Curriculum vitae di *Gabriele Centi*

Sottosettori ERC primari (max 3):

PE4_10 Heterogeneous catalysis, PE4_12 Chemical reactions: mechanisms, dynamics, kinetics and catalytic reactions, PE8_2 Chemical engineering, technical chemistry

Eventuali sottosettori ERC secondari (max 3):

PE4_8 Electrochemistry, electrodialysis, microfluidics, sensors, PE4_15 Photochemistry

PERSONAL DETAILS

CENTI Gabriele
Full prof. of Industrial Chemistry at the University of Messina, Italy
President of the European Research Institute of Catalysis (ERIC aisbl, Brussels)
ORCID 0000-0001-5626-9840 Scopus ID: 35413314000 ResearcherID: A-6099-2010
https://catalysis.unime.it/

He is the author of ~650 scientific publications (about 500 peer-reviewed articles and 140 chapters in reviewed books) and 15 books (+ 2 in print), as well as editor of >25 special issues of journals. The current h-index is 103, with 43,062 citations and 456 articles that have received more than ten citations (Google Scholar, August 2025). He was the coordinator of the EU Network of Excellence on Catalysis IDECAT and of the ERC Synergy SCOPE project on plasma catalysis, in addition to coordinating several EU projects on catalysis. He served for eight years as president of the International Association of Catalysis Societies (IACS) and was the 5th president of the European Federation of Catalysis Societies (EFCATS).

- **Education and key qualifications**

1979 Laurea Degree in Industrial Chemistry at the University of Bologna (prof. F. Trifirò)
1981 Fellowship, Experimental Fuel Station (Milan)

- **Current position(s)**

1996-today Full Professor (Industrial Chemistry), Univ. Messina - Italy (Dept. ChiBiofarAm)
2008- today President of the European Research Institute of Catalysis (ERIC aisbl, Brussels - Belgium)
2020- today PhD Coordinator (International, Industrial) ACCESS "Advanced Catalytic proCesses for using renewable Energy SourceS", Univ. Messina, Italy

- **Previous position(s)**

1983-1987 Researcher (Industrial Chemistry), Univ. Bologna - Fac. Industrial Chemistry, Italy
1987-1995 Associate Professor in Chemical Plants, Univ. of Bologna - Fac. Industrial Chemistry, Italy
2001-2004 Coordinator of the Degree in Industrial Chemistry at the University of Messina, Italy
2019- 2023 Delegate of the Rector of the Univ. Messina (Italy) for the Green Deal
2024 Director of the Dept. ChiBioFarAm of the University of Messina

- **Fellowships and awards:** *Selection*

2025 APACS & EFCATS Michel Che Award, given jointly by the Asia-Pacific Association of Catalysis Societies (APACS) and the European Federation of Catalysis Societies (EFCATS)
2020-25 World's Top 2% Scientists ranking (Stanford University). In the top 10.000 worlds researchers' in chemistry, within the top 50 in the SubField 1 (Physical Chemistry)
2022 Among the 34 worldwide scientists invited by CEFIC (Eur. Fed. Chem. Industries) to celebrate the 50th anniversary of the Society.
2021 Recognition as a Distinguished Scientist by the International Fellowship Initiative (PIFI) of the President of the Chinese Academy of Sciences,
2021 Humboldt Research Award
2019 Recipient and coordinator of ERC Synergy SCOPE (ID: 810182)
2017-today Honorary Professor of Tianjin University (TJU), China
2016-2024 President of IACS (International Association of Catalysis Societies)
2015-today Chemistry Europe Fellow
2017 Gold Medal S. Cannizzaro of the Italian Chemical Society
2016 Chini Memorial Lecture (Italian Chemical Society)
2014 LEE HSUN Lecture 2014 Award, Inst. by Metal Res., Chin. Acad. Science, Shenyang (China)
2013 MPG 2013 Award "Frontiers in Chemical Energy Science" (Mühlheim an der Ruhr, Germany)

Plenary or keynote lectures in over 30 international events in the last 3-4 years.

