

Diego Colombara

Personal Information:

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Date of birth: 23/06/1984

Nationality: Italian

Professional experience:

University of Genova (Italy) – 30th December 2018 – present

Associate Professor c/o Department of Chemistry and Industrial Chemistry

Coordinator of European Innovation Council project REMAP. Reusable mask patterning (budget ca. 3.9 M€).

Curiosity-driven UniGe funded project EDICT. Effective doping of Chalcopyrite (budget ca. 50 k€).

Supervision of one Marie Curie postdoc (Shiva Navazani), two postdocs (Christian Rossi and Marco Piccinni), Co-supervision of three PhD candidates (Michael Casale, Jean Pierre Miranda and Zheming Liu). Supervision of one MSc and two BSc students. Main teaching duties: *General and Inorganic Chemistry* and *Scientific Writing* (tot. 9.5 ECTS).

International Iberian Nanotechnology Laboratory (Portugal) – 1st November 2017 – 29th December 2018

Marie Curie Fellow c/o Quantum Materials Science and Technology Department

H2020 NanoTrain for growth project (lab. budget: 18 k€).

My research at INL was devoted to the development of template-free micropattern electrodeposition with exploratory applications in photovoltaics (Nanostructured Solar Cells Laboratory, led by Dr. Sascha Sadewasser) and water splitting (Nano Materials for Energy Laboratory, led by Dr. Lifeng Liu). It led to [one patent application](#).

Université du Luxembourg (Luxembourg) – 1st June 2012 – 31st October 2017

Core Junior Fellow c/o Laboratory for Energy Materials

FNR-funded project GALDOCHS. Gas-phase alkali doping of chalcogenide semiconductors (budget: ca. 450 k€).

As the principal investigator in this project, I studied a novel gas-phase strategy for the doping of Cu(In,Ga)Se₂ solar cell absorbers with sodium and potassium. Partners involved: LIST (Luxembourg Institute of Science and Technology), University of Surrey (UK), Université de Versailles (France), La Sapienza University of Rome (Italy) and EMPA (Swiss federal laboratories for materials science and technology).

- Planning and leading the project; coordinating partners' contributions and project meetings; dissemination.
- Teaching one bachelor course; scientific mentoring of PhD students/colleagues; doctorate evaluation committee.
- Overseeing chemical safety and chemical waste disposal for the Electrochemistry laboratory; administration.

FP7 European project Scalenano. Development and up-scaling of innovative photovoltaic cell, processes and architectures to pilot-line scale for industrial application.

My contribution to this project is related to the studies of electrodeposition and conversion of Cu-Sn-Zn metal films to *Kesterite* Cu₂ZnSnSe₄ absorber layers for thin film solar cells based on Earth-abundant materials, as well as to the development of an on-line testing tool for photoelectrochemical assessment of the absorbers optoelectronic properties within the framework of an industrial collaboration.

- Designing/assembling new custom-made apparatuses, involving the coordination of several international suppliers (ThermCraft, AnnealSys, Hositrad, Vacom, Carbolite).
- Coordinating scientific collaborations/reporting with project partners in the framework of two work packages.
- Disseminating 19 scientific outcomes of two WPs through peer-reviewed and conference contributions.
- Supervision of one MSc student (Erika Robert) and one PhD candidate (Alexandre Crossay). Teaching of one bachelor course (Inorganic Chemistry).

Fabbricazioni Nucleari S.p.a., Alessandria (Italy) – 15th May 2006 – 15th March 2008

Part-time researcher

I designed a demonstration pilot plant for the production of γ -LiAlO₂ for molten carbonate fuel cells out of a formulation that I had devised during my previous Bachelor internship spent at the company.

Education:

University of Bath (United Kingdom) – 1st November 2008 – 31st May 2012

PhD in Physical Chemistry

Supervisors: Prof. Laurence M. Peter and Prof. Frank Marken
EPSRC project “SuperGen” Photovoltaic materials for the 21st Century.

[Investigation of Chalcogenide Absorber Materials for Photovoltaic Applications](#)

During my PhD project I electroplated thin films of the Cu-Sb-S and Cu-Bi-S systems and I investigated semiconductor alternatives to Cu(In,Ga)Se₂ for photovoltaic applications. The thesis focused on the implications of thermodynamics and kinetics of thin film formation on phase segregation and morphological properties of the resulting chalcogenide films. I also synthesized single crystals of Cu₂ZnSnS₄ via chemical vapour transport for fundamental structural studies.

Università degli Studi di Genova & Cranfield University (Italy, UK) – 18th Sept. 2006 – 15th October 2008

Laurea Specialistica in Scienze Chimiche (Classe 62/S), votazione di 110/110 (Corresponding to 2 year taught master in Chemistry, 110/110)

Supervisors: Prof. K. Rogers (Cranfield University, UK) and Prof. G. Borzone (Università di Genova, IT)
Dissertation project: *Mo/CuInS₂/CdS/TCO thin film photovoltaic systems*.

