LUCA MAGAGNIN
Professional and Scientific Curriculum Vitae (July 2020)

PERSONAL INFORMATION

First name/Surname	**Luca MAGAGNIN**
Office address	Via Mancinelli, 7 20131 Milano, Italy
Phone	+39-02 23993124
e-mail	luca.magagnin@polimi.it
Nationality	Italian

EDUCATION AND TRAINING

July 6th 2020	**Full Professor** in Applied Physical Chemistry (ING-IND/23), Politecnico di Milano, Milan (Italy). Department of Chemistry, Materials and Chemical Engineering Giulio Natta
May 13th 2015	**Associate Professor** in Applied Physical Chemistry (ING-IND/23), Politecnico di Milano, Milan (Italy). Department of Chemistry, Materials and Chemical Engineering Giulio Natta
May 1st 2008	**Assistant Professor** in Metallurgy (ING-IND/21), Politecnico di Milano, Milan (Italy). Department of Chemistry, Materials and Chemical Engineering Giulio Natta
2001-2007	**Post doc** in Metallurgy (ING-IND/21). Politecnico di Milano, Milan (Italy), Department of Chemistry, Materials and Chemical Engineering Giulio Natta.
Feb 12th 2001	**PhD degree in Electrochemical Engineering**. Politecnico di Milano, Milan (Italy), Department of Applied Physical Chemistry. Dissertation: Surface processes for microelectronics and MEMS. Tutor: Prof. G. Serravalle, Advisor: Prof. P.L. Cavallotti, XIII Ciclo (1997-2000) Politecnico di Milano.
1999 - 2000	**Visiting PhD Student**. University of California at Berkeley: Prof. Roya Maboudian, College of Chemistry, Chemical Engineering Dept.
June 16th 1997	**Master Degree (Laurea quinquennale) in Nuclear Engineering** (Materials oriented), Politecnico di Milano, Milan (Italy). Department Applied Physical Chemistry. Thesis: *Pretrattamenti ed interazione rame-zinco-stagno negli strati di saldobrasatura su PCB*. Tutor: Prof. P.L. Cavallotti.
Jul 1989	**Diploma** (High School Diploma). Liceo Scientifico "Collegio San Carlo", Milano (Italy).

WORK EXPERIENCE

2015 - 2020	**Associate Professor** in Applied Physical Chemistry (ING-IND/23). Politecnico di Milano, Milan (Italy). Department of Chemistry, Materials and Chemical Engineering G. Natta.

Nov-Dec 2016 **Visiting Associate Professor** at Keio University, Applied Chemistry Dept., Tokyo (Japan).

Aug-Sept 2015 **Visiting Associate Professor** at Keio University, Chemistry Dept., Tokyo (Japan).

2008 - 2015 **Assistant Professor** in Metallurgy (ING-IND/21). Politecnico di Milano, Milan (Italy). Department of Chemistry, Materials, and Chemical Engineering G. Natta.

May 2001 **Visiting Scientist**. University of California at Berkeley: Prof. Roya Maboudian, College of Chemistry, Chemical Engineering Dept.

1998 - 2008 **Post doc** in Materials Science and Technology (ING-IND/23). Assegno di ricerca Politecnico di Milano, Milan (Italy). Department of Chemistry, Materials, and Chemical Engineering G. Natta.

1998 - today **Technical Consultant for Litigation** (CTU) and Technical Consultant for plating companies.

TECHNOLOGY TRANSFER

2016 **Co-founder and Board Member** of **Captive Systems srl** (www.captivesystems.it): startup and official spinoff of Politecnico di Milano created for the production, commercialization and exploitation of the magnetic sponges technology for the purification of natural and waste waters, recovery of metals and oils, and CO2 capture. Captive Systems has been awarded with the EIT Raw Materials Boost instrument (2018), UniCredit Start Lab (2019) and Seal of Excellence (2019) for SME Instrument phase 2.

AWARDS AND FELLOWSHIPS

2018 **International Award** from SEA Surface and Engineering Association UK and British Jewellery and Giftware for the International contribution to the plating field.

2013 **Johnson Matthey Silver Medal** 2013 from The Institute of Materials Finishing

2003 **Hans-Jürgen Engell Prize** (International Society of Electrochemistry) to younger electrochemists on the basis of published work in the field of corrosion, electrodeposition or surface treatment.

