



FRANCESCO CAPODARCA

CURRICULUM VITAE

MALE

Date of birth:
11/01/95

Italian

Via XXIV Montalto delle marche (AP)

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Career goal

Develop strategic skills in the electrochemical and chemical fields to contribute to the development of new generation batteries and their components, enhancing the skills obtained up to now through a master's degree in chemistry and participation and collaboration with electrochemical research groups on accumulation and conversion systems of energy.

Professional experience

Graduate research Master's degree

CHEMICAL DEPARTMENT
'G. CIAMICIAN' -
LABORATORY
OF ELECTROCHEMISTRY
OF MATERIALS
FOR ENERGETICS (LEME)

Chemistry
BOLOGNA (BO)
07/2022 - 02/2023

Hours: 660

Thesis:

"New polyacrylonitrile/poly(1,3-dioxolane) based electrolytes for solid-state batteries"

Supervisor:

Prof. Arbizzani Catia

Main activities and responsibilities:

During the internship I have generated new composite electrolytes by combining polyacrylonitrile (PAN) prepared by both phase inversion synthesis and electrospinning technique, with poly(1,3-dioxolane)-lithium bis(trifluoromethanesulfonyl)imide (PDOL-LiTFSi). The latter was obtained by adding a liquid solution of DOL-LiTFSI to PAN and performing an in situ electrochemical polymerization using different techniques such as chronopotentiometry, chronoamperometry and cyclic voltammetry. The study aimed to create a homogeneous and stable polymer electrolyte capable of providing good conductivity for lithium ions in lithium metal batteries.

Acquired skills:

- Correct use of the Argon filled **glove box**.
- Ability in **cell assembly** with various designs, symmetrical and asymmetrical. (SS//SS) (Li//SS) (Li//LNMO), with 2 or 3 electrodes (reference)
- Skill in using **VSP** (Princeton Applied Research) **galvanostat/potentiostat** with dedicated **software (EClab)**, used for electrochemical protocol management and data analysis.
- Skill in performing **electrochemical techniques** such as Cyclic Voltammetry (**CV**) Chronopotentiometry (**CP**), Chronoamperometry (**CA**), galvanostatic charge and discharge (**GCD**).
- Use of **electrochemical impedance spectroscopy (EIS)**, employed to follow the evolution of the material during the polymerization and evaluate the conductivity of the solid electrolyte as a function of the temperature.
- **Phase inversion** and **electrospinning** preparation of polyacrylonitrile (PAN)
- Use of scanning electron microscope (**SEM**).
- Use of attenuated total reflection infrared spectroscopy (**ATR-FTIR**).

**Undergraduate Internship
Bachelor's degree**

**CHEMICAL DEPARTMENT
UNIVERSITY OF
CAMERINO -
LABORATORY CHIM06
ORGANIC AND MATERIAL
CHEMISTRY -
POLYURETECH S.R.L**

Chemistry
CAMERINO (MC)
10/2019 - 01/2020

Objectives achieved:

The synthesis of the new composite polymer electrolytes was successfully completed following a screening of possible pathways for electrochemical polymerization. The specifics of the material in terms of ionic conductivity are surprising for a polymeric material, prepared for the first time and not optimized. **The study on this new composite material will be continued in a PNRR program.**

Professional goals:

In addition to the scientific objectives achieved and the specific skills obtained, I have critically analyzed the benefits deriving from the combination of the electrolyte components and organized the research work.

Thesis:

“Evaluation of the migration of chemical substances in polyurethane matrix materials, intended for food contact”.

Supervisor:

Prof. Marcantoni Enrico

Company Tutor:

Mr. Sacripanti Nereo

Main activities and responsibilities:

Study of methods and application of them for the evaluation about the presence of noxious substances in polyurethane (PU) matrix, intended for food contact, by analysis and chemical processes. Study of methods and application of them for evaluation about the presence of specific catalysts in polyurethane matrix intended for contact with the polyvinyl chloride (PVC), to prevent the possible induced degradation.

Acquired skills:

During my internship experience I was able to acquire the ability to study chemical scientific articles in English, to build a work plan that led me to useful results for the company. The work plan included the use of analysis machinery:

- **FIT-IR** analysis.
- **TGA** analysis.
- **(HSPME / GC / MS)** analysis.

I was able to acquire familiarity and ability to interpret data, graphs and I have learned to use programs interfaced with the machines.