Università degli Studi di Genova (Italy) – 22nd September 2003 – 18th September 2006

Laurea Triennale in Chimica (Classe 21), votazione di 110/110 e lode (Corresponding to BSc in Chemistry, 110/110 cum laude)

Supervisor: Prof. A. Saccone
Dissertation project: *Synthesis of γ -LiAlO₂ for matrixes of molten carbonate fuel cells*.

Istituto Tecnico Industriale Statale “A.Gastaldi-G.Giorgi” di Genova (Italy) – 1998-2003

Maturità Tecnica Industriale con specializzazione in Chimica, votazione di 100/100 (Industrial Technical specialization in Chemistry 100/100)

I.P. related training:

Oct 2016 – **Dessins et modèles & droits d'auteur** – Institut de la Propriété Intellectuelle Luxembourg (IPIL)

Oct 2016 – **La marque comme élément de différenciation commerciale** – IPIL

Oct 2016 – **IP, R&D and knowledge transfer** – Sigmar Lampe, University of Luxembourg

Jul 2016 – **General course on intellectual property** – World Intellectual Property Organization

Language skills:

Italian: native; **English:** full proficiency; **French:** intermediary knowledge – certified B1-3 level; **German:** elementary knowledge – certified A2-1 level; **Turkish:** elementary knowledge.

Project Grants (total > 5.0 M€), Bursaries and Awards:

2023 – **Bilateral IT-US project e-APP** (1 of 18 selected by the Italian Ministry of Foreign Affairs) > **190 k€**

2023 – **Supervisor of Marie Curie project FOTOCER** > **170 k€**

2022 – **Supervisor of Marie Curie project SHERPA** > **180 k€**

2021 – **Coordinator of REMAP project**. European Innovation Council, Pathfinder Open > **3.9 M€**

2020 – **PI of EDICT and European Research Incentive projects**. University of Genova. > **110 k€**

2019 – **Back cover highlight** for *physica status solidi (RRL)* – *Rapid Research Letters* 13, 1900145 (2019).

2017 – **Habilitation for Associate Professorship** by Italian Ministry of Education for: (1) *Models and Methods for Chemistry*, (2) *Principles of Chemistry and Inorganic Systems* and (3) *Principles of Chemistry for Applied Technologies*

2015 – **Back cover highlight** for *physica status solidi (a)* 212, 88–102 (2015).

2014 – **Best poster prize** to PhD A. Crossay at 6th World Conference on PV Energy Conversion (Kyoto, Japan).

2014 – **Core Junior fellowship grant**. Fonds National de la Recherche Luxembourg. > **450 k€**

2009 – **First poster prize at the Sustainability Exchange Conference**. University of Exeter.

2009 – **Gold medal “Gianni Stagno”** as best Master Thesis of University of Genova 2007/2008. Rotary Club.

2004 – **Marino Novi Studentship** for Chemistry Bachelor studies. Italian Chemical Society.

2003 – **Silver medal** at the Olympics of Chemistry for “Industrial Technical Students class” of the Regional Ligurian Section, Italian Chemical Society, University of Genova.

Other Scholarly, Academic and Teaching Responsibilities:

- Lecturer of *Chimica Generale e Inorganica* (CHIM/03) for *Laurea Triennale in Chimica e Tecnologie Chimiche* at the University of Genova (5 ECTS, since 2019). Lecturer of *Chimica Generale e Inorganica e Laboratorio* (CHIM/03) for *Laurea Triennale in Scienze Biologiche* at the University of Genova (3.5 ECTS, since 2020). Lecturer of *Scientific Writing* for Erasmus Mundus SERP+ Master programme in *Scienza e Ingegneria dei Materiali* at the University of Genova (1 ECTS, since 2021). Lecturer of *Chimie Inorganique* for BSc degree in Physics at the University of Luxembourg (from 2013 to 2016). Examination assistant of *Chimie Organique* for BSc degree in Physics (2013-2016). Lecture series delivered to Postgraduate School on Material Science at the University of Genova (2013). Demonstrator of *Physical Chemistry Laboratory* to MSc students (2009) and at the international *Electrochemistry Winter School* (2009-2010) at University of Bath, UK.
- President of the 2020 evaluation committee of PhD candidates in *Nanochemistry* at the University of Genova (7 PhD candidates examined). Member of the Faculty Board of the Doctoral School in *Chemical and Materials Science and Technology* of the University of Genova (33 evaluations since 2020). Vice-chairman and member of the scientific evaluation committee of PhD candidates at the University of Luxembourg (2 PhD candidates examined).
- Co-organiser of the *Production and Reliability of CIGS solar cells* symposium at the 49th IEEE Photovoltaics Specialists Conference, Philadelphia/ USA (2022). Member of the organizing committee of the 51st International Conference *Journées des Actinides*, Santa Margherita/ Italy (2022). Conference chair for the *Electro-optical Characterization* session at the 7th World Conference on Photovoltaic Energy Conversion, Waikoloa/ USA (2018).

