

Shoayb Mojtahedi

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I'm an engineer/researcher specializing in advanced manufacturing processes for energy storage technologies, with hands-on experience in the COMAS R&D pilot line, focusing on dry coating of Li-ion battery electrodes. My work bridges the gap between laboratory innovation and industrial scalability, contributing to the next generation of sustainable, solvent-free electrode fabrication. Experienced in wet and dry electrode manufacturing for Li-ion and Na-ion batteries, with strong expertise in powder mixing, slurry preparation, and coating processes. Skilled in blending powders to form homogeneous, dough-like mixtures and in optimizing mixing and coating parameters to produce uniform, high-quality electrodes. I also have experience in materials science, particularly in the recovery of critical metals from spent batteries and in electrode material synthesis for supercapacitors. These capabilities are highly transferable to other advanced material processing and manufacturing fields that demand precision in formulation, mixing, and film formation or deposition.

EDUCATION/ RESEARCH

2022-2025: PhD student in Sustainable Materials, Processes and Systems for Energy Transition, Politecnico di Torino & University of Bologna.

Group of Prof. Francesca Soavi and COMAS company, Innovative processes for the production of electrochemical energy storage systems.

The research project aims at the definition of innovative industrial processes for the production of electrochemical energy storage systems, with a focus on electrodes manufacturing through a dry coating process for lithium-ion batteries.

July 2025-November 2025: Visiting researcher, Fraunhofer Institute for Solar Energy Systems (ISE).

Group of Prof. Lea Eisele and Prof Sonia Dsoke: Battery Cell Technology Group.

Experimental activities in the field of dry electrode manufacturing for Li-ion and Na-ion batteries.

2016-2021: Research assistant. Vali-e-Asr University of Rafsanjan, Iran. Physics, Solid State Physics.

Group of Prof. M. Karimipour, Solid state and Nanotechnology group.

Intense activity in the field of Electrochemical charge storage devices (battery and supercapacitor), Biosensors, Electrocatalyst, Solar cell and materials science.

October 2019-August 2020: Visiting researcher, Politecnico di Torino, Turin, Italy.

Group of Prof. F.C. Pirri, Politecnico di Torino, Turin, Italy.

Activity in the field of electrochemical capacitors energy storage applications and catalysis for CO₂ reduction.

2008-2011: M.Sc. Shahid Rajae Teacher Training University, Iran. Physics, Solid State Physics.

Group of M. Neekamal, Faculty of Basic Science, Department of Physics, Solid State

Group.

Final Grade: 17.50 / 20

Thesis Title: Langevin Equation for the study of diffusive motion in a periodic potential due to the surface of metals.

2005-2008: B.Sc. Hakim Sabzevari University, Iran. Physics.

Final Grade: 15.75 / 20

PROJECTS PARTICIPATION

ELECTRODE MANUFACTURING:

The collaboration between the COMAS company (<https://www.comasitaly.com>), Fraunhofer Institute for Solar Energy System (ISE), University of Bologna (UNIBO) and Politecnico di Torino for up-scaling the dry electrode manufacturing in the R&D pilot-line for energy storage devices in particular Li-ion and Na-ion batteries.

Patent: F. Soavi, S. Mojtahedi, E. Maruccia, M. Serafin. Method of manufacturing an electrode, electrode and energy storage device, May 2024, Submitted to Italian Patent and Trademark Office (PCT/EP2025/065647).

Mixing Skill:

- Skilled in operating and optimizing various mixers (planetary, high-shear, and double planetary types) for slurry preparation in wet and dry electrode manufacturing.
- Experienced in controlling mixing parameters (speed, sequence, time, and temperature) to achieve uniform dispersion of active materials, binders, and conductive additives.
- Knowledgeable in rheology adjustment and slurry viscosity control to ensure coating consistency and electrode quality.
- Capable of scaling laboratory formulations to pilot or production-level mixing processes.

Coating Skills

- Experienced in coating electrode slurries onto current collectors using different techniques such as slot-die, comma bar, and doctor blade coating.
- Skilled in optimizing coating parameters (gap, speed, and drying temperature) to achieve desired film thickness, adhesion, and surface uniformity.
- Proficient in both wet and dry coating processes for Li-ion and Na-ion battery electrode fabrication.
- Knowledgeable in troubleshooting coating defects and improving coating quality and process stability.