- **Institutional Responsibilities:** *Selection*

2016-2019 Vice-President of the Interuniversity Consortium INSTM
2005-today Member of several international panels and boards of International Institutions

RESEARCH ACHIEVEMENTS AND PEER RECOGNITION

Track Record:

Last 10 years: >200 publications in peer-reviewed journals + 35 chapters in peer-reviewed books. Scopus: 245 publications (70% articles, 12% reviews), of which ~80% as corresponding or first/last authors; ~65% in the top 25% most cited documents worldwide; ~76% in the top 25% journals by CiteScore).

Below is a selection of ten representative publications as corresponding author (average IF of 20,6):

1. Water Structure in the First Layers on TiO_2: A Key Factor for Boosting Solar-Driven Water-Splitting Performances, *J. Am. Chem. Soc.* 2024, 146, 26, 18061–18073 (IF 15.6). DOI: 10.1021/jacs.4c05042
2. Understanding the complexity in bridging thermal and electrocatalytic methanation of CO_2, *Chem Soc Rev* 2023, 52, 3627 (IF 39,0). DOI: 10.1039/D2CS00214K
3. Transforming catalysis to produce e-fuels: Prospects and gaps, *Chi J Catal* 2022, 43, 1194 (IF 17,7). DOI: 10.1016/S1872-2067(21)64016-0
4. Status and gaps toward fossil-free sustainable chemical production, *Green Chem* 2022, 24, 7305 (IF 9,2). DOI: 10.1039/D2GC01572B
5. CO_2 conversion to solar fuels and chemicals: Opening the new paths, *J Energy Chem* 2024, 91, 680 (IF 14,9). DOI: 10.1016/j.jechem.2024.01.021
6. Catalysis for e-Chemistry: Need and Gaps for a Future De-Fossilized Chemical Production, with Focus on the Role of Complex (Direct) Syntheses by Electrocatalysis, *ACS Catal* 2022, 12, 2861 (IF 13,1). DOI: /10.1021/acscatal.2c00099
7. Current density in solar fuel technologies, *Energy Environ. Sci.*, 2021,14, 5760 (IF 30,8). DOI: 10.1039/D1EE02512K
8. Nanocarbon for Energy Material Applications: N_2 Reduction Reaction, *Small* 2021, 17, 2007055 (IF 12,1). DOI: 10.1002/smll.202007055
9. Enhanced performance in the direct electrocatalytic synthesis of ammonia from N_2 and H_2O by an in-situ electrochemical activation of CNT-supported iron oxide nanoparticles, *J Energy Chem* 2020, 49, 22 (IF 14,9). DOI 10.1016/j.jechem.2020.01.011
10. New catalytic materials for energy and chemistry in transition, *Chem. Soc. Rev*., 2018, 47, 8066 (IF 39,0). DOI: 10.1039/C8CS90119H

Publications of last three years in:

2025: Nature Comm., J. Energy Chem., Chem. Eng. J., Carbon Capture Sci. & Techn., EES Catal., Catal. Sci. & Techn., Chi. J. Catal., ChemCatChem, Chem. Rec., ACS Catal., Energy & fuels, Top. Catal.
2024: ChemSusChem, Int. J. H_2 Energy, JACS, EES Catal., Current Opinion Green and Sustainable Chem., Pure & Appl. Chem., J. Energy Chem., Catal. Today, J. Catal., Chem. Eng. J., Chem. Eng. Trans.
2023: Nature Catal., Energy & Env. Sci., Green Chem., MMM, Chem. Soc. Rev., ACS Catal., Current Opinions in Chem Eng, Catal. Today, Chem. Comm., Chem. Synth., and others

Over the last decade, I have delivered nearly 100 lectures (plenary, keynote, and invited) at international conferences and advanced schools; details are available at https://catalysis.unime.it/invited-lecture.html.

