# Curriculum Vitae

# Prof. Angiolina Comotti

Angiolina Comotti got a Master degree in Chemistry at the University of Milan, in 1995 she held a Fellowship for one year at the ETH in Zurich and in 1998 she got her PhD degree in Chemistry. In 2001 she was appointed as an Assistant Professor (tenured position) of Physical Chemistry at the Department of Materials Science at the University of Milano-Bicocca where she is currently Full Professor of Industrial Chemistry.

She carried out research activity at Cambridge University (Prof. Ian Paterson), University of California at Berkeley (by Prof. Alexander Pines) and has been Visiting Scientist at New York University for one year (by Prof. Michael D. Ward) and at the University of Strasbourg (Prof. Wais Hosseini). She performed neutron diffraction experiments at the Rutherford Appleton Laboratory ISIS (Oxford) and was in charge of several projects at synchrotron light source at ESRF (Grenoble).

**INSTITUTIONAL AND INTERNATIONAL RESPONSABILITIES**

1/10/2020 now - Director of the Bachelor and Master degrees in Materials Science at the University of Milano Bicocca.

1/10/2020 now – Member of the Department Board in Department of Excellence 2017 “Materials for Energy” project

1/10/2020 now – Member of Didactic Board of the Department of Materials Science

1/10/2020 now – Member of Research Board of the Department of Materials Science

2020-2021 – Member of University Board for recruitment

2021/2022 – Panel Member of European Research Council

Publications 155 articles on high impact index journals including 1 Science, 1 Nature Materials, 4 Nature Chemistry, 3 Nature Photonics, 1 Nature Communications and several Advanced Materials, Angew. Chem. Int. Ed. and J. Am. Chem. Soc. and 3 international patents

Google Scholar 6690 citations, H-index 51 ISI WEB of SCIENCE

Communications at Conferences: 180 Plenary Lectures and keynote Lectures. She has received the national award for Industrial Innovation by AIRI at the Accademia dei Lincei in 1995, the "SAPIO NMR 2000" award and the "Micromeritics" grant award 2012.

Several publications were selected as HOT or VIP papers and highlighted in the cover of the journals (12 covers). Several publications were selected as HOT or VIP papers and highlighted in the cover of the journals (10 covers). The discovery of a new class of organic zeolites and their storage capacity was remarked by C&EN (2000), C&EN (2005) (Freeemantle), Chem-DE (2005), Spectroscopy Now “Crystal Gas Tank” (2005) (D. Bradley) and C&EN (2009). The novelty of the results published in Science 2011 was highlighted in a "Perspective" article of the same issue, in Royal Society of Chemistry and Scientific American press releases, and in over 40 websites. Chem.& Eng. News dedicated the "News of the Week" to the results. The recent article published in Nature Chemistry 2015 about the CO2 capture/release on command in a porous molecular crystal has been featured in Chemistry World Royal Society of Chemistry and several other journals.

## TEACHING ACTIVITIES

2010 – now

Bachelor Degree in Materials Science: Laboratorio di Chimica Strumentale 8 CFU

Master Degree in Materials Science: Chemistry and Technology of Polymers and Industrial Applications 6 CFU

2018 - Doctorate in Materials Science and Nanotechnology: Supramolecular and Macromolecular Chemistry

## CURRENT GRANTS

1. Principal Investigator (Bicocca Unit) European FET-SPARTE “Scintillating Porous Architectures for RadioacTivE gas detection – SPARTE”
2. Principal investigator of “Hydrogen storage” section in “Dipartimenti di Eccellenza” “ELectricity and Energy Carriers for Renewable Sources”
3. Participant to the Project Enhancing Photosynthesis – Lombardy Region 2021
4. Participant to the Project PRIN-NEMO – 2015

## AWARDS

She has received the National Award for Industrial Innovation by AIRI at the Accademia dei Lincei in 1995, the "SAPIO NMR 2000" award and the "Micromeritics" grant award 2012.

