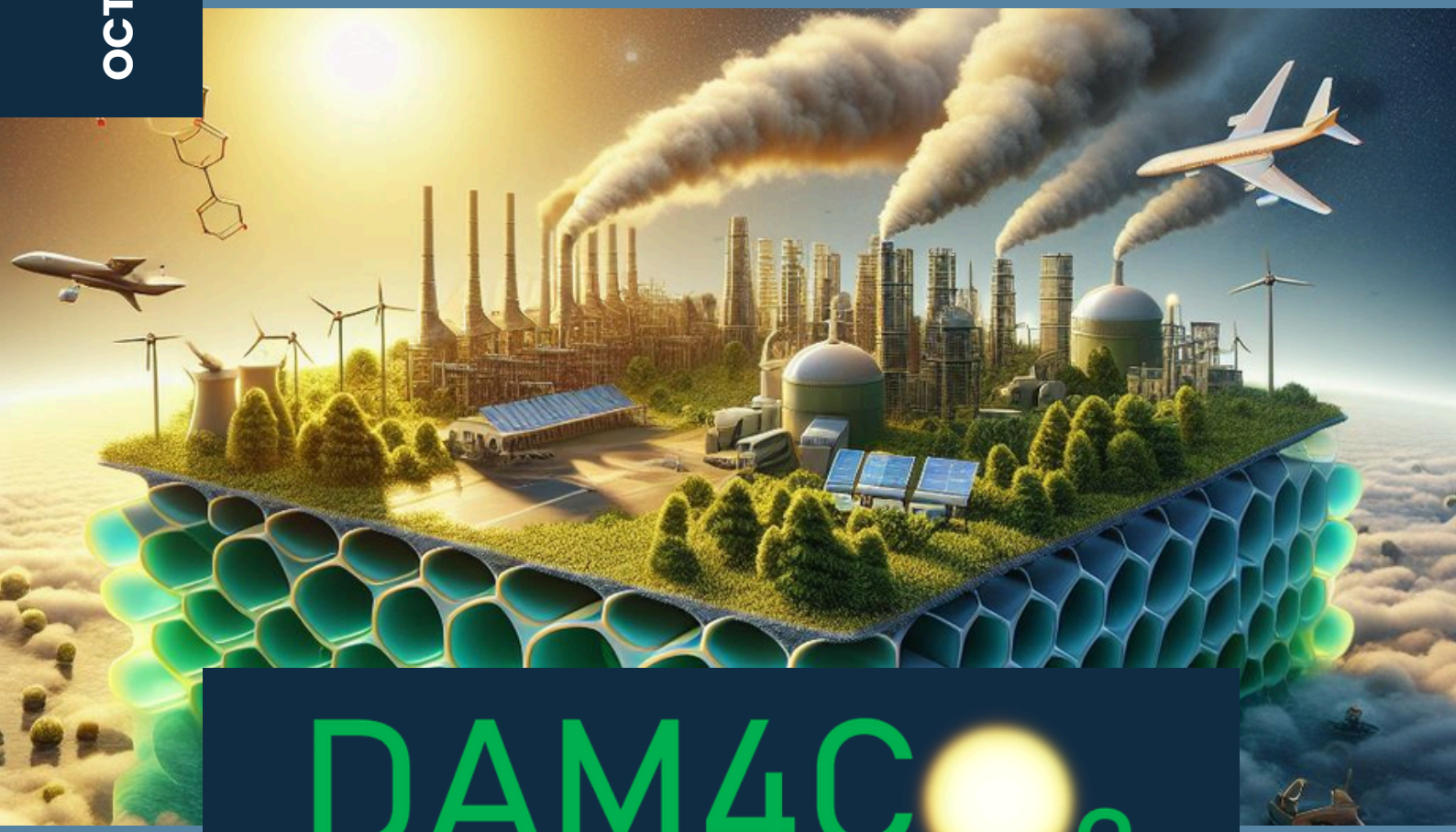
ISSUE N°6
OCTOBER 2026

NEWSLETTER



DAM4CO2

Double-**A**ctive **M**embranes **for** a sustainable CO_2 cycle

PARTNERS

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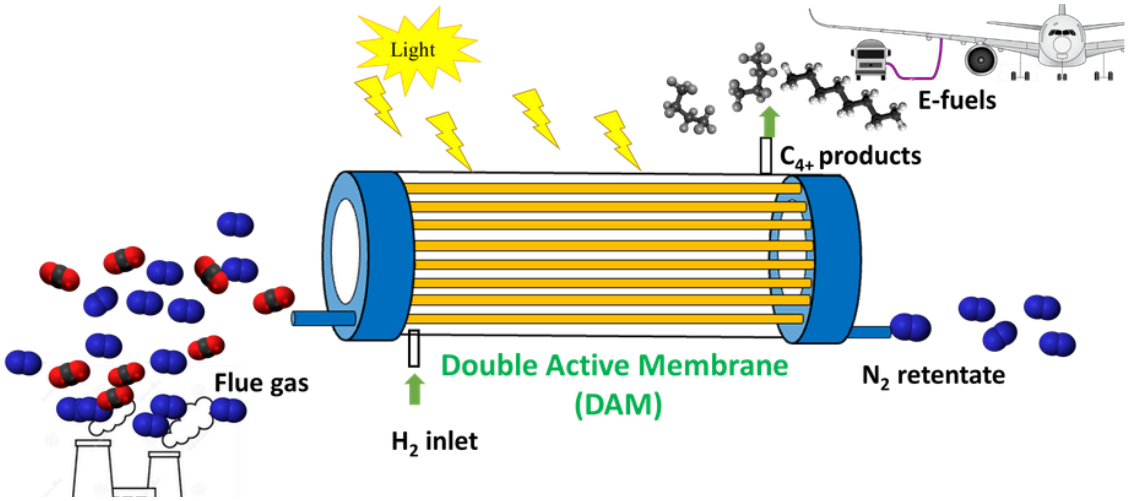
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ABOUT DAM4CO2