Selection of 10 representative plenaries over the last 3 years:

(1) Europacat 2025 (16th Eur. Congress on Catalysis), 31 Aug. / 6 Sept. 2025, Trondheim (Norway).
(2) IUPAC World Chemistry Conference 2025, 14-19 Jul 2025, Kuala Lumpur, Malaysia
(3) GCS4CE Scientific Symposium, 21 Feb. 2025, Padova - Italy
(4) AD HOC 2024, 30th June - 4th July 2024, Venice, Italy
(5) University of Science and Technology of China (USTC), Hefei - China, 22th Jan. 2024
(6) Int. Workshop Multiscale Computational Design of Heterogeneous Catalysts, 14-15 Feb. 2024, Napoli
(7) Catalysis in a Changing Environment – Linking Fundamentals Aspects to Engineering, 21-23 July 2024, TUM - Munich, Germany
(8) IC-MES2023 ALGERIA, 12-14 November 2023.
(9) 4th EECAT, 15-18th Oct. 2023, Beijing, China
(10) Inter Symposium on Plasma Catalysis for CO_2 Recycling, 13th-15th Sept 2022, Krakow, Poland

Coordinator of EU projects - selection (in addition to PI in several additional projects):

1. DECADE (DistributEd Chemicals And fuels production from CO_2 in photoelectrocatalytic DEvices), ID: 862030, 1/5/2020 - 30/4/2024, Total cost € 5.358.672,49
2. SCOPE (Surface-COnfined fast-modulated Plasma for process and Energy intensification in small molecules conversion), ID: 810182, ERC Synergy, 1/4/2019 - 31/3/2026, Total cost € 10.400.695,38
3. TERRA "New adaptable catalytic reactor methodologies for Process Intensification", Project ID: 67747. From 2015-09-15 to 2019-09-14, H2020-SPIRE-2015, Total cost: EUR 4.424.785,25
4. SOLAR-H_2 "Solar Artificial Trees for Hydrogen on-Demand Production", project ID: 101247232, ERC PoC; 18 months from 1st Sept. 2025, €150.000,00.

Scientific profile:

G Centi is internationally recognised in catalysis, particularly (in the last decade) for electrifying chemical processes and solar fuels. He employed a multifaceted approach to accelerate this transformation, ranging from scientific advances and prototype engineering and development to exploring novel, unconventional directions and catalysis. This proposal falls under the last path and the effort, aiming for a fundamental understanding of catalysis through localised phonons and their interaction with excitons to form polarons or trions, which are able to transfer energy in (electro)catalytic processes selectively. This creates new perspectives on design photo- and electrocatalysis in CO_2 or N_2 selective conversion. He pioneered gas-phase-type electrocatalytic reactors (zero-gap) for CO_2 conversion, demonstrating the role of reactor/electrode in determining the pathways of transformation. His reviews on CO_2 conversion and reuse are among the top cited, as well as those on nanocarbon catalysis. He also contributed to the techno-economic and sustainability assessment of CO_2 utilisation processes. Among other contributions, he pioneered producing i) C3 hydrocarbons and alcohols by electrocatalytic reduction of CO_2, ii) olefins from CO_2, iii) new aspects in the mechanism of C-C bond formation in CO_2 electroreduction,and iv) showed the dynamic change of the electrocatalysts during CO_2 conversion by operando spectroscopies and the role of the dynamics at polarised CO_2–iron oxyhydroxide interfaces.

He addressed catalysis, and specifically the conversion of small molecules (CO_2, N_2, H_2O, CH_4) from multiple viewpoints: i) traditional heterogeneous catalysis, ii) electrocatalysis, iii) photo- and/or photoelectro-catalysis and iv) plasma catalysis. Recently, he reported the dream reaction of CO_2 to C + O_2 conversion by combining plasma activation and catalysis. Relevant is also his pioneering contribution in developing the electrocatalytic N_2 to NH_3 conversion using iron-based nanocatalysts to distribute ammonia as an H-vector.