2003 **NACE 2003 A.B. Campbell Award** for the most outstanding manuscript published in Corrosion or MP in the previous year by young authors.

2001 **Fellowship (1 year): Accademia Nazionale dei Lincei**, Fondazione Donegani, Roma, Italy (2001).

1998 **Travel grant of The Electrochemical Society**, Electrodeposition Division, for the 194th ECS Meeting in Boston, MA, USA, November (1998).

ADDITIONAL ACTIVITY

Editorial Board

2018 – today **Editor in Chief**. Galvanotecnica e Nuove Finiture (Official Journal of the Italian Association of Metal Finishing)

2000 – today **Member** of the **International Advisory and Editorial Boards:** Coatings; Galvanotecnica e Nuove Finiture; American Journal of Materials Science; ISRN Materials Science; Research and Reviews in Electrochemistry; Innovations in Corrosion and Materials Science; Journal of Electrochemistry and Plating Technology.

Referee for International Journals

2000 - today Reviewer for several international journals in the field of Materials Science and Engineering, Electrochemistry and Microelectronics *(ACS Applied Materials & Interfaces, Electrochimica Acta, Applied Surface Science, Journal of Alloys and Compounds, Applied Physics Letters, Surface and Coatings Technology, Journal of Electroanalytical Chemistry, Journal of Materials Science, Journal of The Electrochemical Society*)

Duties in Scientific Societies

2012 - today **President** of **AIFM** (Italian Association of Metal Finishing)

2015 - today **Officer** of the **Electrodeposition Division of The Electrochemical Society** (Division Secretary 2020-2021)

2015 - today **Board Member** of **EAST** European Academy for Surface Treatments

2015-2018 **General Secretary** of **IUSF** International Union of Surface Finishing

2010-2014 **Vicepresident** of **IUSF** International Union of Surface Finishing

2008-2012 **Vicepresident** of **AIFM** (Italian Association of Metal Finishing)

2010 – today ***Electrochemical Society ECS Symposium organizer:***

- Main organizer Symposium E04—Applied Electrodeposition: From Electrowinning to Electroforming – it – ***L. Magagnin***, A. Bund, A. Ispas, M. Innocenti, T. Homma (238th ECS Meeting Honolulu): 2020
- E03—Electrochemical and Electroless Deposition of Thin-films and Nanostructures - Theory, Numerical Simulations, and Applications – N. Vasiljevic, ***L. Magagnin*** et al. (238th ECS Meeting Honolulu): 2020
- E01 — Electroless Plating: Principles and Applications 4: in honor of Milan Paunovic and Mordechay Schlesinger — S. Djokic, ***L. Magagnin***, T. Homma, S. Yoshihara (230th ECS Meeting Orlando): 2016
- Main organizer Symposium E01 — Metallization of Flexible Electronics — ***L. Magagnin***, Yosi Shacham-Diamand, Takayuki Homma, Andrew Hoff, Paula Cojocaru, Vincenzo Arcella, Giovanni Zangari (227th ECS Meeting Chicago): 2015
- D1 — Electrodeposition for Energy Applications 3 – S. Brankovic, L. Deligianni, N. Dimitrov, ***L. Magagnin***, S. Calabrese Barton, M. Shao, M. Innocenti, A. Lavacchi (226th ECS Meeting Cancun): 2014
- D4 Surface — Treatments for Biomedical Applications 4S — Djokic, D. C. Hansen, S. Virtanen, E. J. Taylor, ***L. Magagnin*** (226th ECS Meeting Cancun): 2014
- D2 — Electroless Plating: Principles and Applications 3 — S. Djokic, N. Dimitrov, J. Stickney, ***L. Magagnin*** (225th ECS Meeting Orlando): 2014
- F2 — Novel Design and Electrodeposition Modalities — E. Podlaha, S. Djokic, ***L. Magagnin*** (223rd ECS Meeting Toronto): 2013
- F3 — Electroless Deposition: Principles, Activation and Applications 2 — S. Djokic, W. Cai, T. Homma, ***L. Magagnin***, M. Ryan, L. Stickney, G. Zangari (222nd ECS Meeting Honolulu): 2012
- F2 — Surface Treatments for Biomedical Applications 3 — S. Djokic, D. C. Hansen, ***L. Magagnin***, L. A. Nagahara, Y. Yoon (221st ECS Meeting Seattle): 2012
- F1 — Electroless Deposition Principles, Activation, and Applications — S. Djokic, ***L. Magagnin***, M. Ryan, J. Stickney, and G. Zangari (218th ECS Meeting Las Vegas): 2010