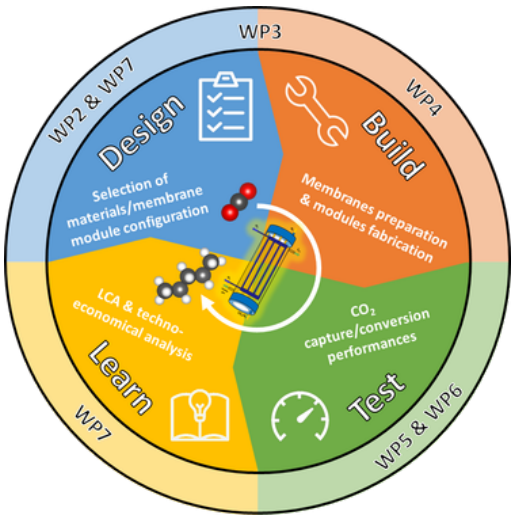
The project "Double-Active Membranes for a sustainable CO_2 cycle" ($DAM4CO_2$) aims to investigate possible ways to convert the carbon dioxide emitted by industries into renewable fuels. It is one of the eight projects, among hundred proposals submitted, funded by the European Innovation Council in the framework of the call "EIC Pathfinder Challenge: Carbon dioxide and Nitrogen management and valorisation" and it is coordinated by the Institute on Membrane Technology of the National Research Council.

The aim of $DAM4CO_2$ is to develop a novel membrane technology, for the simultaneous CO_2 separation and its photocatalytic conversion to C_{4+} molecules, as renewable fuels. The project will deliver a prototype, designed using the design-build-test-learn approach, for a proof-of-concept validation that will be tested in lab-conditions. Close attention is paid to the use of non-critical raw materials at any stage of the process, and the carbon-neutrality in order to reverse the increase of greenhouse gases emissions to mitigate the serious consequences on the global climate and to achieve the goals of the European Green Deal.



Watch the video to have a full overview of the project and follow our YouTube channel.

See on YouTube



Graphical representation of the design-build-test-learn approach that will be used in $DAM4CO_2$

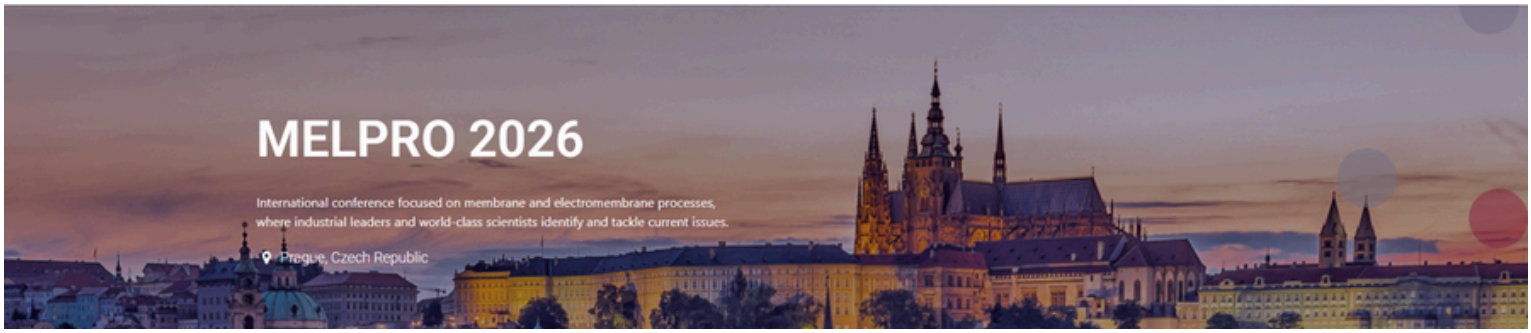
DAM4CO2 Project Extended to April 2027!

We are delighted to share that the DAM4CO2 project has been granted an official extension, resulting in a new total duration of 42 months and a project end date of 30 April 2027.



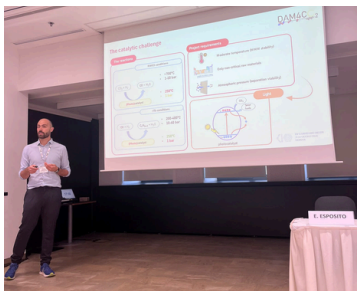
This exciting development allows our consortium valuable additional time to integrate our experimental and computational results and further enhance our advanced on double active hollow-fiber membranes. We are committed to maximizing the positive scientific, environmental, and socio-economic outcomes of our CCU research. We invite you to stay informed as we shape a more sustainable future.

DAM4CO2 Workshop: Special Session at MELPRO Prague



We had the great pleasure of organizing the DAM4CO2 satellite Workshop as part of the MELPRO 2026 conference in Prague. Co-chaired by Elena Tocci, Alessio Fuoco, and Elisa Esposito from CNR-ITM, the workshop provided a dynamic platform to present the DAM4CO2 project to the international scientific community, exchange breakthrough ideas, and showcase our latest research achievements in carbon capture and utilization technologies. We would like to express our gratitude to all the speakers who enriched the workshop with their valuable oral contributions: Alessio Fuoco (CNR-ITM), Lucia Calucci (CNR-ICCOM), Matteo Signorile (University of Turin), Hermenegildo García Baldoví (Universitat Politècnica de València / ITQ CSIC-UPV), Mariachiara Ferrari (The University of Edinburgh), Mariolino Carta (Instituto de Síntesis Química y Catálisis Homogénea), Elisa Esposito (CNR-ITM), and Elena Tocci (CNR-ITM).