The scientific profile, expertise, and capabilities are thus well-suited to those necessary for successfully executing the project and demonstrate the ability to conduct groundbreaking research.

Ten selected research outputs:

1. Mitigation of C-deposits in plasma-assisted non-oxidative methane coupling using a water-cooled double dielectric barrier discharge reactor, V Longo, S Perathoner, G Centi, C Genovese, *Chem. Eng. Journal*, **2025**, *517*, 164334. DOI: 10.1016/j.cej.2025.164334
   A radically different plasma chemistry is shown when reducing the discharge gap to the μm scale, resulting in plasma confinement near the electrode surface, which enhances the selective C-H activation.
2. Boosting the activity in the liquid-phase hydrogenation of S-containing nitroarenes by dual-site Pt/CeO_2 catalysts design, X Ren, J Huang, J Ma, Y Zhang, W Chu, S Perathoner, G Centi, Y Liu, *Nature Comm.* **2025**, *16*, 4851. DOI: 10.1038/s41467-025-59920-x
   A new strategy for converting S-containing nitroarenes by developing a dual-sites Pt/CeO_2 catalyst consisting of highly defective CeO_2 with abundant active oxygen vacancy and Pt sub-nano clusters.
3. Perspectives and emerging trends in plasma catalysis: Addressing the challenge of electrifying chemical production. A Bogaerts, G Centi, V Hessel, E Rebrov. *ChemCatChem* **2025**, *17*, e202401938. DOI: 10.1002/cctc.202401938
   Together with another paper (*Catal Today* 2023, 420, 114180), it showcases the results of the ERC Synergy SCOPE project, presenting also a vision for the future of plasma catalysis and new unconventional catalysis directions to develop for a sustainable future.
4. Addressing the Complexity of Bridging Thermal and Reactive Catalysis. The Role of Strong Localised Electrical Fields, G Centi, S Perathoner, *Topics in Catal.* **2025**, 1-18. DOI: 10.1007/s11244-025-02062-7
   This paper sheds light on the differences between thermal (on one side) and photo, electro, and plasma (reactive) catalysis on the other side. It reports the role of strong localised electrical fields (LEF) generated by the coupling of charges with localised phonon modes, i.e. catalyst vibrations.
5. Develop High-Performance Cu-Based RWGS Catalysts by Controlling Oxide–Oxide Interface, S Li, X Liu, J Ma, F Xu, Y Lyu, S Perathoner, G Centi, Y Liu, *ACS Catal.* **2025**, *15*, 3475-3486. DOI:10.1021/acscatal.4c07729

The paper introduces and demonstrates that it is possible to obtain high-performance and stable catalysts by modifying the mechanism of action in Cu/CeO_x-MgO catalysts for CO_2 hydrogenation. H and CO_2 activation sites are decoupled but connected via the surface mobility of H-spillover species. The latter is realised via an enhanced oxide–oxide interface, allowing high performance and stability.