Laboratory Assistant

CHEMICAL DEPARTMENT
UNIVERSITY OF
CAMERINO -
LABORATORY CHIM06
ORGANIC AND MATERIAL
CHEMISTRY

Chemistry
CAMERINO (MC)
10/2019 - 01/2020

Objectives achieved:

My work demonstrated the presence of some volatile and semi-volatile compounds inside the polyurethane matrix that could migrate in case of food or other polymeric matrix contact. That useful information is used by the company to evaluate the safety of the material matrix under study.

Professional Goals:

In addition to the scientific objectives achieved and the specific skills obtained, through the articles study and the work I was also able to deepen the topic concerning materials, additive components, catalysts and possible degradations that can involve different matrices studied including polyurethane and PVC.

Supervisor:

Prof. Marcantoni Enrico

Main activities and responsibilities:

During the period of undergraduate internship of the bachelor's degree in the chemical department of the University of Camerino – Laboratory CHIM06 Organic and Material Chemistry, I assisted the doctor Gentili Dario in his PhD work about synthesis and functionalization of organic compounds.

Acquired skills:

The work of assistant laboratory for organic synthesis has allowed me to learn the use of implants, instrumentation and methodologies useful for the synthesis (including the control of reaction environment) purification and extraction of various organic and metalorganic compounds:

- Ability to carry out **organic synthesis** and **functionalization** experiments.
- Schlenk line and **inert atmosphere** for oxygen sensible reactions.
- **Purification** methodologies as **crystallization**, **solvent extraction**, **purification column**.
- Use of **rotary evaporator**.
- Drying from water THF solvent by metallic sodium.
- **(HPLC / MS)** analysis.

Professional Goals:

After this work, I improved my ability to work in a laboratory obtaining also better knowledge about organic chemistry with application of useful methodologies employed in different research laboratories.

Education

MASTER'S DEGREE

September/2020 -
March/2023
(Within degree period)



MSc in Photochemistry and molecular materials (LM-54, second level degree in Chemistry)

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

Final mark: 110 / 110 cum Laude

Thesis: "New polyacrylonitrile/poly(1,3-dioxolane) based electrolytes for solid-state batteries".

Thesis subject: Electrochemical energy storage devices.

Supervisor: Prof. Arbizzani Catia

Co-supervisor: Doc. Albanelli Nicolò

Future of the thesis work: The thesis results will be used as **preliminary study for a PNRR program**.

Relevant attended courses:

I obtained the following marks in the electrochemical field at the University of Bologna.

- **Electrochemical systems for energy storage and conversion:** 30 cum Laude. (Professor: Arbizzani Catia). Oral examination.
- **Molecular electrochemistry:** 30 cum Laude (Professor: Paolucci Francesco). Oral examination.

BACHELOR'S DEGREE

2015 - 2020



BSc in chemical science and technology (L-27, first level degree in Chemistry)

Università degli studi di Camerino
Dipartimento di Chimica

Final mark: 104 / 110

Thesis: "Evaluation of the migration of chemical substances in polyurethane matrix materials, intended for food contact".

Thesis subject: Polymer science.

Supervisor: Marcantoni Enrico

Company tutor: Mr. Sacripanti Nereo

SCIENTIFIC CERTIFICATE

RIPATRANSONE (AP)

September 2009 – July 2015



Scientific High School Diploma, Applied Sciences

Istituto d'istruzione superiore "Fazzini-Mercantini"
Ripatransone (AP)

Final mark: 73/100

Participation to research groups

CHEMICAL DEPARTMENT 'G. CIAMICIAN' - LABORATORY OF ELECTROCHEMISTRY OF MATERIALS FOR ENERGETICS (LEME)

Chemistry
BOLOGNA (BO)
07/2022 - 02/2023

Supervisor: Prof. Arbizzani Catia

Hours: 660

During the master's degree internship in the University of Bologna, I joined the Laboratory of Electrochemistry of Materials for Energetics, with Prof. Arbizzani Catia and her collaborators for my MSc thesis project and I participated in active way to solve issues linked to other research works. I have also attended to different laboratory meetings with the purpose of being updated on new progresses concerning the research on electrochemical energy storage devices and their components. In those group meetings I have also presented the results about my thesis work and made critical discussion with the other scientists.