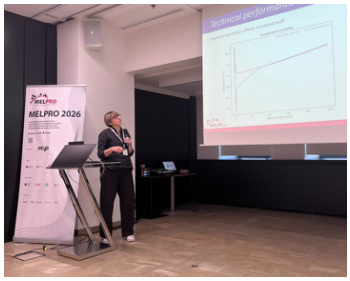




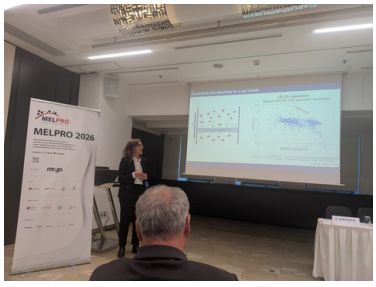






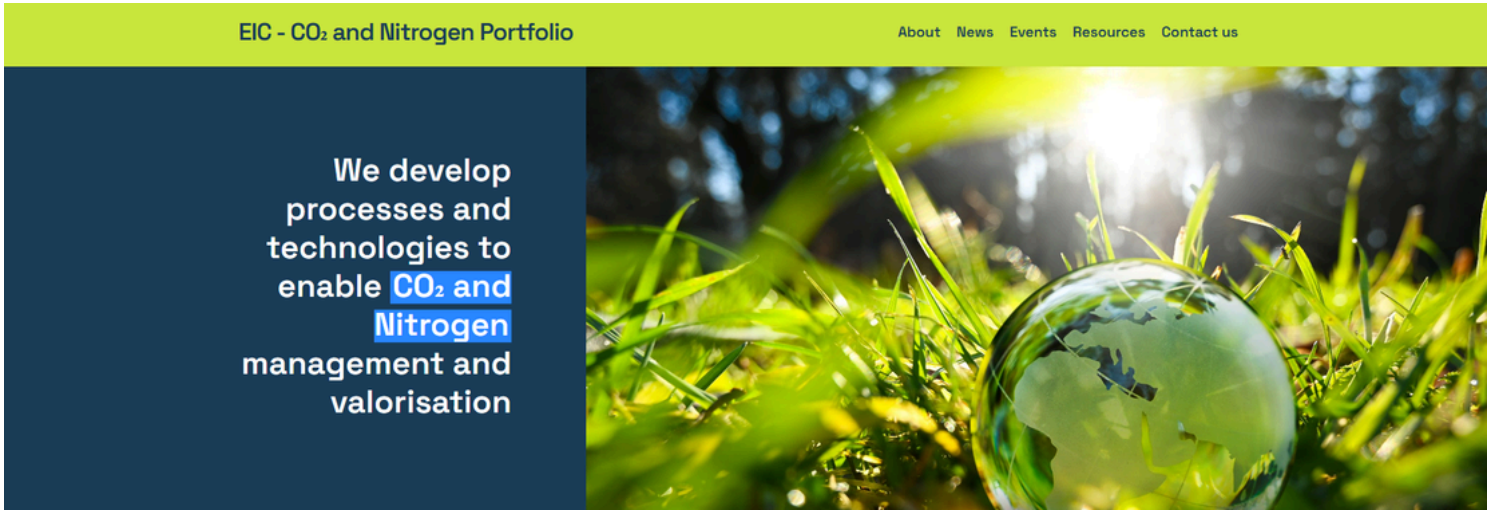








During the workshop, a special focus was dedicated to presenting the broader portfolio activities and collaborative projects associated with DAM4CO2. In particular, Alessio Fuoco delivered a comprehensive talk outlining the strategic vision and methodology behind the EIC portfolios. He highlighted the ongoing journey, key synergies, and ambitious goals of the "Carbon dioxide and nitrogen management and valorisation" portfolio, emphasizing how joint European initiatives drive innovation, facilitate knowledge exchange, and accelerate the development of sustainable technologies for industrial decarbonization.



EVENTS DAM4CO2

5th Edition of Pomeriggi di Scienza: "Artificial Intelligence and Real Impact: From Research to Applications"

Vincenzo Vigna participated in the 5th edition of Pomeriggi di Scienza, held on May 28, 2026, at the Salone degli Stemmi of the Archdiocese of Cosenza. The event was dedicated to artificial intelligence and its tangible impact on society. On this occasion, he delivered a presentation titled “Artificial Intelligence and Membranes: From Research to Sustainability Challenges,” exploring the role of AI in driving innovation within membrane technologies, with a strong focus on practical applications and key sustainability challenges.



51st Congress of the Physical Chemistry Division, Bari, July 7–10, 2026



A. Scarperi delivered the lecture "Multinuclear Solid-State NMR Investigation of Adsorption-Induced Structural Changes and CO2 Dynamics in CALF-20" on behalf of co-authors A. Scarperi, S. Bertolozzi, F. Nerli, F. Della Croce, G. Bresciani, E. Carignani, M. Taddei, and L. Calucci, highlighting cutting-edge NMR research applied to carbon capture materials.



Accademia delle Scienze di Torino, Turin, September 2026

Prof. Valentina Crocellà delivered an engaging lecture entitled “Materials for the future: addressing the challenges of carbon dioxide and water capture in the new millennium” at the prestigious Turin Academy of Sciences. Held as part of a professional development programme for upper secondary school teachers, organised by the Academy as an institution accredited by the Italian Ministry of Education and Merit, the event aimed to provide educators with up-to-date scientific knowledge and insights into pioneering research developments, thereby promoting their integration into modern school curricula.

10th Congress of the Theoretical and Computational Chemistry Division , Rome, 14–16 September 2026

From September 14 to 16, 2026, Vincenzo represented our team at the 10th Congress of the Theoretical and Computational Chemistry Division (DCTC), hosted by the Department of Chemistry at Sapienza University of Rome. The prestigious event brought together the Italian theoretical and computational chemistry community to discuss the latest methodological breakthroughs and emerging applications across diverse domains of chemical research. On this occasion, Vincenzo delivered an oral presentation, showcasing our recent computational achievements and engaging in fruitful scientific exchanges with leading experts in the field.