## SUPERVISION OF GRADUATE STUDENTS AND POSTDOCTORAL FELLOWS

2022 – now 3 Post-doc students/ 1 PhD student / 5 Master Students/ 6 Bachelor Students

## MEMBERSHIP/CHAIR OF INTERNATIONAL SOCIETY

Co-chair (A. Comotti and R. Matsuda) of Microsymposium 25th International Union of Crystallography IUCr Congress “Porous framework materials for gas adsorption/separation” (Prague, 14-22 August 2021).

2009 – now

Member of the Advisory Board of International Conference of Chemistry Organic Solid State

## REVIEWING ACTIVITIES

Nature Chem., Nature Mater., Nature Comm., J. Am. Chem. Soc., Angew. Chem. Int. Ed., Chem. Sci., J. Mater. Chem., Chem. Comm., Macromolecules.

## CURRENT INTERNATIONAL COLLABORATIONS

Prof. Ben Feringa – Nobel Price 2016

Prof. Michael Zawototko – Limerick Univerisity

Prof. Takashi Uemura – Tokyo University

## RESEARCH ACTIVITIES

The research activity deals with the generation of frameworks containing one-, two- and three-dimensional confined spaces with uniform and precisely engineered geometries to create new environments for capture of chemical entities. The study is focused on new materials with nanoscale architectures for storage of important gases, such as methane and hydrogen, considered as clean

fuels. Additionally, carbon dioxide and other pollutants are removed from nitrogen and hydrogen by selective sequestration in pores. The construction of stable and robust covalent organic and hybrid frameworks with 3D periodic motifs can increase separation, capture and storage of small gas molecules, especially molecular hydrogen. These frameworks can arrange sites and receptors into arrays, for interacting with the targeted gas species. The adsorption properties of the novel materials are superior in many instances to the existing ones and yielded patents for applications in gas storage and purification. Characterization methods of the porous structures and of the confined gases/vapors is currently achieved by X-ray diffraction techniques: advanced experiments using synchrotron-light and neutron sources are currently performed at various European facilities, such as at ESRF (Grenoble) and Elettra (Trieste). In particular, the synchrotron XRD experiments enable the in-situ observations of the gas arrangement as well as adsorption kinetics. Additionally, the dynamics of gases and vapors in the confined state and the identification of weak interactions will be studied in depth by advanced solid state NMR spectroscopy.

Metal Organic Frameworks containing conjugated ligands are ideal candidate for the study of luminescent and scintillating properties. The study was centered on the development of composite materials based on fluorescent metal-organic framework (MOF) nanocrystals which can work as fast scintillators. The MOF consists of high-Z linking nodes interacting with ionizing radiation and sensitizing the fluorescent ligands orderly arranged at a nanometric distance. The ultrafast scintillation supports the development of new scintillators (Nature Photonics 2021). Porous emitting fluorescent nanoparticles made by emitters integrated into the robust covalent architectures enabled the conversion of low-energy light into photons of higher energy based on sensitized triplet-triplet annihilation upconversion promised accessed to wavelength-shifting methodology and excitation powers as low as the solar irradiance (Adv. Mater. 2019).

A challenging issue is the dynamics of nanoporous solids. The research activity is focused on the insertion of molecular rotors in the building blocks of the porous materials, giving access to the control of rotary motion by chemical and physical stimuli. The combination of porosity with ultra-fast rotor dynamics is investigated in molecular crystals, covalent organic frameworks and MOFs by complementary techniques, which were proved to be sensitive to motion at regimes ranging from $10^4$ to $10^{11}$ Hz. Remarkably, the rotor dynamics can be switched on and off by guest absorption/desorption, showing a change of material dynamics, which, in turn, produces modulated phsical responses (Nature Chem. 2020, Nanoletters 2020 and J. Am. Chem. Soc. 2021).

Photoresponsive switches were incorporated into high surface area amorphous porous hyper-crosslinked polymer structures (POPs). This was the first insertion into covalent lattices of photoactive elements, which expore bistable states with 100% conversion yields. By exploiting the quantitative photoisomerization in the solid state and the porosity of the structure, it was possible to modulate the absorption of the gas in response to light (Nature Chem. 2020). The results were obtained thanks to the international collaboration with the research group of Prof. Ben Feringa (Nobel Laureate) of the University of Groningen.