6. Water Structure in the First Layers on TiO_2: A Key Factor for Boosting Solar-Driven Water-Splitting Performances, R Verduci, F Creazzo, F Tavella, S Abate, C Ampelli, S Luber, S Perathoner, G Cassone, G Centi, G D'Angelo, *J Am Chem Soc* **2024**, *146*, 18061. DOI: 10.1021/jacs.4c05042
   This work unveils how doping the semiconductor surface affects the local electric field, determining the water splitting rate by influencing the H-bond topologies in the first water layers. This evidence opens new prospects for designing efficient photocatalysts for water splitting.
7. High photocatalytic yield in the non-oxidative coupling of methane using a Pd–TiO_2 nanomembrane gas flow-through reactor, V Longo, L De Pasquale, F Tavella, M Barawi, M Gomez-Mendoza, V de la Peña O'Shea, C Ampelli, S Perathoner, G Centi, C Genovese, EES Catal. 2024, 2, 1164. DOI: 10.1039/D4EY00112E
   A novel flow-through photocatalytic reactor for the photocatalytic non-oxidative coupling of methane, giving high performance and selectivity to C2 hydrocarbons.
8. Making chemicals from the air: the new frontier for hybrid electrosyntheses in artificial tree-like devices. G Centi, S Perathoner, *Green Chem.* **2024**, 26, 15. DOI: 10.1039/D3GC02135A
   It discussed how making chemicals from the air through hybrid electrosynthesis technologies; it is a visionary objective that can potentially revolutionise chemical production.
9. Generation of oxide surface patches promoting H-spillover in Ru/(TiO_x)MnO catalysts enables CO_2 reduction to CO, H Kang, L Zhu, S Li, S Yu, Y Niu, B Zhang, W Chu, X Liu, S Perathoner, G Centi, Y Liu, *Nature Catal.* **2023**, *6*, 1062. DOI: 10.1038/s41929-023-01040-0
   The paper presents new perspectives for designing novel selective CO_2 hydrogenation catalysts through the in situ creation of oxide–oxide interfaces that serve as hydrogen-species transport channels.
10. An artificial leaf device built with earth-abundant materials for combined H_2 production and storage as formate with efficiency> 10%, C Ampelli, D Giusi, M Miceli, T Merdzhanova, V Smirnov, U Chime, G Centi et al., *Energy & Env Sci* **2023**, 16, 1644. DOI: 10.1039/D2EE03215E
    It reports a world-top-performing artificial-leaf-type cell with a solar-to-fuel efficiency of over 10% for directly converting CO_2, water, and sunlight into sustainable fuels and chemicals.

Peer recognition

- **Editor and Advisory Activities:** *Selection*

2015-today Editor-in-chief *Journal of Energy Chemistry* (Elsevier)
2003-today Editor in chief of the *Studies in Surface Science and Catalysis* series of books published by Elsevier Science (Amsterdam) (180 Vol. published in the series)
2013-today Editor of 7 peer-reviewed books (+ 2 in press), and >10 special issues of journals
2007-2019 Chairman of the editorial board of Wiley-VCH magazine *ChemSusChem* (Chemistry & Sustainability, Energy & Materials)
2011-2018 Editor of the series of books *Green Energy* published by De Gruyter (Berlin)
2012-2016 Member of the Advisory Board of Wiley Energy Technology journal,
2012-today Member of the Advisory Editors Board or the Scientific Committee of various journals (Journal of CO_2 Utilization, Chinese Journal of Catalysis, Batteries & Supercaps, Journal of the Chinese Chemical Society, Journal of Catalysis, ChemCatChem, Applied Catalysis etc.)

- **Organisation of Scientific Meetings**: *Selection as Chairman*

2010 Int. Zeolite and Mesoporous Materials conference (IZC16/IMMS7: Sorrento July 2010)
2011 X European Workshop on Selective Oxidation (ISO 2011; Glasgow, Sept. 2011),
2014 CIMTEC 2014 - Symp Advances in Photocatalytic Materials for Energy and Environmental Sustainability, Montecatini 8-13, 2014
2015 CRS-3 Catalysis for Renewable Sources: Fuel, Energy, Chemicals (Catania, 6-11 Sept. 2015)
2016 CIMTEC 2016, Symp "New Concepts and Advances in Photocatalytic Materials for Energy and Environmental Applications, Perugia (Italy), June 5-9, 2016
2017 Europacat 2017 (Florence, Italy), August 27-31, 2017
2022 CIMTEC 2022, Perugia (Italy), June 27-29th,
2025 13th ICEC Inter Conf. on Environmental Catalysis, Isola delle Femmine (PA), 2-5 June 2025

Member of the organisation or scientific committees in over 40 international events.