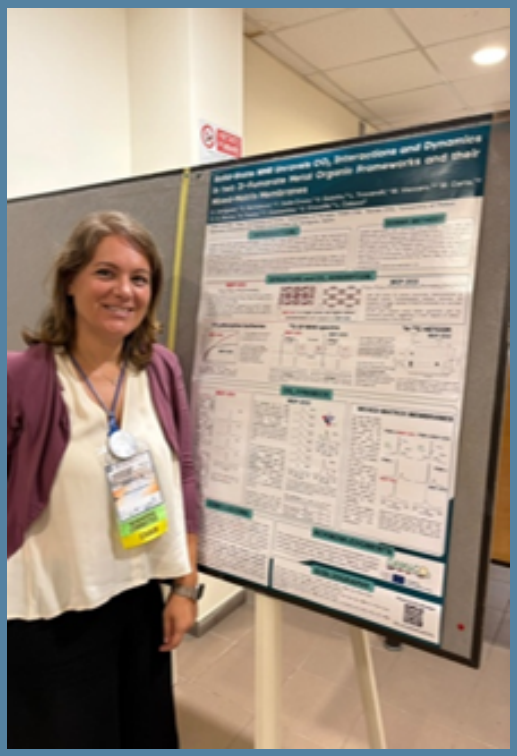


Società Chimica Italiana

53rd National Congress on Magnetic Resonance, Caserta, September 9–11, 2026

A. Scarperi gave the lecture "Solid-State NMR Insights into Hydration, Framework Flexibility, and Guest Dynamics in CALF-20" on behalf of co-authors A. Scarperi, S. Bertolozzi, F. Nerli, F. Della Croce, G. Bresciani, E. Carignani, M. Taddei, and L. Calucci, highlighting key findings on metal-organic framework interactions.



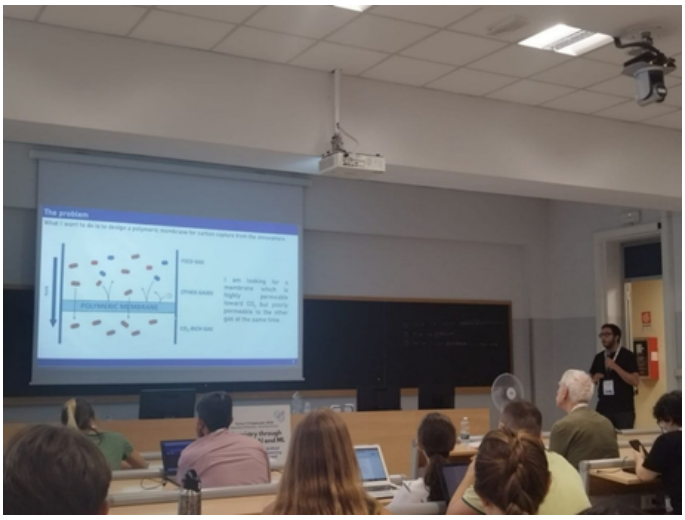


E. Carignani presented the poster "Solid State NMR Unravels CO2 Interactions and Dynamics in Two Zr-Fumarate Metal-Organic Frameworks and Their Mixed-Matrix Membranes" on behalf of co-authors E. Carignani, S. Bertolozzi, F. Della Croce, V. Guiotto, L. Trovarelli, M. Vaccaro, M. Carta, C.G. Bezzu, A. Fuoco, F. Costantino, V. Crocellà, and L. Calucci.



Chemistry Through the Eyes of AI and ML" School ,Turin, September 7–11, 2026







Società Chimica Italiana

Divisione di Chimica Fisica – Divisione di Chimica Teorica e Computazionale

Con la presente si certifica che

Vincenzo Vigna

Riceve l'**Award** per il contributo flash:

RAGMODEX: Retrieval-Augmented Generation for Molecular Design and Explainable AI - Interpretable QSAR for Guided Molecular Design

Presentato alla Scuola "Chemistry through the eyes of AI and ML" della Divisione di Chimica Fisica e della Divisione di Chimica Teorica e Computazionale della Società Chimica Italiana.