Novel fluorinated dipole-bearing molecular rotors can be inserted on porous architectures, realizing ordered arrays of fast dipolar molecular rotors (Angew. Chem. 2015). The extremely rapid re-orientation in solids is challenging and enables the fabrication of ferroelectric switches, as revealed by dielectric measurements. The combination of pore-structure and dipolar rotors can be exploited for stimulated guest release.

A series of flexible molecular crystals made by azobenzene tetramers, that form porous molecular crystals in their trans configuration is pursued. The efficient trans→cis photo-isomerization of the azobenzene units converts the crystals into a non-porous phase but crystallinity and porosity are restored upon Z→E isomerization promoted by visible light irradiation or heating. The photo-isomerization enables reversible on/off switching of optical properties as well as the capture of CO2 from the gas phase (Nature Chem. 2015).

## Recent Selected Publications

M. Orfano, J. Perego, F. Cova, C. X. Bezuidenhout, C. Dujardin, B. Sabot, S. Pierre, P. Mai, C. Daniel, S. Bracco, A. Comotti, P. E. Sozzani, A. Vedda, A. Monguzzi
Radioactive gas detection by porous metal-organic framework fast scintillating nanocrystals.
*Nature Photonics*, Accepted.

*S. Mauree, V. Villemot, M. Hamel, B. Sabot, S. Pierre, C. Dujardin, F. Belloni, A. Comotti, S. Bracco, J. Perego, G. H. V. Bertrand*
"Detection of Radioactive Gas with Scintillating MOFs"
*Adv. Funct. Mater.* ***2023,*** 2302877

J. Perego, C. X Bezuidenhout, S. Bracco, S. Piva, G. Prando, C. Aloisi, P. Carretta, J. Kaleta, T. P. Le, P. Sozzani, A. Daolio, A. Comotti
"Benchmark Dynamics of Dipolar Molecular Rotors in Fluorinated Metal-Organic Frameworks"
*Angew. Chem. Int. Ed.* **2023**, e202215893.

J. Perego , Charl X. Bezuidenhout , I. Villa , F. Cova , R. Crapanzano, I. Frank, F. Pagano, N. Kratochwill, E. Auffray, S. Bracco, A. Vedda, C. Dujardin, P. E. Sozzani, F. Meinardi, A. Comotti, A. Monguzzi
"Highly luminescent scintillating hetero-ligand MOF nanocrystals with engineered Stokes shift for photonic applications"
*Nature Communications* **2022**, *13*, 3504.

M. L. Zaffalon, F. Cova, M. Liu, A. Cemmi, I. Di Sarcina, F. Rossi, F. Carulli, A. Erroi, C. Rodà, J. Perego, A. Comotti, M. Fasoli, F. Meinardi, L. Li, A. Vedda, S. Brovelli
"Extreme γ-ray radiation hardness and high scintillation yield in perovskite nanocrystals"
*Nature Photonics* **2022**, *16*, 860-868.

Perego, J.; Villa, I.; Pedrini, A.; Padovani, E. C.; Crapanzano, R.; Vedda, A.; Dujardin, C.; Bezuidenhout, Charl X.; Bracco, S.; Sozzani, P. E.; Comotti, A.; Gironi, L.; Beretta, M.; Salomoni, M.; Kratochwil, N.; Gundacker, S.; Auffray, E.; Meinardi, F.; Monguzzi, A.
"Composite fast scintillators based on high-*Z* fluorescent metal–organic framework nanocrystals"
*Nature Photonics* **2021**, *15*, 393-400.

Perego, J.; Bezuidenhout, C. X.; Bracco, S.; Prando, G.; Marchiò, L.; Negroni, M.; Carretta, P.; Sozzani, P.; Comotti, A.
"Cascade Dynamics of Multiple Molecular Rotors in a MOF: Benchmark Mobility at a Few Kelvins and Dynamics Control by $CO_2$"
*J. Am. Chem. Soc.* **2021**, *143*, 13082-13090.