Other Scientific roles

- 2018 – today: **Member** of UNI/CT 026/SC 12/GL 03 "Trattamenti superficiali e corrosione" committee
- 2015 – today: **Member** of Sub-committee SC12 – UNIMET "Light metals and alloys"
- 2015 – 2019: **STSM Short Term Scientific Missions Coordinator** in MP-1407 COST Action e-MINDS - Electrochemical processing methodologies and corrosion protection for device and systems miniaturization
- **Chair** of the 12th International Symposium EMNT - ELECTROCHEMICAL MICRO & NANO SYSTEM TECHNOLOGIES (Milan, Italy - August 28-31 /September 11, 2018).
- **Co-Chair** of Nano & Dispersion Coatings International Meeting 2015 (Milan, 26-27 February 2015).
- **Co-Chair** of Nanocoatings International Meeting 2013 (Milan, 8-9 July 2013).
- **Co-Chair** of Interfinish International Meeting 2012 (Milan, 14-16 November 2012).
- **Chair** of EDNANO-8 International Meeting (Milan, 17-19 March 2011)

Academic Commitments

2020 - 2022	**President** of the Scientific Committee of the Department of Chemistry, Materials and Chemical Engineering Giulio Natta, Politecnico di Milano, Milano (Italy)
2020 - 2022	**Member** of the Executive Body (Giunta) of the Department of Chemistry, Materials and Chemical Engineering Giulio Natta, Politecnico di Milano, Milano (Italy)
2019 - 2021	**Member** of the Scientific Committee of Polifab, Silicon Microfab at Politecnico di Milano, Milano (Italy)
2013 - today	**Member** of the PhD program Committee in Materials Engineering, PhD School, Politecnico di Milano, Milano (Italy)
2020	**External Examiner Member** of PhD Final Exam Committee Doctoral School in Engineering Sciences – Vrije University Brussel
2018	**External Examiner Member** of PhD Final Exam Committee Doctoral School in Materials Science – Autonomous University of Barcelona
2017	**External Examiner** of PhD Final Exam Graduate School of Science and Technology – Keio University
2015	**External Examiner Member** of PhD Final Exam Committee Doctoral School in Chemical Engineering – Newcastle University
2012	**External Examiner Member** of PhD Final Exam Committee Doctoral School in Electrochemistry – University of Barcelona

INVITED SEMINARS AND LECTURES

Dec 2019	**Massachusetts Institute of Technology, Department of Materials Science and Engineering, Boston**: *Electrochemical Processes for Microrobotics/Devices and Batteries* (December 6th, 2019) – *Invited lecture*
June 2019	**NGRC 2019** - 2nd Nucleation & Growth Research Conference, June 9-13, 2019, Kyoto, Japan: *Production of Cu2O/CuO photocathodes with non-noble catalysts for improved photocurrent and stability – Invited lecture*
Oct 2017	**232nd ECS MEETING** (National Harbor, MD (greater Washington, DC area) - *Electrodeposition of Metals and Alloys for Graphene Growth*) – *Invited lecture*

Sept 2016 **Plenary Lecture**: *Electrochemical deposition processes for solar application.* Interfinish 2016 - 19th Interfinish World Congress, September 20-22, 2016, Beijing, China

Nov 2014 **7th Waseda Workshop on Electrochemistry**, Tokyo: *Metallization for flexible and stretchable devices* (November 11, 2014) – *Invited lecture*

Nov 2014 **Keio University**, Tokyo: *Metallization for flexible and stretchable devices* (November 9-10, 2014) – *Invited lecture*

Nov 2014 **Keynote speaker**: Electroless plating for alternative energy systems and TSV integration. Electrochemical micro and nanotechnologies EMNT 2014, November 5-8, 2014, Okinawa, Japan (Nov. 5-8, 2014)