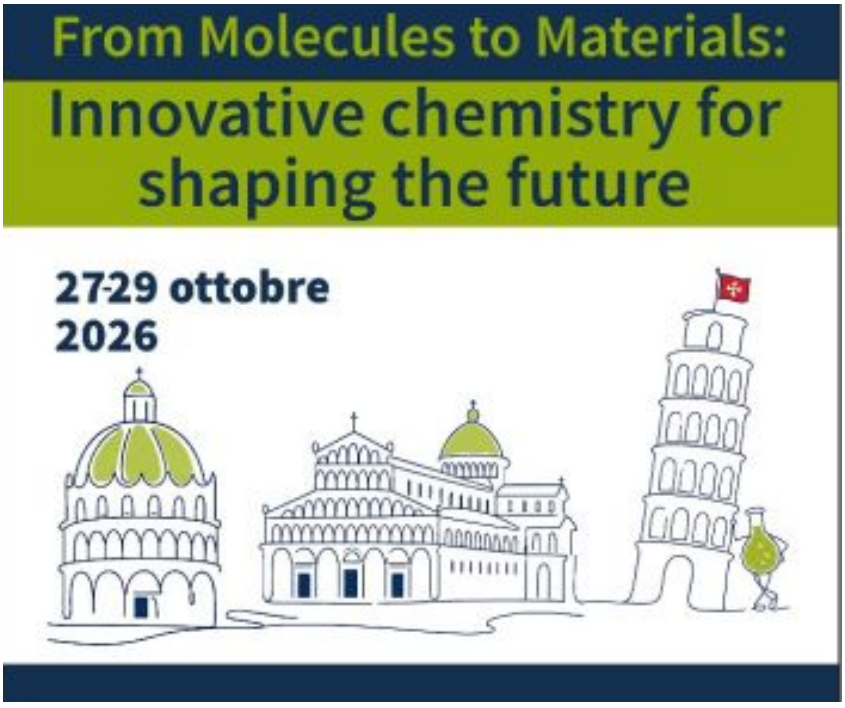
Torino, 11 settembre 2026

Prof. Piero Ugliengo
Presidente del Comitato Organizzatore della scuola

From September 7 to 11, 2026, Vincenzo represented our project at the prestigious summer school "Chemistry Through the Eyes of AI and ML," hosted by the Department of Chemistry at the University of Turin. The program was specifically designed to explore the frontier where artificial intelligence and machine learning intersect with modern chemistry and materials science. During the event, Vincenzo presented a flash talk titled "Generative AI and Information Retrieval for Interpretable Molecular Design." His contribution stood out for its innovative approach, demonstrating how combining generative AI algorithms with intelligent information retrieval systems can dramatically accelerate the discovery and tailored design of novel molecules. We are thrilled to share that his presentation was recognized by the scientific committee with a best flash presentation award, underscoring the high impact of integrating model interpretability into AI-guided molecular engineering.







The DAM4CO2 team actively participated in the Giornate Scientifiche DSCTM, hosted in Pisa under the theme "From Molecules to Materials: Innovative chemistry shaping the future." The conference brought together leading researchers from across the national scientific community to showcase how pioneering chemical research can address global sustainability and energy challenges. Representing CNR-ICCOM within the DAM4CO2 project, Lucia Calucci and Elisa Carignani showcased the poster "Understanding materials for the energy and ecological transition by solid-state NMR"—co-authored by Silvia Borsacchi, Lucia Calucci, Elisa Carignani, Silvia Pizzanelli, and Andrea Scarperi, highlighting the essential role of advanced solid-state NMR techniques in revealing atomic-scale structural features and host-guest dynamics. At the same time, CNR-ITM further enriched the project's contributions with an oral presentation by Alessio Fuoco entitled "Photocatalytic mixed matrix membrane for efficient CO_2 management and valorisation" and a poster presentation by Martina Vaccaro titled "Advanced Sustainable Hollow Fiber Supports for CO2 capture and conversion", driving scientific discussions on novel membrane-based technologies for a sustainable future.



During the European Researchers' Night (SuperScienceMe), covering Calabria and Basilicata, the 2026 edition embraced the theme "Research is your North STAR." On this occasion, DAM4CO$_2$ researchers actively engaged with the public by presenting both the project and the broader EIC Carbon and Nitrogen Portfolio, highlighting the essential role of carbon and nitrogen cycles in driving a sustainable future.

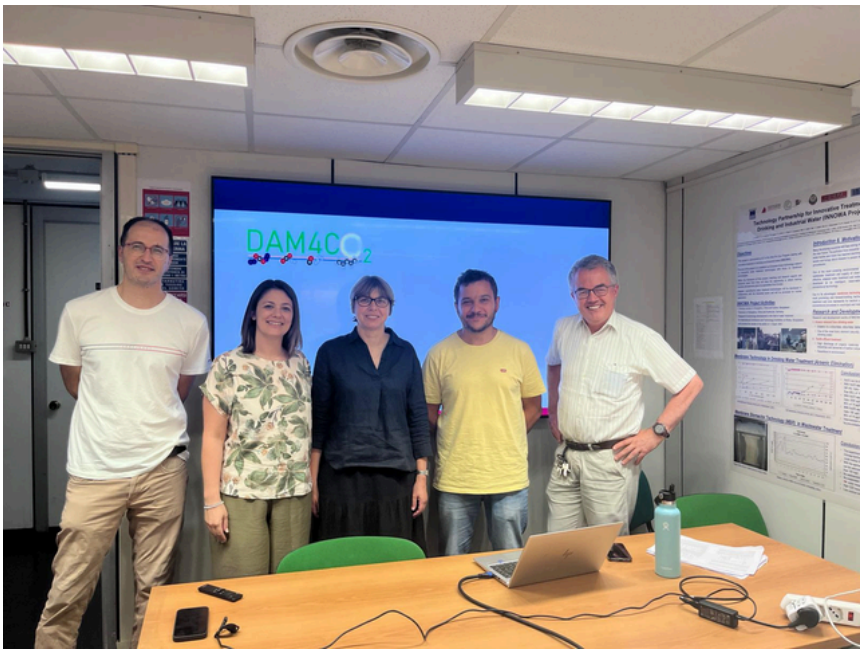






The event provided an excellent platform to interact with a diverse audience, ranging from primary school pupils to university students and professors. Through the interactive SuperVal card game, younger participants were able to discover complex scientific concepts in a fun, accessible, and hands-on manner

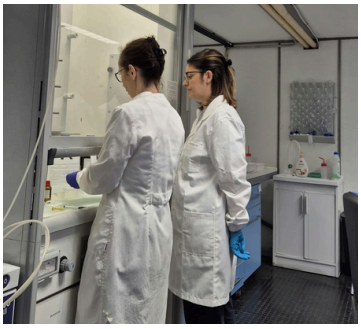
Scientific visit

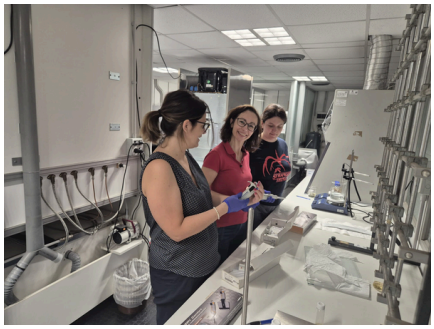


In June, as part of the DAM4CO2 project, Professor Mariachiara Ferrari completed a two-week visiting research stay at CNR-ITM. During her visit, she delivered a lecture entitled "Thermally efficient membrane-based carbon capture: "*A techno-economic optimisation of performance-cost trade-offs*." This stay provided an invaluable opportunity to exchange insights on recent project outcomes, discuss ongoing research developments, and foster closer collaboration on future modeling and experimental strategies within the DAM4CO2 project.

