during university, work, sports and association experiences.
Team building skills and high ability to adapt to different working contexts.

Software skills

Microsoft Office tools; ChemBioDraw; Origin; MestReNova (NMR data processing and analysis); EClab (electrochemistry)

Consapevole delle sanzioni penali, nel caso di dichiarazioni non veritiere, di formazione o uso di atti falsi, richiamate dall'art. 76 del DPR 445/2000, dichiaro che quanto sopra corrisponde a verità.
Autorizzo il trattamento dei miei dati personali ai sensi del Decreto Legislativo 30 giugno 2003, n. 196 "Codice in materia di protezione dei dati personali" e del GDPR- Regolamento UE 2016/679

Bologna, 13/06/24