Sept 24th2012 **IMEC, Leuven**, Belgium: *Fundamentals of electroless plating and application in microelectronics – Invited lecture*

Oct 11th 2012 **University of California at Berkeley** (USA): *Electroless deposition of metals – Invited lecture*

July 2012 **18° scuola AIMAT** (Ischia, NA): *Innovazioni e applicazioni nei rivestimenti anticorrosivi nell'automotive*. July 11-15, 2012 – *Invited lecture*

June 10th2012 **Invited panelist** at NASF International Surface Finishing Panel, Las Vegas

May 9th 2012 **University of California at Berkeley** (USA): *Coatings and industrial application of electrochemical processes – Invited lecture*

AFFILIATION

1998 - today **Member** of **ECS The Electrochemical Society**

2008 - today **Member** of **ISE** (International Society of Electrochemistry)

SCIENTIFIC ACTIVITY (ORCID: HTTPS://ORCID.ORG/0000-0001-5553-6441)

Luca Magagnin started his research activity at Department of Applied Physical Chemistry of Politecnico di Milano in 1996 as M.Sc. student. Since then he has worked at Politecnico di Milano in the same Department (now Department of Chemistry, Materials and Chemical Engineering "Giulio Natta") (with visiting periods at the University of California at Berkeley and at Keio University, Tokyo), and, since 2008 he has been leading the research group ***SEE Lab*** – Surface and Electrochemical Engineering Lab of Politecnico di Milano, setting up in 2019 the ***e-lite Lab*** – Electrochemical Innovative Technologies for Energy Lab.

The scientific activity of Luca Magagnin concerns topics related to Chemical Engineering and Materials Engineering.

Main research topics are:

1. Electrochemical processes for surface treatment and finishing
2. Electrochemical processes for energy and environment
3. Physical chemistry of surfaces for microelectronics

1 - Electrochemical processes for surface treatment and finishing

Electrochemical surface finishing is a highly scalable manufacturing process that traditionally uses aqueous electrolytes to achieve the desired surface profiles on metallic and non-metallic parts. Together with the development of new electrolytes to deposit functional and decorative coatings, the research activity is focused onto emerging approaches, e.g. using pulse and pulse reverse electric fields to control current distribution, formulating non-aqueous electrolytes and adapting these processes to parts produced by additive manufacturing. The understanding of the electrochemical processes, including the

thermodynamics, electrode kinetics, as well as transport phenomena, is oriented to the development of sustainable industrial processes.

i. **Electrochemical deposition of functional and decorative coatings.** Electrochemical deposition of metals and alloys, including electroless plating, is used to form coatings with improved corrosion and wear resistances. In the last few years, processes for the deposition of composite metal matrix materials have been developed for the oil and gas industry. Electroless and electrolytic processes have been also studied to understand the fundamental mechanism and the formation of metastable phases not predicted in the binary phase diagram.

ii. **Electrodeposition from non-aqueous solvents.** Since the discovery of non-aqueous electrolytes and their applicability to electrodeposition, pure metals and alloys plating have been among the most studied systems. The low reduction potential of some metals may consist in a limit considering the traditional aqueous solutions because of the unavoidable water electrolysis. The adoption of non-aqueous solutions is indeed a valid alternative to limit or even hinder secondary reactions and to potentially obtain high-quality. Deep eutectic solvents and ethylene glycol based electrolytes have been studied for the electrodeposition of pure metals, magnetic alloys and corrosion protective coatings.

iii. **Surface finishing for additive manufacturing.** 3D and inkjet printing have recently acquired great relevance for research and industrial applications due to its advantages with respect to traditional manufacturing techniques: the opportunity to create geometries impossible to obtain with other techniques, low cost and great scalability. A possible solution to obtain a metallic finish on a printed object is to metallize only the surface of the resin. This makes possible to obtain some properties of metals without having a bulk metallic object. It can be convenient to use electroless plating, a method able to provide thick and uniform metal layers on non-conductive substrates, such as the resins used in the printing step, and its combination with electrolytic processes. The aim of this activity is thus the application of the 3D or inkjet printing/metallization route to realize prototypical capacitive MEMS and magnetic microrobots.