Scientific visit

In July, Dr. Grazia Bezzu and Prof. Mariolino Carta spent a three-week visiting period at CNR-ITM as part of ongoing research activities linked to the DAM4CO2 project. During this stay, Dr. Bezzu carried out research awarded through the Short Term Mobility (STM) Program 2026, alongside Dr. Elisa Esposito, focusing on the "*Investigation of water vapour, O2 and H2 Transport in Quaternized Tröger's Base Polymers for High-Performance Anion Exchange Membranes*." This visit offered a valuable opportunity to advance experimental research, exchange preliminary findings, and further align joint efforts between the project teams.







ARTICLE

PUBLISHED

1. Virginia Guiotto, Elisa Carignani, Letizia Trovarelli, Martina Vaccaro, Francesco Della Croce, Siria Bertolozzi, Mariolino Carta, C. Grazia Bezzu, Alessio Fuoco, Ferdinando Costantino, Lucia Calucci, Valentina Crocellà "Impact of framework topologies on CO2 adsorption and transport properties in Zr-fumarate metal–organic frameworks and their mixed-matrix membranes" Mater. Adv. 2026, 7 (18), 9057–9069. https://doi.org/10.1039/d6ma00781c

2. Mostafa Jafari, Kamran Ghasemzadeh, Maria-Chiara Ferrari, Adele Brunetti, Simona Liguori, Rashid Jamshidi "New integrated CCS and CCU schemes with small-scale biogas-fired combined-cycle power plant: A Comparative techno-economic assessment", Fuel Processing Technology, 2026 (DOI: 10.1016/j.fuproc.2026.108449)

3. Vincenzo Vigna, Mariagiulia Longo, Marcello Monteleone, Johannes C. Jansen, Mariolino Carta, C. Grazia Bezzu, Neil B. McKeown, Alessio Fuoco, Elena Tocci, Machine learning as a microscope: Uncovering structure-Property relationships in polymeric membranes for CO2 separation | Journal of Membrane Science, 2026 (DOI: 10.1016/j.memsci.2026.125426)

4. Mariagiulia Longo, Md Khairul Amin, Marcello Monteleone, Pegah Hajivand, Alessio Fuoco, Chunchun Ye, Johannes C. Jansen, Neil B. McKeown, Light gas and propene/propane permeabilities of copolymers of intrinsic microporosity containing highly rigid triptycene-like naphthopleiadene or spiropyrimidinone units | Journal of Membrane Science, 2026 (DOI: 10.1016/j.memsci.2026.125466)

5. Pegah Hajivand, Mariagiulia Longo, Marcello Monteleone, Alessio Fuoco, Elisa Esposito, Teresa Fina Mastropietro, Javier Navarro-Alapont, Donatella Armentano, Johannes Carolus Jansen, Sustainable Thin-Film Composite Mixed-Matrix Membranes Based on Cellulose Acetate, Bimetallic ZIF-8-67, and Ionic Liquid for Enhanced Propene/Propane Separation, 2026 Polymers (2026). DOI: 10.3390/polym18030396

6. Yuting Li, C. Grazia Bezzu, Anže Zupanc, Luis Simbari, Shrestha Banerjee, Dominik J. Kubicki, Tomislav Friščić, Marjan Jereb, Ross D. Jansen-van Vuuren, Mariolino Carta, Stefan Bräse, [2.2]Paracyclophane-Based Polyimides of Intrinsic Microporosity for Gas Separation, ACS Appl. Polym. Mater. (2026). DOI: 10.1021/acsapm.6c00411

7. Francesca Nerli, Virginia Guiotto, Francesca Nardelli, Andrea Giovanelli, Linda Bizzarro, Federico Zizzi, Matteo Signorile, Marco Geppi, Lucia Calucci, Valentina Crocellà, Marco Lessi, Marco Taddei, On the Role of Linker Fluorination in the Adsorption-Induced Structural Response of CeIV-Based Metal-Organic Frameworks | Chemistry – A European Journal (2026). DOI: 10.1002/chem.70830

8. Francesca Nerli, Virginia Guiotto, Francesca Nardelli, Andrea Giovanelli, Linda Bizzarro, Federico Zizzi, Matteo Signorile, Marco Geppi, Lucia Calucci, Valentina Crocellà, Marco Lessi, Marco Taddei,"On the Role of Linker Fluorination in the Adsorption-Induced Structural Response of CeIV-Based Metal-Organic Frameworks"Chemistry – A European Journal (2026). DOI: 10.1002/chem.70830

9. C. Grazia Bezzu, Natasha Hawkins, Rebecca Foster, Ariana R. Antonangelo, James W. Ryan, Anna Williamson, Mariolino Carta,"Hyper-Cross-Linked Microporous Polymers as Cheap and Efficient Catalysts for the Synthesis of Biodiesel"ACS Appl. Eng. Mater. (2026), 4 (4). DOI: 10.1021/acsaenm.6c00096

10. Letizia Trovarelli, Virginia Guiotto, Maria Sole Notari, Lorenzo Isidoro, Giacomo Provinciali, Concetta Bafaro, Andrea Rossin, Martino Degli Innocenti, Naomi Anna Consoli, Moreno Lelli, Marco Taddei, Matteo Signorile, Valentina Crocellà, Ferdinando Costantino,"Structure and Carbon Dioxide Adsorption Properties of a Nanosized Aluminum l-Aspartate Metal–Organic Framework"ACS Applied Nano Materials (2026). DOI: 10.1021/acsanm.6c00412

11. Carmen Rizzuto, Haoli Zhou, Ariana R. Antonangelo, C. Grazia Bezzu, Johannes Carolus Jansen, Mariolino Carta, Alessio Fuoco,"Enhancement of the gas separation performance of mixed matrix membranes (MMMs) with functionalized triptycene hypercrosslinked polymers of intrinsic microporosity (HCP-PIMs)"Separation and Purification Technology (2026), Volume 382, Part 2, 135814. DOI: 10.1016/j.seppur.2025.135814