Battery Cell Assembly and Testing Skills

- Experienced in assembling coin cells, and other battery formats under controlled environments (e.g., glovebox conditions).
- Skilled in electrode cutting, stacking, electrolyte filling, sealing, and formation processes.

- Proficient in conducting electrochemical performance testing, including cyclic voltammetry (CV), electrochemical impedance spectroscopy (EIS), and galvanostatic charge–discharge (GCD) analysis.
- Capable of interpreting test data to evaluate cell performance, cycle stability, and degradation mechanisms.
- Knowledgeable in cell teardown and post-mortem analysis for material recovery and failure investigation.

Supervisors: Prof. Francesca Soavi (UNIBO), Dr. Fulvio Pastore (COMAS), Prof. Lea Eisele (ISE) and Prof. Sonia Dsoke (ISE)

RELY PROJECT:

RELY Project – Transformation of Recovered/Recycled Spent Lithium-ion Battery Cathodes into Porous Materials for High Power–Energy Storage

Supervisors: Prof. Francesca Soavi (University of Bologna) & Prof. Ncholu Manyala (University of Pretoria)

Institutions: University of Bologna (UNIBO) & University of Pretoria (UP)

Co-financing: National Research Foundation (NRF, South Africa) and Ministero degli Affari Esteri e della Cooperazione Internazionale (MAECI, Italy)

Project Overview:

RELY builds on the collaboration between the University of Bologna and the University of Pretoria, established through the ISARP2018 Project “Integration of High Power Energy Storage Systems for Sustainable Water and Renewable Sources Management.” The project aims to demonstrate the transformation of spent lithium-ion battery (LIB) cathodes into porous materials for high-power, high-energy hybrid supercapacitors. Its long-term goal is to develop sustainable technological solutions that reduce costs and environmental impact in LIB recycling, while valorizing critical raw materials (CRMs) within a circular economy framework.

Skills and Activities:

- Contributed to the recovery and transformation of spent Li-ion battery cathodes into porous materials for hybrid supercapacitor applications.
- Utilized deep eutectic solvents (DES) for the eco-friendly recovery of critical metal ions (Li, Ni, Co, Mn) from spent electrodes.
- Developed and optimized chemical and thermal processes for cathode regeneration and structural modification.
- Conducted materials characterization (XRD, SEM, BET, XPS) to evaluate porosity, crystallinity, and surface chemistry.
- Participated in electrode fabrication and electrochemical testing to assess the performance of recycled materials.
- Supported circular economy strategies for critical raw material valorization and sustainable energy storage system development.

BattValue – Spent Battery Management Training (Tutor Team)

Organizer: University of Bologna, with support from BattValue

Location: ENERCUBE Lab, Tecnopolo Ravenna, Marina di Ravenna, Italy.

About the Training:

The program focused on sustainable management of spent lithium-ion batteries (LIBs), including electrochemical evaluation, disassembly, and recovery of critical metals. The training combined theoretical instruction with practical demonstrations to strengthen participants' knowledge across the battery recycling value chain.

Key Activities and Skills:

- Served as part of the tutor team, supporting hands-on training sessions and guiding participants through laboratory and analysis procedures.
- Assisted in evaluating the State of Health (SOH) of aged LIB cells.
- Demonstrated and supervised safe disassembly of spent cells under controlled conditions.
- Supported materials analysis using XRD, FTIR, Raman, and SEM techniques.
- Contributed to demonstrations of metal recovery processes from LIB cathodes.
- Promoted sustainable practices in battery end-of-life management and circular economy approaches.

Purpose:

To provide professionals and trainees in the battery value chain with practical and theoretical knowledge for sustainable spent battery management and recovery.