2 - Electrochemical processes for energy and environment

Renewable energy sources are highly desirable in this era of dwindling petroleum reserves and increasing environmental concerns. Solar energy can cover a substantial share of global energy needs, but due to the intermittency and diluteness of this source, storage in energy-dense commodities, is required. The research activities in this field are oriented to the electrodeposition of photoactive materials for photovoltaic cell production and photo-assisted water splitting for hydrogen production. To improve the efficiency of existing and to develop new routes for energy storage, new materials for metal ions batteries are proposed together with the development of new chemistries for redox flow batteries. Electrochemical processes are also studied and proposed for the recycling of raw materials and the development of electrochemical reactors for environmental pollution control.

i. **Electrodeposition of photoactive layers.** Cu_2ZnSnS_4 (CZTS) thin film technology has been widely investigated for photo-conversion devices in the last few decades. The employment of earth-abundant elements, suitable optical properties such as an energy bandgap of 1.4–1.5 eV and a relatively high absorption coefficient are the prerequisites for potential low-cost and high-efficiency devices. Electrodeposition is one of the most attractive fabrication routes since it is a large-area and low cost

process, and it is studied and proposed to develop CZTS-based devices for PV cells and photo-assisted electrochemical hydrogen production.

ii. **Redox flow and metal ions based batteries.** Rechargeable flow batteries (RFBs) are one of the most promising technologies for integration in grid-connected electricity, especially if combined with unpredictable and intermittent renewable energy sources, due to their high efficiency, power/energy independent sizing, room temperature operation and long lifecycle. A zinc-iron RFB working in mild acidic conditions with low cost and high energy density is studied. In particular, inorganic electrolytes based on high soluble salts have been developed, achieving a charge density of 25-70 Wh L^{-1}. The combination of high energy efficiency of the Zn-Fe RFB with its ability to withstand a large number of charge/discharge cycles and the low cost, makes this battery system suitable for energy storage applications. New materials or new surface treatments of electrodic materials are also studied for the development of lithium and sodium ions batteries. Moreover, the research activity is now moving towards the recycling of bio-waste for Li and Na ions batteries and the development of new safer solid and semisolid electrolytes.

iii. **Industrial processes for environment and their intensification by electrochemical routes.** Advanced remediation processes have been studied as performing alternatives to conventional methods for removal of pollutants from water and wastewater. Electrochemical treatment of spent etchant solutions has been proposed to recover solutions from the decommissioning of nuclear plants and to separate radioactive elements. Selective electrochemical extraction of metals was proposed to recover precious metals from the electronic wastes.

3 - Physical chemistry of surfaces and interfaces

Research activities are focused to the modification of surfaces and their functionalization in order to control surface energy, wettability and sensing properties in microelectronics and MEMS technology. The fundamental understanding of electrochemical intercalation phenomena have been recently investigated to highlight the role of electrode overpotential for oxygen evolution and its role versus competitive reactions. The comprehension of fundamental mechanisms in the localized and general corrosion of stainless steels has been the focus of many published works. Surface modification was also applied to textile to improve flame retardant behavior.

i. **Self assembled monolayers for integrated circuits and MEMS**. The tendency to exploit the ability of self-assembled monolayers (SAM) in making covalent bonds with oxidized insulator substrates can be exploited in the production of integrated circuits. A possible application is the manufacturing of through-silicon vias (TSV) for the microelectronics industry and the use of SAM for controlling the wettability of silicon surfaces and stiction phenomena in MEMS technology.

ii. **Electrochemical intercalation at carbonaceous electrodes**. Graphite materials are employed as the support in technological applications, from the realization of electrodes in batteries to the production of graphene foils by electrochemical (EC) procedures. Blisters and other phenomena occurring on the HOPG surface during the anion intercalation process were investigated on a local microscopic scale by EC scanning tunneling and atomic force microscopy (EC-STM/AFM), as in situ tools by which details on both the mechanisms and the kinetics of the process have been proposed and discussed.

iii. **Metallization for flexible electronics**. Flexible transparent thin films are strongly required for electronic devices, display or electric equipment. To obtain both transparency and flexibility, electroless and electrolytic deposition together with surface functionalization of the polymer have been studied, combining various polymeric substrates and metallization processes.

