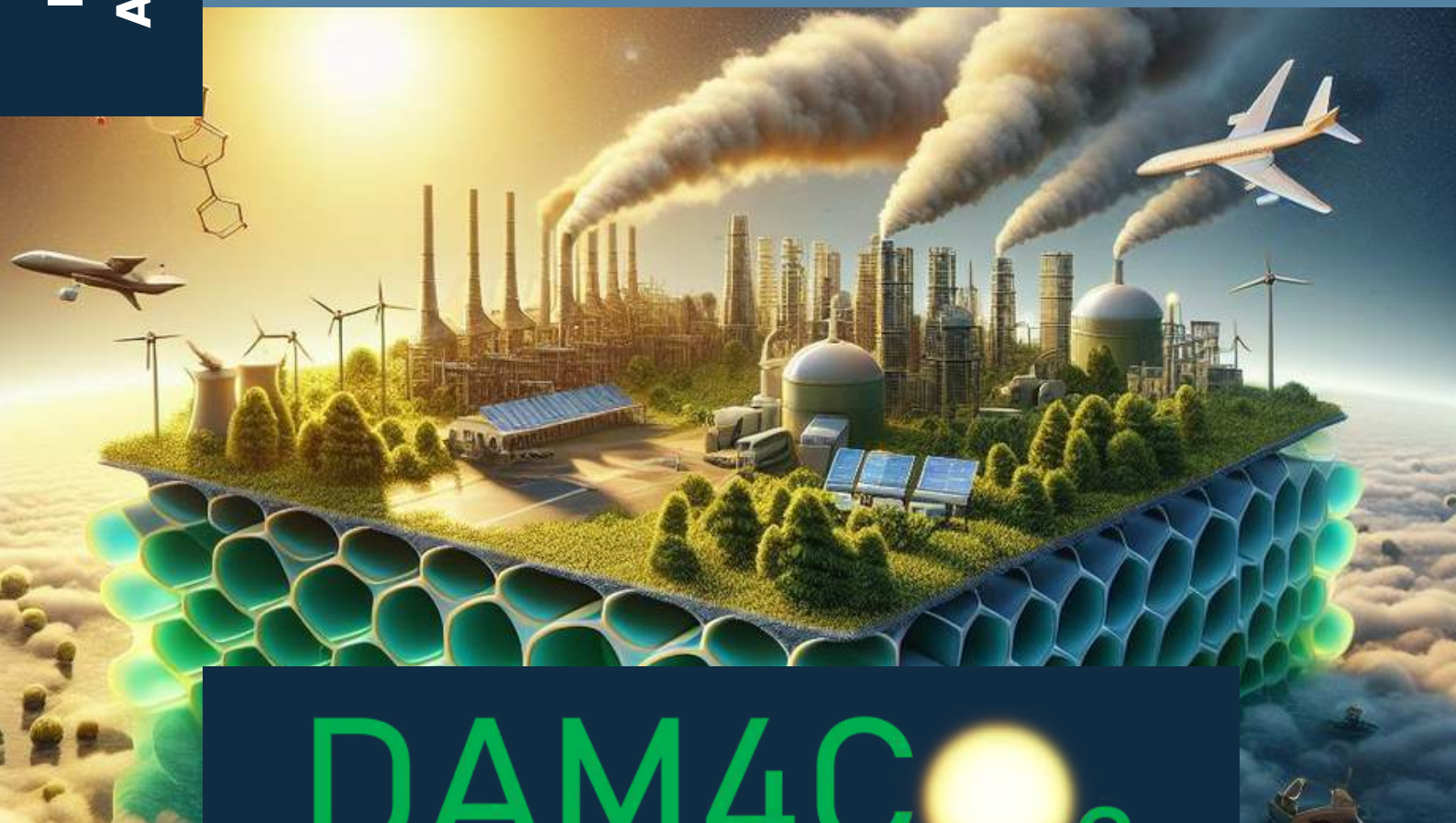


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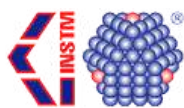
NEWSLETTER