Affiliations and Other Experiences:

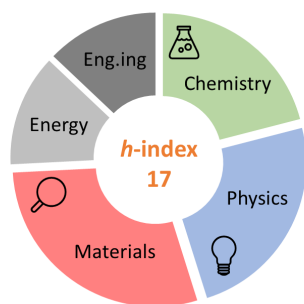
- Associate Member of the Royal Society of Chemistry (RSC) since January 2010
- Member of Società Chimica Italiana (SCI) since January 2018. Regional Board member since January 2023
- Regular reviewer for Wiley, Elsevier, Springer-Nature, American Chemical Society and RSC journals
- Responsible in charge of chemical safety and toxic chemical waste disposal (May 2013 – October 2017)
- Lab custodian of a Research Physical Chemistry. Lab. involving handling of glove boxes since January 2010
- Knowledge of main Microsoft Office package and Origin, ongoing training for Comsol Multiphysics

Selected Conferences, Workshops and Schools attended:

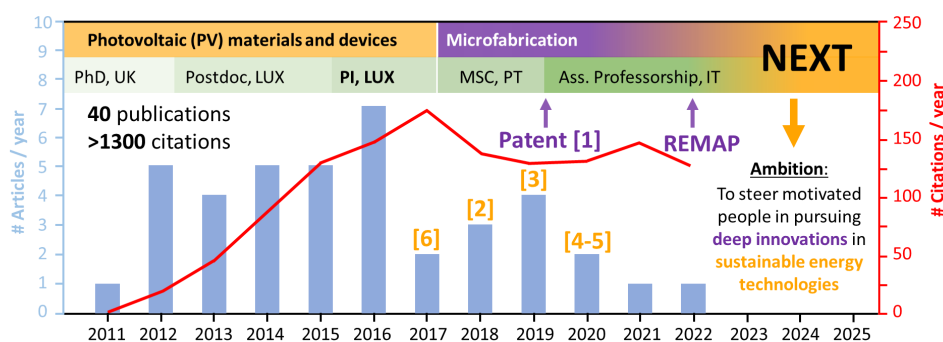
June 2022 – 49th IEEE Photovoltaic Specialist Conference – Philadelphia (Single-authored, Oral)
Sept 2021 – 27th National Congress of the Italian Chemical Society – Online event (Co-authored, Oral)
Feb 2020 – SuperFOx (superconductivity and functional oxides) – Santa Margherita, Italy (Oral)
Sept 2019 – 47th Inorganic Chemistry Congress of Italian Chemical Society – Bari, Italy (Invited Talk)
June 2019 – 46th IEEE Photovoltaic Specialist Conference – Chicago, USA (Poster)
June 2018 – 7th World Conference on Photovoltaic Energy Conversion – Waikoloa, USA (Poster)
May 2017 – 231st Electrochemical Society Meeting – New Orleans, USA (Invited Talk)
Apr 2017 – Materials Research Society Meeting – Phoenix, USA (Poster)
Aug 2016 – SPIE Optics and Photonics for Sustainable Energy – San Diego, USA (Oral)
Nov 2015 – ManuFuture-EU Conference – Luxembourg, (Attendant)
May 2015 – 227th Electrochemical Society Meeting – Chicago, USA (Oral)
Nov 2014 – Collaborative Conference on Crystal Growth – Phuket, Thailand (Invited Talk)
Sept 2014 – EU PVSEC Specialist conference – Amsterdam, Netherlands (Poster)
Oct 2013 – 224th Electrochemical Society Meeting – San Francisco, USA (Poster)
Aug 2013 – Solar Energy for World Peace Conference – Istanbul, Turkey (Oral)
July 2011 – X-ray and neutron scattering Summer School – INEL Caen, France
May 2011 – E-MRS/MRS Bilateral Conference on Energy- Nice, France (Poster)
Nov 2010 – 1st Kesterite Workshop – Ångström lab, Uppsala Universitet, Sweden (Oral)
June 2010 – E-MRS Conference – Strasbourg, France (Poster)
Sept 2009 – Quantsol International Summer School – Hirshegg, Austria
Nov 2007 – Hydrogen and Fuel Cells Workshop – ENEA Casaccia research centre, Rome, Italy (Oral)

Publications

40, of which 21 as first or corresponding author. H index (citations) – Scopus: 17 (1333); Google Scholar: 19 (1719). Overall, my disseminations comprise 31 corresponding-author presentations (of which 4 invited talks) at conferences such as Electrochemical Society, E-MRS/MRS, SPIE, EU-PVSEC/IEEE-PVSC/WCPEC, and 8 invited seminars.