Perego, J.; Bracco, S.; Comotti, A.; Piga, D.; Bassanetti, I.; Sozzani, P.
"Anionic Polymerization in Porous Organic Frameworks: A Strategy to Fabricate Anchored Polymers and Copolymers"
*Angew. Chem. Int. Ed.* **2021**, *60*, 6117-6123.

Perego, J.; Bracco, S.; Negroni, M.; Bezuidenhout, C. X.; Prando, G.; Carretta, P.; Comotti, A.; Sozzani, P.
"Fast motion of molecular rotors in metal–organic framework struts at very low temperatures"
*Nature Chemistry* **2020**, *12*, 845-851.

Castiglioni, F.; Danowski, W.; Perego, J.; Leung, F. K.-C.; Sozzani, P.; Bracco, S.; Wezenberg, S. J.; Comotti, A.; Feringa, B. L.
"Modulation of porosity in a solid material enabled by bulk photoisomerization of an overcrowded alkene"
*Nature Chemistry* **2020**, *12*, 595-602.

Danowski, W.; Castiglioni, F.; Karuse, S.; Pfeofer, L.; Roke, S.; Comotti, A.; Browne, W. R. Feringa, B.
"Visible-light-driven rotation of molecular motors in a dual-function metal-organic framework enabled by energy transfer"
*J. Am. Chem. Soc.* **2020,** 142, 9048-9056.

Molecular Rotors in a Metal−Organic Framework: Muons on a Hyper-Fast Carousel
Prando, G.; Perego, J.; Negroni, M.; Riccò, M.; Bracco, S.; Comotti, A.; Sozzani, P.; Carretta, P.
*Nanoletters* **2020**, 10, 7613–7618.

Zhang, X.; Kitao, T.; Piga, D.; Hongu, R.; Bracco, S.; Comotti, A.; Sozzani, P.; Uemura, T.
"Carbonization of single polyacrylonitrile chains in coordination nanospaces"
*Chemical Science* **2020**, 11, 10844-10849.

Perego, J.; Bezuidenhout, C. X.; Pedrini, A.; Bracco, S.; Negroni, M.; Comotti, A.; Sozzani, P.
"Reorientable fluorinated aryl rings in triangular channel Fe-MOFs: an investigation on $CO_2$–matrix interactions"
*Journal of Materials Chemistry A* **2020**, 8, 11406-11413.

Pizzi, A.; Ozores, H. L.; Calvelo, M.; Garcia-Fandino, R.; Amorin, M.; Demitri, N.; Terraneo, G.; Bracco, S.; Comotti, A.; Sozzani, P.; Bezuidenhout, C. X.; Metrangolo, P.; Granja, J. R.
"Tight xenon confinement in a crystalline sandwich-like hydrogen-bonded dimeric capsule of a cyclic peptide"
*Angewandte Chemie, International Edition* 2019, 58(41), 14472-14476.

Perego, J.; Pedrini, J.; Bezuidenhout, C. X.; Sozzani, P. E.; Meinardi, F.; Bracco, S.; Comotti, A.; Monguzzi, A.
"Engineering Porous Emitting Framework Nanoparticles with Integrated Sensitizers for Low-Power Photon Upconversion by Triplet Fusion"
*Advanced Materials* **2019**, 31(40), 1903309.

Comotti, A.; Castiglioni, F.; Bracco, S.; Perego, J.; Pedrini, A.; Negroni, M.; Sozzani, P.
"Fluorinated porous organic frameworks for improved $CO_2$ and $CH_4$ capture"
*Chemical Communications* **2019**, 55(61), 8999-9002.

Xing, G.; Bassanetti, I.; Bracco, S.; Negroni, M.; Bezuidenhout, C.; Ben, T.; Sozzani, P.; Comotti, A.
"A double helix of opposite charges to form channels with unique $CO_2$ selectivity and dynamics"
*Chemical Science* **2019**, *10* (3),730-736. Highlighted in Nature Nanotechnology.