DAM4C₂

Double-Active Membranes for
a sustainable CO₂ cycle

PARTNERS



Me Sep

PRIMALCHIT

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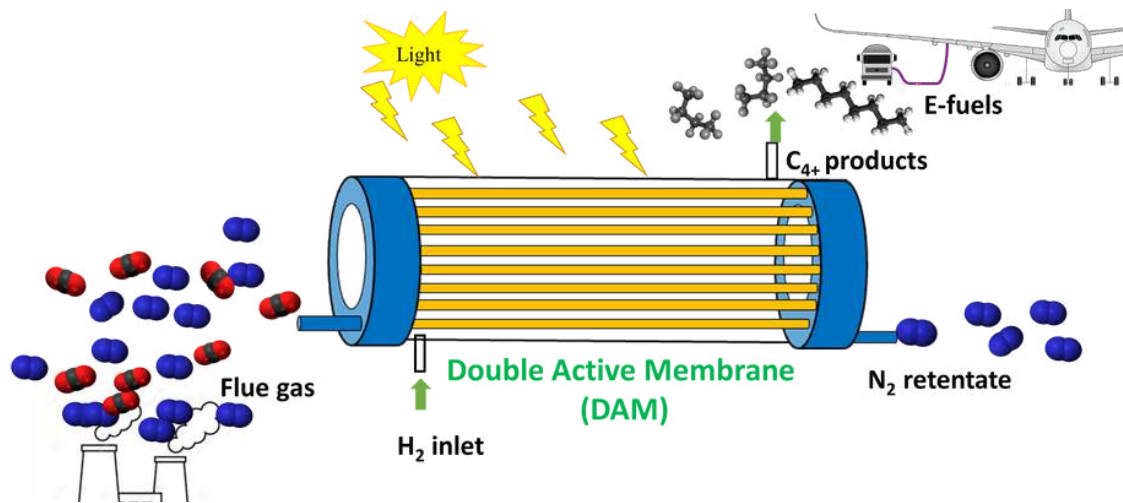
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ABOUT DAM4CO₂



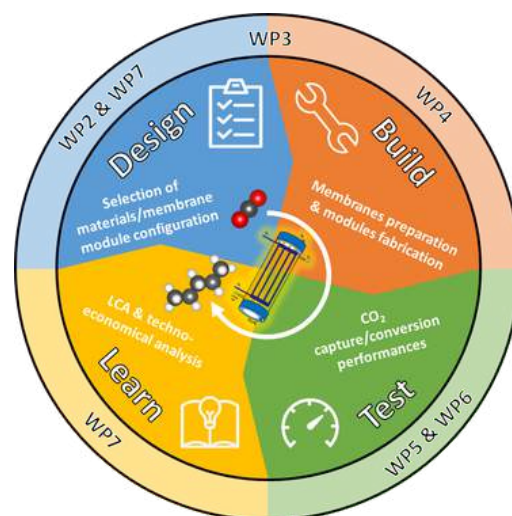
The project “Double-Active Membranes for a sustainable CO₂ cycle” (DAM4CO₂) aims to investigate possible ways to convert the carbon dioxide emitted by industries into renewable fuels. It is one of the eight projects, among hundred proposals submitted, funded by the European Innovation Council in the 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 DAM4CO₂ is to develop a novel membrane technology, for the simultaneous CO₂ separation and its photocatalytic conversion to C₄₊ 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 will be 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 DAM4CO₂

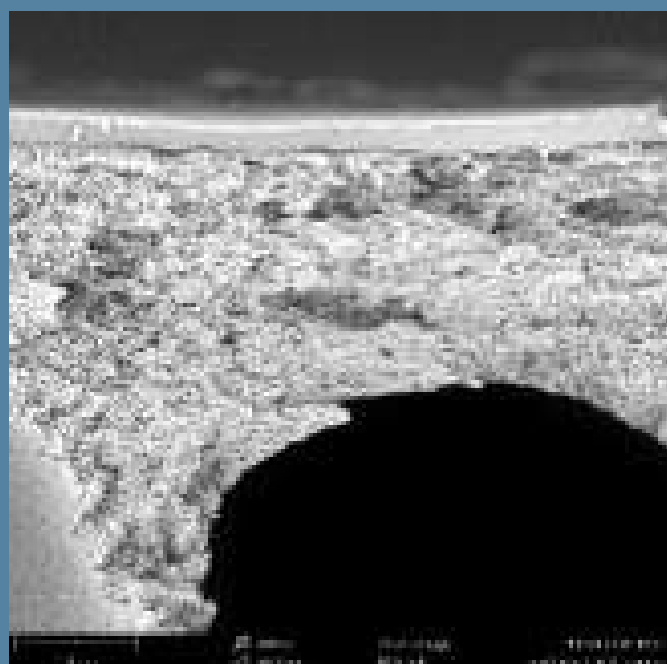
ABOUT DELIVERABLES

DAM4CO₂

Deliverable 4.2

The preparation of Thin Film Composite (TFC) membrane is the most versatile way to produce a membrane with a thin selective layer and a strong porous substrate. A good preparation protocol is crucial to obtain a defect-free and selective membrane, and it will likely play a crucial role to meet the DAM4CO₂ targets. It will also be a pivotal procedure for the future exploitation of the project's innovation. The deliverable 4.2 focused on this technological aspect, which represent the first step in the lab-to-market journey during membrane development.