Member of the Teaching and Examination Team

Institution: University of Bologna – Department of Industrial Chemistry "Toso Montanari"

Role: Tutor and Examination Committee Member

Served as a member of the teaching and examination team, contributing to student training, assessment, and evaluation in the following graduate-level courses:

1. Electrochemical Energy Storage and Conversion M

Campus: Bologna

Programs:

- Master's Degree in Electric Vehicle Engineering (Code 6713)
- Master's Degree in Greening Energy Market and Finance (Code 5885)
- Master's Degree in Electrical Energy Engineering (Code 9066)
- Master's Degree in Advanced Automotive Engineering (Code 9239)

2. Technologies for Energy Storage/Conversion: Chemistry, Electrochemistry and Processes

Campus: Bologna

Programs:

- Master's Degree in Greening Energy Market and Finance (Code 5885)
- Master's Degree in Electric Vehicle Engineering (Code 6713)
- Master's Degree in Electrical Energy Engineering (Code 9066)
- Master's Degree in Advanced Automotive Engineering (Code 9239)

ACHIEVEMENTS

Awarded a Research Grant – “Development of Systems for the Control and Integration of MEMS and NEMS, Sensors, Optical Sources, Devices for Diagnostics, and Industrial Applications” at Politecnico di Torino, Turin, Italy.

Awarded a Research Grant – “Novel Battery Electrolytes” at Alma Mater Studiorum – University of Bologna, Department of Chemistry “Giacomo Ciamician”.

PUBLICATIONS

- 1) N. Albanelli, A. Gregucci, **S. Mojtahedi**, A. Staffolani, S. Ratso, E. Karu, S. Pohlmann, C. Arbizzani, F. Soavi, “Exploiting CO₂-Derived Carbon in Lithium-Ion Batteries,” *Adv. Energy Sustain. Res.* (2025) 2400217.
- 2) **S. Mojtahedi**, M. Serrapede, A. Lamberti, C. F. Pirri, E. Heydari-Bafrooei, M. Molaei and M. Karimipour, “A facile, safe and controllable morphology synthesis of rGO_Cu₂O nanocomposite as a binder-free electrode for electrochemical capacitors,” *Electrochim. Acta.* 2021. 138856.
- 3) **S. Mojtahedi**, M. Karimipour, E. Heydari-Bafrooei, and M. Molaei, “Application of ascorbic acid in the synthesis of rGO/micro-octahedral Cu₂O nanocomposites and its effect on the wide linear response range of glucose detection,” *Microchem. J.*, vol. 159, no. July, p. 105405, 2020.

CONFERENCES/ POSTER PRESENTATION

- 1) **S. Mojtahedi**, A. Staffolani, E. Maruccia, M. Serafin, F. Pastore, and F. Soavi, “Eco-Friendly Manufacturing of Lithium-Ion Battery Electrode via a Semi-Dry Coating Process,” 76th Annual Meeting of the International Society of Electrochemistry (ISE), 7-12th September, 2025, Mainz, Germany.
- 2) **S. Mojtahedi**, F. Mascetti, S. Xierzati, A. Vitale, S. D’Agostino, C. Samorì, A. G. Rombolà, L. Sparascio, C. Zentile, D. Cespi, F. Passarini, E. Fallahtalouki, A. Staffolani, N. Manyala, F. Soavi, “Recycling Cobalt from Spent Lithium Cobalt Oxide Cathodes: An Environmentally Sustainable Approach for Metal Recovery Using Direct Recycling Techniques,” 76th Annual Meeting of the International Society of Electrochemistry (ISE), 7-12th September, 2025, Mainz, Germany.
- 3) **S. Mojtahedi**, A. Staffolani, E. Maruccia, M. Serafin, F. Pastore, and F. Soavi, “Sustainable Lithium-Ion Battery Anode Production Using a Semi-Solventless Coating Method,” 1st Joint Conference of “Gruppo Interdivisionale di Chimica per l’Accumulo e la Conversione Elettrochimica dell’Energia” – GISEL (ACee - GISEL), 21-23rd May, 2025, Padova, Italy.
- 4) M. Giovannucci, S. Mojtahedi, A. Gregucci, F. Mascetti, F. Capodarca, E. Petri, L. Yeasmin, S. Xierzati, P. Stragliotto, S. Marsico, A. Staffolani, A. Brilloni and F. Soavi, “Innovating Energy with Electrochemistry: From Recycled Materials to

Scalable Solutions,” European Researcher’s Night. 27th September, 2024, Bologna, Italy.