Balestri, D.; Bassanetti, I.; Canossa, S.; Gazzurelli, C.; Bacchi, A.; Bracco, S.; Comotti, A.; Pelagatti, P.
"Changing the Dress to a MOF through Fluorination and Transmetalation. Structural and Gas-Sorption Effects"
*Crystal Growth & Design* **2018**, *18* (11), 6824-6832.

Perego, J.; Piga, D.; Bracco, S.; Sozzani, P.; Comotti, A.
"Expandable porous organic frameworks with built-in amino and hydroxyl functions for $CO_2$ and $CH_4$ capture"
*Chemical Communications* **2018**, *54* (67), 9321-9324.

Bassanetti, I**.;** Bracco, S.; Comotti, A.; Negroni, M.; Bezuidenhout, C.; Canossa, S.; Mazzeo, P. P.; Marchio, L.; Sozzani,
"Flexible porous molecular materials responsive to $CO_2$, $CH_4$ and Xe stimuli"
*Journal of Materials Chemistry A: Materials for Energy and Sustainability* **2018**, *6* (29), 14231-14239.

Xing, G.; Bassanetti, I.; Ben, T.; Bracco, S.; Sozzani, P.; Marchio, L.; Comotti, A.
"Multifunctional Organosulfonate Anions Self-Assembled with Organic Cations by Charge-Assisted Hydrogen Bonds and the Cooperation of Water".
*Crystal Growth & Design* **2018**, *18* (4), 2082-2092. ACS Publications.

Bracco, S.; Piga, D.; Bassanetti, I.; Perego, J.; Comotti, A.; Sozzani, P.
"Porous 3D polymers for high pressure methane storage and carbon dioxide capture".
*Journal of Materials Chemistry A: Materials for Energy and Sustainability* **2017**, *5* (21), 10328-10337.

Kishida, K.; Okumura, Y.; Watanabe, Y.; Mukoyoshi, M.; Bracco, S.; Comotti, A.; Sozzani, P.; Horike, S.; Kitagawa, S.
"Recognition of 1,3-Butadiene by a Porous Coordination Polymer".
*Angewandte Chemie, International Edition* **2016**, *55* (44), 13784-13788.

Comotti, A; Bracco, S.; Sozzani, P.
"Molecular Rotors Built in Porous Materials".
*Accounts of Chemical Research.* **2016**, *49* (9), 1701-1710.

Yadav, V. N.; Comotti, A.; Sozzani, P.; Bracco, S.; Bonge-Hansen, T.; Hennum, M.; Goerbitz, C. H.
"Microporous Molecular Materials from Dipeptides Containing Non-proteinogenic Residues".
*Angewandte Chemie, International Edition* **2015**, *54* (52), 15684-15688 (VIP Paper, Frontispiece).

Kitao, T.; Bracco, S.; Comotti, A.; Sozzani, P.; Naito, M.; Seki, S.; Uemura, T.: Kitagawa, S.
"Confinement of Single Polysilane Chains in Coordination Nanospaces"
*Journal of the American Chemical Society* **2015**,*137* (15), 5231-5238.

Bracco, S.; Beretta, M.; Cattaneo, A.; Comotti, A.; Falqui, A.; Zhao, K.; Rogers, C.; Sozzani, P.
"Dipolar Rotors Orderly Aligned in Mesoporous Fluorinated Organosilica Architectures".
*Angew. Chem. Int. Ed.* **2015**, *54*, 4773-4777 (VIP Paper, Front Cover).

Baroncini, M.; d'Agostino, M.; Bergamini, G.; Ceroni, P.; Comotti, A.; Sozzani, P.; Bassanetti, I.; Grepioni, F.; Hernandez, T. M.; Silvi, S.; Venturi, M.; Credi, A.

Photoinduced reversible switching of porosity in molecular crystals based on star-shaped azobenzene tetramers”
*Nature Chem.* **2015**, *7*, 634-640.