Currently, there are several methods to produce TFCs and for a consistent screening of the preparation protocols we have mainly used commercial supports, with well-defined specifications, while using different coating techniques and coating solution parameters and conditions. For this deliverable, we have explored 3 different coating methods: i) casting with the traditional doctor blade, ii) the spin-coating and iii) the double-kiss coating method. The latter has been specifically developed within the DAM4CO₂ framework, and this membrane preparation procedure can be taken into consideration for IP protection.



Optical picture of a uniform and defect-free layer of PIM-1 over a support (left) and the SEM image of its cross-section (right), as example of the TFCs produced within the deliverable D4.2.

3rd PROJECT MEETING

5-6 November 2024 - Lucca (IT)



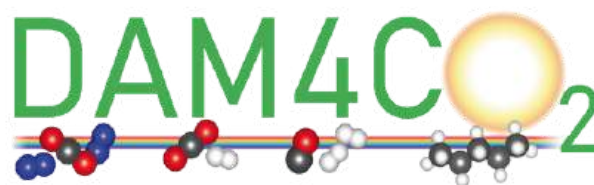
The 12 months meeting of our project was jointly organized by INSTM and CNR-ICCOM in Lucca (Italy) on Nov 5-6, 2024. 20+ partners participated in person to the meeting, while others were virtually connected exploiting the hybrid nature of the meeting.

The first day was devoted to the discussion of the experimental results, while the second day was the right time to discuss the results from the in-silico experiments, the portfolio and dissemination activities. We have also allocated some time to discuss the preparation of the first review meeting of DAM4CO₂. We are glad to inform that the project implementation was positively evaluated, and we got some suggestions to improve our action.





EVENTS



On February the 11th 2025, DAM4CO₂ participated to the IUPAC Global Women's Breakfast (GWB). The IUPAC GWB is a global event aimed at establishing an active network of people to overcome the barriers to gender equality in science. Groups from all types of science organizations from high schools, to science societies, universities, companies, governments and non-governmental organizations are invited to organise local events on the same day. The 2025 edition touched the record of 448 events all over the world.

DAM4CO₂ organized 3 local events in Rende (IT), Pisa (IT), and Swansea (UK) to exchange ideas and discuss about the gender and diversity inclusion in European Projects. The coffee breaks were sponsored by DAM4CO₂, and while drinking our coffee, some data on the involvement of women in European projects were presented and discussed together with strategies to encourage gender and diversity inclusion. In total, more than 100 participant were present, including master and PhD students, researchers and professors from CNR, University of Pisa, University of Calabria, Swansea University and associated institutions.

In Pisa and Rende, the participants also joined the online event of the Italian National Commission for IUPAC (NAO-CNR):
 "The Periodic Table's Women" a lecture by Prof. Margherita Venturi (University of Bologna).





European Innovation Council
 Funded by the European Union

February, 11th 2025, 10 AM

 Rende (IT), Pisa (IT), and Swansea (UK)

Global Women's Breakfast 2025



COMMUNICATION ACTIVITIES



In March 2025, Valentina Crocellà and Matteo Signorile (INSTM unit) participated as speakers to a dissemination event at “University of the Third Age” (Cuneo - Italy) with the title: “From waste to resource: carbon dioxide capture and conversion, towards a sustainable future”. The event involved a non-specialized audience of ca. 200 participants and a Youtube link of the event (in Italian) is available [here!](#)

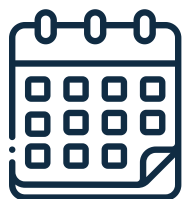


From December to March, Alessio Fuoco presented the DAM4CO₂ concept as well as what an EIC or Horizon Europe project is in different schools. This dissemination events were organized together with a colleague from CNR-ITM, Maria Concetta Carnevale, in the framework of the “Researchers at Schools” – SuperScienceMe – Research is your Elevation action.