Source: Scopus



My expertise stands at the junction between Chemistry, Physics, Materials Science and Engineering, as reflected in the publication pie chart above. Under this triple lens, I have been studying photovoltaic (PV) materials, processes, and devices from 2008 to 2017. Then, my career took a diversion when I joined the International Nanotechnology Laboratory in Portugal to develop a novel surface patterning technique, thus investing in microfabrication training. This deliberate choice meant a drop in my publication and citation records, but this effort was re-paid by one patent application on surface patterning [1] and by the establishment of the large [REMAP consortium](#) -funded by the Pathfinder Open scheme of the European Innovation Council- that is entirely devoted to demonstrate my surface patterning invention applied to microconcentrator PV. Below is a selection of 7 outputs from my research. My most cherished scientific achievements are the rejection of a 20-years old assumption on **sodium doping in Cu(In,Ga)Se₂** [2], and the subsequent single-author study [3], both of which result from my first independent project [GALDOCHS](#).

[1] D. Colombara, “[Method for patterning a surface of a substrate](#)”, Publication Number WO/2020/136057, International Application No. PCT/EP2019/086023, 2019

[2] D. Colombara, F. Werner, T. Schwarz, I. C. Infante, Y. Fleming, N. Valle, C. Spindler, E. Vacchieri, G. Rey, M. Guennou, M. Bouttemy, A. Garzón Manjón, I. Peral Alonso, M. Melchiorre, B. El Adib, B. Gault, D. Raabe, P. J. Dale, and S. Siebentritt, “[Sodium enhances indium-gallium interdiffusion in copper indium gallium diselenide](#)”, *Nature Communications*, vol. 9, p. 826, 2018

[3] D. Colombara, “[Frank-Turnbull dopant migration may enhance heteroatom diffusivity: Evidence from alkali-doped Cu\(In,Ga\)Se₂](#)”, *Physical Review Materials*, vol. 3, p. 054602, 2019

[4] D. Colombara, K. Conley, M. Malitckaya, H. P. Komsa, and M. J. Puska, “[The fox and the hound: in-depth and in-grain Na doping and Ga grading in Cu\(In,Ga\)Se₂ solar cells](#)”, *Journal of Materials Chemistry A*, vol. 8, p. 6471, 2020

[5] D. Colombara, H. Elanzeery, N. Nicoara, D. Sharma, M. Claro, T. Schwarz, A. Koprek, M. H. Wolter, M. Melchiorre, M. Sood, N. Valle, O. Bondarchuk, F. Babbe, C. Spindler, O. Cojocar-Miredin, D. Raabe, P. J. Dale, S. Sadewasser, S. Siebentritt, “[Chemical instability at chalcogenide surfaces impacts chalcopyrite devices well beyond the surface](#)”, *Nature Communications*, vol. 11, p. 3634, 2020

[6] D. Colombara, U. Berner, A. Ciccioi, J. C. Malaquias, T. Bertram, A. Crossay, M. Schöneich, H. J. Meadows, D. Regesch, S. Delsante, G. Gigli, N. Valle, J. Guillot, B. E. Adib, P. Grysan, P. J. Dale, “[Deliberate and Accidental Gas-Phase Alkali Doping of Chalcogenide Semiconductors: Cu\(In,Ga\)Se₂](#)”, *Scientific Reports*, vol. 7, p. 43266, 2017

[7] D. Colombara, A.-M. Gonçalves, A. Etcheberry, “[Synthesis of K₂Se solar cell dopant in liquid NH₃ by solvated electron transfer to elemental selenium](#)”, *Electrochemistry Communications*, vol. 93, p. 44, 2018.

Career statement:

Over the past 11 years, I have established myself as a key player in the chalcogenide photovoltaic (PV) field. As the Coordinator of REMAP, I have the privilege of fostering the added value of interdisciplinarity by steering around 60 people towards a clear technological demonstration for advanced PV micro-fabrication. This experience taught me that I am pretty good at coaching research teams by leveraging each individuals’ strengths in pursuing clear research strategies including necessary mitigations. At the same time, I have become a successful writer of grant proposals, as demonstrated by the 4.5 M€ I raised over the last 5 years through highly competitive schemes.

As a challenge seeker, I look for opportunities to replicate radical transformations in sustainable energy technologies beyond PV, such as future generation thermoelectric and dissipationless computing devices by unveiling the properties of chalcogenide topological insulators, as well as efficient electrochemical energy conversion devices by unbundling recently discovered exotic solid state atomic diffusion phenomena.

Genova, 1-3-2023

Signature