CHEMICAL DEPARTMENT UNIVERSITY OF CAMERINO - LABORATORY CHIM06 ORGANIC AND MATERIAL CHEMISTRY

Chemistry
CAMERINO (MC)
10/2019 - 01/2020

Supervisor: Marcantoni Enrico

Hours: 250

During the bachelor's degree internship in the University of Camerino, I joined the Laboratory CHIM06 Organic and Material Chemistry with Prof. Marcantoni Enrico and his collaborators for my BSc thesis project and to assist the work of Doctor Gentili Dario concerning the synthesis and the functionalization of organic compounds.

Conferences, seminars and courses.

Conferences

Chemical department
"Giacomo Ciamician"

07/2022 - 02/2023

Hours: 6

Lab meetings - Laboratory of Electrochemistry of Materials for Energetics - LEME

Active participation to periodic Lab Meetings on electrochemical energy storage devices and their components by presenting my thesis work progresses and attending to other scientists results like:

- Nano porous formation via phase inversion of bio-based separators.
- Copper redox flow battery system.
- Effect on cycling performance after pressure application on LFP cathode material.
- Passivating additives on lithium metal surfaces, investigation on mechanism via SEM.
- Test results discussion on carbon based conductive additives, obtained from CO₂ in LFP cathode material.

Besides the lab meetings, our collaborations and critical discussions continued also in laboratory and during the research work.

Seminar

29/11/2022

ONLINE

Hours: 7

EMIRI TechTalk: Advanced Materials for Solid-state Batteries

Participation to seminar focused on advanced materials for solid state batteries.

Seminar

WEBINAR SERIES

06/21/2021
06/22/2021
06/23/2021

ONLINE
(Registered)

Hours: 7

ARTISTIC Project Webinar Series 2021 - 2nd International Battery Manufacturing Days

Participation to the seminar consisting in a discussion about the links between battery manufacturing process and electrode properties, encompassing both (physical and machine learning) modelling and experimental approaches.

Seminar

Chemical department
"Giacomo Ciamician"

16/09/2022
Hours: 8

Ritorno al Futuro Sostenibile: 100 Anni dopo Ciamician

Participation to a dedicated event on new technologies for sustainable energy development.

Course

University of
Camerino

CAMERINO (MC)

16/05/2019

Hours: 120

Participation to “Percorso formativo 24 CFU” with certification release.

The course and the exam purpose is to give useful knowledge in the fields of anthro-psycho-pedagogical and in teaching methodologies/technologies and to certify requirements to teach in a school.

Outcome: passed

Certification Link:

<https://drive.google.com/file/d/1rqvhlGQSWfTq0JoHeQNNLUyFYRD9ukA/view?usp=sharing>

Personal skills

Professional skills

- Use of the Argon filled **glove box**.
- Ability in **cell assembly** with various designs, **symmetrical** and **asymmetrical** with **2 or 3 electrodes** (reference)
- Skill in using **VSP** (Princeton Applied Research) **galvanostat/potentiostat** with dedicated **software (EClab)**, used for electrochemical protocol management and data analysis.
- Skill in performing **electrochemical techniques** such as Cyclic Voltammetry (**CV**) Chronopotentiometry (**CP**), Chronoamperometry (**CA**), galvanostatic charge and discharge (**GCD**).
- Experience about **electrochemical polymerization**.
- Use of **electrochemical impedance spectroscopy (EIS)**.
- **Phase inversion** and **electrospinning** preparation of polyacrylonitrile (PAN)
- Use of attenuated total reflection infrared spectroscopy (**ATR-FTIR**).
- Thermo-Gravimetric analysis (**TGA**).
- Ability to read and interpret Differential Scanning Calorimetry (**DSC**) results.
- Scanning electron microscopy (**SEM**, basic)
- (**HSPME / GC / MS**) analysis.
- Skills in using **spectrophotometer, spectrofluorometer, Time Correlated single photon counting** (basic).
- Ability to carry out **organic synthesis** and **functionalization** experiments.
- Schlenk line and **inert atmosphere** for oxygen sensible reactions.
- **Purification** methodologies as **crystallization, solvent extraction, purification column**.
- Use of **rotary evaporator**.
- Application of **analysis procedures, experimental protocols** and adaptation to the desired function, **processing of scientific data** collected with specific programs.
- **Research of scientific literature** used to produce **reports and elaborated** and to take **inspiration for my work**.

Besides the professional skills acquired during the professional experiences, the “Photochemistry and Molecular Materials” course allowed me to access knowledge inherent to chemical fields as:

- Electrochemistry, especially in the energetic field.
- Photochemistry, related to technology and analysis.