April 2025: Margherita Cavallo and Virginia Guiotto (INSTM unit) attended a series of dissemination events as speakers. The event focused on preparing six different chemistry lessons for children aged nine/ten years old, with special emphasis on climate change and CO₂.





EVENTS PAST & FUTURE

CONGRESS & SEMINARS

- *December 2024*, Luigi Vaccaro, Ferdinando Costantino, Alessio Fuoco, Letizia Trovarelli and Federico Panagini attended the “2nd Workshop of the Italian PhD Program in Catalysis” in Reggio Calabria. Letizia and Federico gave oral presentations on: "Synthesis, characterization, and testing of Metal-Organic Frameworks (MOFs) for CO₂ separation and conversion in Mixed Matrix Membranes (MMMs)" (Trovarelli) and “Metal- and metal-oxide-based catalysts for photothermal reductions” (Panagini).
- Invited seminar at the University of Valladolid (06/03/2025) “Polymers of Intrinsic Microporosity (PIMs): Materials for Advanced Applications”
- Invited seminar at the University of Ljubljana (16/03/2025) “Polymers of Intrinsic Microporosity (PIMs): Materials for Advanced Applications”

WHERE YOU WILL FIND US

- *May 2025*: 15th Fundamentals of Adsorption, Porto - Portugal.
- *June 2025*: 8th Annual UKPorMat Conference (03-04/06/2025) Birmingham,
- *June/July 2025*: Joint 50th Congress of the Physical Chemistry Division of the Società Chimica Italiana and 5th European Conference on Physical Chemistry (CDCF50&5thECPC), Pisa, 29 June - 3 July 2025
- *June/July 2025*: World Filtration Congress (WFC14) in Bordeaux from June 30 to July 4.
- *July 2025*: 40th European Membrane Society Summer School in Enschede from July 6th to 11th
- *September 2025*: 52ND Italian National Conference on Magnetic Resonance, Verona, 10-12/09/2025
- *September 2025*: Imagine Membrane | Azores 14-19 September
- *September 2025*: CDGO 2025 (XLII Convegno Nazionale della Divisione di Chimica Organica, CDGO 2025), Villasimius (21-25/09/2025) Cagliari (IT).
- *September 2025*: 9th International Conference on Semiconductor Photochemistry (SP9), Madrid -Spain.
- *September 2025*: 6th European Conference on Metal Organic Frameworks and Porous Polymers (EuroMOF2025), Crete - Greece.
- *October 2025*: INSTM Young Researchers' Forum, Napoli - Italy
- *October 2025*: 105th IUVESTA workshop on “Characterization of gas transport through materials: applications to Vacuum Science and Technology” will be held between 21st and 24th of October 2025

PEOPLE HIRED ON THE PROJECT



Arturo Sanz Marco was born in Valencia in 1993. After completing his Bachelor's degree in Energy Engineering at the Universidad Politécnica de Valencia in 2015, he continued his scientific training by earning a Master's degree in Materials Engineering from the Universidad Politécnica de Madrid. Following a brief collaboration at the Instituto Universitario de Ciencias de los Materiales de la Universidad de Valencia, he pursued his PhD studies in the Department of Chemical Engineering and Environmental Technology, developing photocatalytic materials for CO₂ hydrogenation within the Nanofilms And Particles (NFP) group, part of the Instituto de Nanociencia y Materiales de Aragón (INMA). After defending his thesis in early 2024, he took part for a year in the BONIFACE project, developing solutions to integrate perovskite-based solar cells into ceramic materials for construction. He has recently joined the team at the Instituto de Tecnología Química as part of the DAM4CO₂ project. His research focuses on environmental photocatalysis, electronic physics, and the synthesis and characterization of nanostructured materials.



Dr. **Margherita Cavallo** received his Master's degree in Materials Science from the University of Torino in 2020. In 2021, she joined the Doctoral School in Chemistry and Material Science at the same institution. She defended her PhD thesis titled "Exploring innovative materials for carbon dioxide capture and valorisation" in February 2025. Since 2020, her research has focused on the advanced characterization of materials for Carbon Dioxide Capture, Utilization, and Storage (CCUS). Her expertise includes the physical-chemical characterization of adsorbents and catalysts using techniques such as transmission IR, ATR, DRIFT, Raman, DR-UV-Vis spectroscopies, volumetry, microcalorimetry, XRD, and TGA. She has participated in two funded research projects: "SATURNO" (Scarti organici e Anidride carbonica Trasformati in carbURanti, fertilizzanti e prodotti chimici; applicazione concreta dell'econoMia circolare), a regional European-funded project, and "4AirCRAFT" (Air Carbon Recycling for Aviation Fuel Technology) funded by the European Union's Horizon 2020 research and innovation programme. Since November 2024, she has been involved in the European project DAM4CO₂"Double Active Membranes for a Sustainable CO₂ Cycle", under the supervision of Dr. Matteo Signorile and Prof. Valentina Crocellà.