12. Giulio Bresciani, Marco Taddei,"Revisiting the Crystal Structure of Metal-Organic Framework UTSA-16 for Chemical Consistency",, ACS Org. Inorg. Au (2026), 6 (3), 277–281. DOI: 10.1021/acsorginorgau.6c00018

13. Francesco Della Croce, Giulio Bresciani, Marco Taddei, "Squarate-based isoreticular analogue of CALF-20: fact or fiction?"Crystal Growth & Design (2026), 26 (16), 6310–6318. DOI: 10.1021/acs.cgd.6c00193

14. Francesca Nerli, Francesca Nardelli, Virginia Guiotto, Valentina Crocellà, Marco Taddei, Lucia Calucci, "Metal-Dependent Adsorption Mechanism in Perfluorinated MIL-140A Metal–Organic Frameworks",ACS Omega (2026), 11 (24), 35957–35964. DOI: 10.1021/acsomega.6c02924

15. Yuancheng Liu, John M. Tobin, Gary S. Nichol, Dominic Taylor, Jiyao Huang, Carmen Rizzuto, Johannes C. Jansen, Alessio Fuoco, Neil B. McKeown, "An epoxydinaphthalene monomer for the synthesis of a poly (aryl ether sulfone) and a poly (aryl ether ketone) with enhanced performance for membrane gas separations" Polym. Chem. (2026), 17 (35), 3816–3821.

16. P. Hajivand, E. Esposito, M. Longo, M. Monteleone, A. Fuoco, T.F. Mastropietro, D. Armentano, M. Carta, C.G. Bezzu, J.C. Jansen, "Strong Hints of Antiplasticization by Multivariate ZIF-8-67 in PIM-EA(Me2)-TB-Based Mixed-Matrix Membranes for Propene/Propane Separation", ACS Applied Materials & Interfaces (2026), 48054.

UNPUBLISHED

1. Carmen Rizzuto, Francesca Nerli, Virginia Guiotto, Francesca Nardelli, Lucia Calucci, Valentina Crocellà, Marco Lessi, Marco Taddei, Alessio Fuoco, Tailoring Gas Transport Properties in MOF-Based Mixed Matrix Membranes: The Role of Filler Morphology and Surface Functionalization, accepted for publication in ACS Omega.

2. Manuscript entitled "Bridging Zeolites and Metal-Organic Frameworks: Alkali Metal Cation Modulation in Zn-based UTSA-16" was submitted to Materials Today Chemistry.

EVENTS PAST& FUTURE

May 2026 – **Accademia Nazionale dei Lincei Conference (Rome, Italy):** Prof. Silvia Bordiga delivered an oral presentation entitled "From molecules to materials".

May 2026 – **5th Ed. Pomeriggi di Scienza (Cosenza, Italy)**: Vincenzo Vigna presented an oral contribution entitled "Artificial intelligence and membranes: from research to sustainability challenges".

June 2026 – **GIC 2026 / XXIV National Catalysis Congress (Turin, Italy):**

- Prof. Valentina Crocellà served as a member of the local organizing committee.
- Dr. Margherita Cavallo presented a poster entitled "Photo-thermal CO2 Reduction over Cu–Fe Oxide: an Infrared Study of Powder and Membrane Systems".
- Federico Panagini delivered an oral presentation entitled "FeZnCuK Mixed-Metal Oxide Catalysts for Mild CO2-to-Hydrocarbons Conversion in Double-Active Membranes".

June 2026 – **15th INSTM Conference (Genoa, Italy):**

- Prof. Marco Taddei gave a short talk entitled "A mild water-based route to synthesise UiO-66 from terephthalate esters".
- Prof. Matteo Signorile delivered an oral contribution entitled "CO2 conversion to light hydrocarbons on membrane-embedded catalysts".

June 2026 – **ICCC26 (Odense, Denmark):** Prof. Marco Taddei gave an invited talk entitled "Squarate-Based Isoreticular Analogue Of CALF-20: The MOF That Should Not Be".

July 2026 – **BOSS 19th Belgian Organic Synthesis Symposium (Leuven, Belgium):** Marco Lessi et al. presented a poster entitled "Synthesis of PIM-1 oligomers for the surface functionalisation of Metal-Organic Frameworks. Application in the preparation of mixed matrix membranes".

J**uly 2026** – **CDCF51 / 51st Congress of the Physical Chemistry Division (Bari, Italy):**

- Federico Panagini delivered an oral contribution entitled "Structural Insights on FeZnCuK Catalysts for Mild Photothermal CO2-to-Hydrocarbons".
- Andrea Scarperi et al. presented a lecture entitled "Multinuclear Solid-State NMR Investigation of Adsorption-Induced Structural Changes and CO2 Dynamics in CALF-20".

July 2026 – F**EZA 2026 (Naples, Italy):**

- Prof. Silvia Bordiga delivered a plenary talk entitled "Zeolites and MOFs for Energy Transition and Air Remediation".
- Prof. Valentina Crocellà delivered an oral contribution entitled "Shaping microporous materials for real-world applications: how 3D printing governs CO2 adsorption in zeolites and MOFs".
- Dr. Virginia Guiotto presented a poster entitled "From Zeolites to MOFs: Counterion-Driven Adsorption in the Metal-Organic Frameworks UTSA-16".

July 2026 – **ECC10 / 10th EuChemS Chemistry Congress (Antwerp, Belgium)**: Prof. Marco Taddei presented a poster entitled "A water-based synthetic route to the metal-organic framework UiO-66 starting from PET derived terephthalate esters".

September 2026 – **Shaping 10 Conference (Padua, Italy)**: Dr. Margherita Cavallo presented an oral contribution entitled "Layered Double Hydroxides for CO2 capture at medium-high temperature: from powder to 3D monoliths".