- Material chemistry, in particular polymers.
- Organic chemistry, aimed at the synthesis and functionalization of materials for technological application.
- Nanotechnology, applied in different research fields.
- Conducting materials (ions or electrons) for technological application.
- Crystal engineering.
- Computational chemistry

Language skills

Mother tongue: Italian

Other Languages: English

- The entire course of Photochemistry and Molecular was held in English Language, the requirement was B1 level. I passed the oral test to be included in the program and I successfully completed the study course.
- In my work experiences I have also worked as barman and waiter in the restaurant “Osteria Castello De Marte” for five months when I spoke to several costumers in English language without any problems since I was 19 years old.

Software skills

- Microsoft office tools.
- ChemDraw.
- Origin.
- EClab software.
- Boukamp EIS fitting program.
- TA universal analysis.
- PERKIN ELMER UV-VIS (basic)
- Operating systems (advanced, Microsoft Windows)
- Gaussian (basic)
- MATHLAB (basic)
- Avogadro (basic)

Communication and organization skills

I possess an opened mind and a friendly personality that allow me to establish **solid relations** with collaborators and people in general, inside and outside the laboratory. Those traits make me suitable for the **Teamwork** and allow me to be always updated on ideas and research results of my colleagues, taking **inspiration for my work** and **giving my contribution** to other researchers work. I like very much to try to **solve issues** concerning **mine or others work**, **considering the solution as a personal goal to reach**, even if it doesn't concern me directly.

I am really suitable to **talk in public**, activity that makes me feel appreciated and pushes me to do the best **in work and ideas presentations**, with attention to details in content and design of presentation materials and with **engaging enthusiasm** during the explanation. I was elected as “Representative Student” in the last year of high school, period where **I have organized** and

presented different **activities and laboratories** for the students together **with conferences** with hosts from different work fields.

I have **conceived, organized** and **carried out** my master's degree **thesis work** with the shared ideas and knowledge of my colleagues but working in **autonomy** after understood the basis of cell assembly and electrochemical protocols.

Other work experiences

Barman and waiter

OSTERIA CASTELLO DE MARTE

Cossignano (AP)
03/2015 - 08/2015

Main activities and responsibilities:

My work was focused on bar service and table service as waiter (since the bar was also a restaurant) and accounting register management.

Acquired skills:

I have learned about speaking without any problem with the costumers in English. I was able to respect working hours that the job required and I have acquired dexterity with precision practices and familiarity with the relation with the costumers.

Traffic management

PODERI DEI COLLI

San Benedetto del Tronto (AP)
06/2018 - 08/2018

Main activities and responsibilities:

My job was to direct traffic while public works and road maintenance were done.

Acquired skills:

I was able to stay focused on work even in prohibitive weather conditions and respect the working hours.

Driving licence certificate (B)

https://drive.google.com/file/d/10b_gV0v4autikmbMMPu1we2MfaSY32Vc/view?usp=sharing

Letter of recommendation from Professor Arbizzani Catia



DIPARTIMENTO DI CHIMICA "GIACOMO CIAMICIAN"

TO WHOM IT CONCERNS

Francesco Capodarca was a proficient student of the course of Photochemistry and Molecular Materials at the Dept. of Chemistry "Giacomo Ciamician", Alma Mater Studiorum –University of Bologna. He attended my class "Electrochemical Systems for Energy Storage and Conversion" and got in the exam the maximum mark (30/30 cum laude). He got the Master degree (110/110 cum laude) on March 2023 with the thesis "New polyacrylonitrile/poly(1,3-dioxolane) based electrolytes for solid-state batteries" under my supervision in the Laboratory of Electrochemistry of Materials for Energetics, Dept. of Chemistry "Giacomo Ciamician", Alma Mater Studiorum – University of Bologna.

During the thesis period, he acquired very good skills in polymer preparation and physico-chemical and electrochemical characterization, in cell assembly and in the critical analysis of the results. He learned new techniques, such as impedance spectroscopy, and new synthesis procedures in electrolyte preparation, carrying out his duties in autonomy, working hard and with enthusiasm on his thesis program.

What I appreciate of Francesco is his experimental attitude and his enthusiasm in facing research problems and challenges. He demonstrates excellent autonomy, and he was able to work in group and to interact with others researchers in a very respectful way. Francesco has a very friendly personality and has established excellent collaborative relationships in the research group.

I am happy to give more details if you would like additional information.

Bologna, 29th March 2023

Prof. Catia Arbizzani

Bologna, 28/03/2023

Signature

Francesca Codacci