iv. **Surface functionalization for sensors and bio-applications.** One of the most stimulating research topics in modern medicine and bio-applications is the investigation on innovative platforms and materials for sensing, controlled drug delivery and cells interactions. The expertise in surface functionalization and metallization technique has been applied to develop many applications in the field, from nanostructured polypirrole layers for drug delivery to deposition of nanoparticles for biosensors.

v. **Corrosion of stainless steels in seawater.** The electrochemical behavior of stainless steels in seawater near the corrosion potential was evaluated using a statistical approach to characterize the ennoblement of the corrosion potential. The effects of biofouling on the corrosion potential during exposure to seawater was investigated in the absence and presence of localized corrosion.

Dissemination

Starting the dissemination of his research activity in 1999, Luca Magagnin is co-author of 115 original article papers, 50 proceeding papers, 1 edited book and 4 book chapters indexed in the two main abstract and publication databases (Web of Science WOS, SCOPUS):

- 151 original WOS indexed publications (h index =18), which have collected more than 1547 citations (source WOS) since 1999
- 172 original SCOPUS indexed publications (h index = 19), which have collected more than 1645 citations (source SCOPUS) since 1999

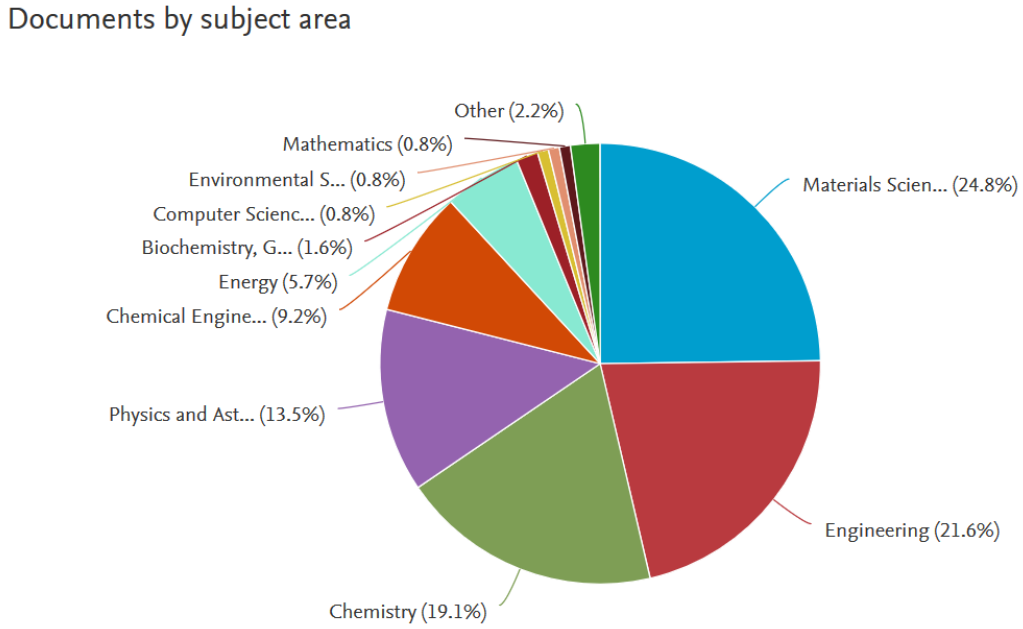

Figure 1. Distribution of research areas of Luca Magagnin. Source SCOPUS.

These publications concern mainly the areas of Chemical-Electrochemical Engineering, Materials Science and Engineering, as indicated by the analysis of research publications of Luca Magagnin (Figure 1).

Luca Magagnin is also co-inventor of 20 patents related to displays technology, energy storage and power systems, surface modifications of materials intended for industrial applications. He presented his scientific results, related to his research in several oral and poster communications (more than 150) at national and international meetings.

FUNDING

Luca Magagnin actively participated to different National and International calls on electrochemical processes, materials science and technology ***(total funds raised ≈ 3.600.000 euros)****, and he is active in establishing research contracts with National and International companies* ***(total funds raised ≈ 1.500.000 euros)****.*

Luca Magagnin