September 2026 – **53rd National Congress on Magnetic Resonance (Caserta, Italy):**

- Andrea Scarperi et al. presented a lecture entitled "SOLID-STATE NMR INSIGHTS INTO HYDRATION, FRAMEWORK FLEXIBILITY, AND GUEST DYNAMICS IN CALF-20".
- Dr. Elisa Carignani et al. presented a poster entitled "SOLID STATE NMR UNRAVELS CO2 INTERACTIONS AND DYNAMICS IN TWO Zr-FUMARATE METAL-ORGANIC FRAMEWORKS AND THEIR MIXED-MATRIX MEMBRANES".

September 2026 – School "Chemistry through the Eyes of AI and ML" (Turin, Italy): Vincenzo Vigna participated and won an award for his flash contribution on AI/ML-guided molecular design.

September 2026 – X Congress of the Theoretical and Computational Chemistry Division (Rome, Italy): Vincenzo Vigna delivered an oral communication on recent computational chemistry methodologies.

October 2026 – MELPRO 2026 (Prague, Czech Republic): Dr. Lucia Calucci et al. delivered a lecture entitled "SOLID-STATE NMR AS A TOOL TO STUDY CO2 ADSORPTION MECHANISMS IN MEMBRANES".

October 2026 – DSCTM Department Days "From Molecules to Materials" (Pisa, Italy):

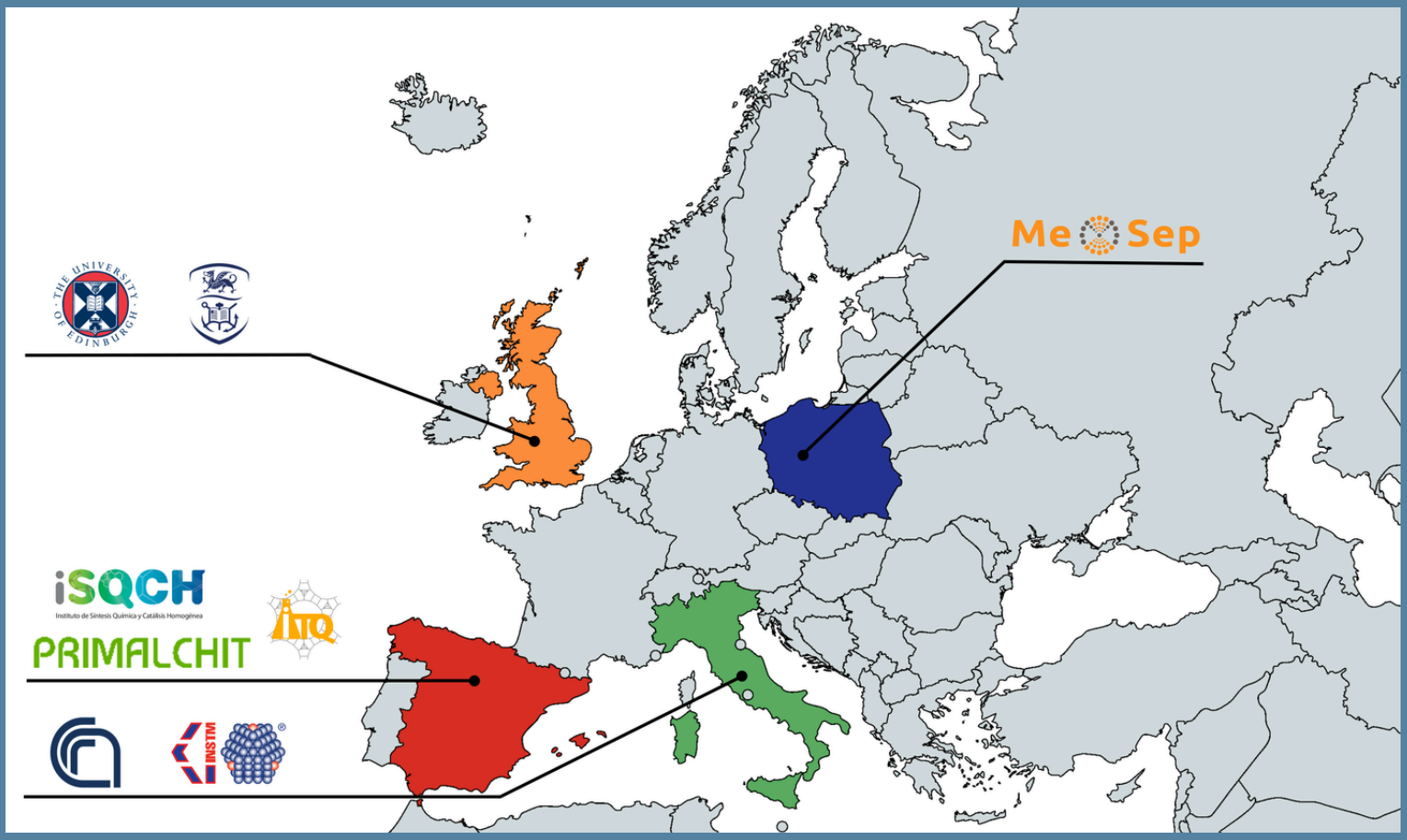
- Martina Vaccaro presented a poster entitled "Advanced Sustainable Hollow Fiber Supports for CO2 capture and conversion".
- Dr. Lucia Calucci, Dr. Elisa Carignani et al. presented a poster entitled "Understanding materials for the energy and ecological transition by solid-state NMR".
- A.Fuoco, delivered an oral presentation entitled "Photocatalytic mixed matrix membrane for efficient CO_2 management and valorisation".

FUTURE EVENTS

November 2026 – **Pore2Med Congress** (Ayia Napa, Cyprus): Dr. Margherita Cavallo and Dr. Virginia Guiotto will attend and deliver oral presentations detailing project outcomes.

July 2027 – **EuroMOF Congress:** Prof. Valentina Crocellà, Prof. Ferdinando Costantino, and Prof. Marco Taddei will serve as members of the local organizing committee.

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European Innovation Council
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UK Research and Innovation

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