- 5) H. Bukovska, M. Giovannucci, **S. Mojtahedi**, F. Soavi, M. B. G. Mancebo, M. I. R. Sáez. Performance of thermally reduced holey graphene oxide binder. 14th edition of the largest European Conference & Exhibition in Graphene and 2D Materials, 25-28th June, 2024, Madrid, Spain.
- 6) E. Petri, M. Giovannucci, **S. Mojtahedi**, A. Gregucci, F. Mascetti, L. Yeasmin, F. Capodarca, A. Trebbi, A. Ashir, S. Xierzati, P. Stragliotto, A. Staffolani, F. Soavi. Development of new electrochemical systems for energy storage/conversion with high performance and low environmental and economic impact & knowledge transfer. Recruiting Day Navile District, 30th May, 2024, Bologna, Italy.
- 7) F. Soav, A. Staffolani, M. Giovannucci, E. Petri, F. Mascetti, F. Capodarca, **S. Mojtahedi**, S. Xierzati, A. Gregucci. LIB cathode production processes designed for direct recycling. NANOINNOVATION conference, 9-13th September, 2024, Rome, Italy.
- 8) **S. Mojtahedia**, A. Staffolani, E. Maruccia, M. Serafin, F. Pastore, and F. Soavi. Sustainable Approach for Lithium-Ion Battery Cathode Manufacturing: Alternative Binder Compositions and Semi-Solventless Coating Process. 37th Topical Meeting of the International Society of Electrochemistry, June 9-12, 2024, Stresa, Italy
- 9) N. Albanelli, **S. Mojtahedi**, A. Gregucci, F. Soavi, C. Arbizzani. Manufacturing of Lithium-ion battery electrodes by using carbon nanomaterials (CNM) as conductive additive produced via CO₂ reduction process. Giornate dell'Elettrochimica Italiana (GEI) 2023, the annual congress of the Division of Electrochemistry of the Italian Chemical Society, September 17-21, 2023, Cefalu, Italy.
- 10) S. Khazraee, M. Karimipour, M. Molaei, **S. Mojtahedi**, 2017. Synthesis of MoS₂ nanoplates for application in solar cells based on quantum dots. 7TH Conference On Nanostructured Solar Cells (NSSC96), December 21, 2017, Sharif University of Technology, Iran.
- 11) A. Armand, J. Zamiranvari, and **S. Mojtahedi**. 2016. The presentation of Looking Glass software in mirrors and lenses optics education. The 8TH National Conference On Education, May 25-26, 2016, Shahid Rajaei Teacher Training University, Iran.
- 12) **S. Mojtahedi**, B. Askari, A. Armand. 2014. Understanding and Applying Simulation Techniques in High School Physics for Solving Object Motion Equations Based on Newton's Second Law. 15TH Physics Training Conference, August 29-31, 2014, Farhangian University of Sanandaj, Iran.
- 13) **S. Mojtahedi**, M. Neekamal. 2011. Langevin equation for diffusive motion in a periodic potential. 12TH Physics Training Conference, September 7-9, 2011, Amirkabir University of Technology, Iran.

- 14) **S. Mojtahedi**, M. Neekamal. 2011. Langevin equation to investigate the diffusive motion in a periodic potential arising from the metal surface. 5TH National Conference On Physics, October 18-20, 2011, Payam Noor University of Tabriz, Iran.

COMPUTER SKILLS

- Hardware: able to install, change and configure peripherals and instrumentation connected to a computer.
- Software: knowledge of the operating system Microsoft Windows, competent with most Microsoft Office programs (Word, Excel, Power Point), good command of Origin, Xpert, Tecplot and K3 analyst (A software related to spectrophotometer device) for the data analyzing, Computer programming skills: Fortran / Matlab/ Mathematica/ C++, Fullprof software for XRD analysis, advance knowledge in electrochemical software such as EC-LAB and NOVA and good knowledge in Fullprof software for XRD data analysis.

LANGUAGE

Language	Understanding	Speaking	Writing
Persian	C2	C2	C2
English	C1	C1	C1
Italian	A2	A2	A2

REFERENCES

Prof. Francesca Soavi

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