Siria Bertolozzi received her Master's degree in Chemistry from the University of Pisa in September 2024, with a master thesis on new selenourea based chiral solvating agents for NMR enantiodiscrimination of amino acid derivatives. In November 2024, she joined the European project "Double Active Membranes for a Sustainable CO₂ Cycle" (DAM4CO₂) under the supervision of Dr. Lucia Calucci. Her research focuses on the characterisation of fillers (Metal-organic frameworks and insoluble polymers), soluble polymers, and mixed matrix membranes developed within DAM4CO₂ through solid-state NMR techniques with aim of obtaining detailed information on structure and dynamics of the investigated compounds and their interactions with CO₂.



Alessandro Rizzuti, with a Master's degree in Business Administration and Management, has acquired in-depth knowledge mainly in economics field and various multidisciplinary skills in management, law, business/market and data analysis. Since February 2025, he joined the European project "Double Active Membranes for a Sustainable CO₂ Cycle" (DAM4CO₂) as a research fellow under the supervision of Dr. Alessio Fuoco and Dr. Valentina Tortelli. Currently, his work focuses mostly on project tracking activities, gives his contribution in all stages of the project's life during the process of development, financial planning, management and reporting. That is closely linked to certain aspects of a project and therefore necessary for the refund by the European Commission of the eligible expenses carried over and the proper implementation during all the different stages of the work plan.



Federico Panagini, graduated in Industrial Chemistry at the University of Turin in October 2024 working on the catalytic field under the supervision of Dr. Matteo Signorile. From November 2024 he is involved in the European project "Double Active Membranes for a sustainable CO₂ cycle" (DAM4CO₂) as a PhD student. His project, focused on advanced characterization of metal- and metal-oxides for catalysis, is supervised by Dr. Matteo Signorile and Prof. Valentina Crocellà.





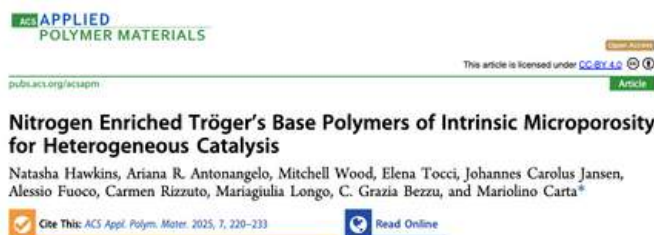
Dr. **Virginia Guiotto** graduated in Materials Science at the University of Torino in 2021. In January 2022, she started her PhD in Chemical and Materials Sciences at the same university, under the supervision of Prof. Valentina Crocellà. The main target of the PhD programme was the advanced characterization of novel metal-organic frameworks (MOFs) potentially employed as fillers in novel composite materials for CO₂ separation. During the PhD, she collaborated with an Italian PRIN project (doMino) and spent three months at the Heriot-Watt University of Edinburgh. She successfully completed her PhD program in March 2025. Dr. Virginia Guiotto has been working as an INSTM Junior Researcher in the Horizon Europe DAM4CO₂ research project. Her research interests concern the advanced characterization of microporous materials such as MOFs and polymers of intrinsic microporosity (PIMs), with a particular focus on in situ infrared spectroscopy and volumetric/calorimetric techniques.

Dr. **Vincenzo Vigna** is currently pursuing his Ph.D. in Translational Medicine at the University of Calabria, with a dissertation focused on combining Artificial Intelligence and QM computational approaches to elucidate the mechanism of action of anticancer drugs. Since 2025, he has been working as a Research Fellow on the European project "Double Active Membranes for a Sustainable CO₂ Cycle" (DAM4CO₂) at the Institute on Membrane Technology of the National Research Council of Italy (CNR-ITM) under the supervision of Dr. Alessio Fuoco and Dr. Elena Tocci. His research focuses on in silico design of membranes for CO₂ capture through the development of Artificial Intelligence models, combining classical machine learning techniques and advanced neural networks. Dr. Vigna holds a Master's degree in Chemistry at the University of Calabria (2021), where he specialized in Chemistry for Environment, Health, and Territory and Computational Chemistry.

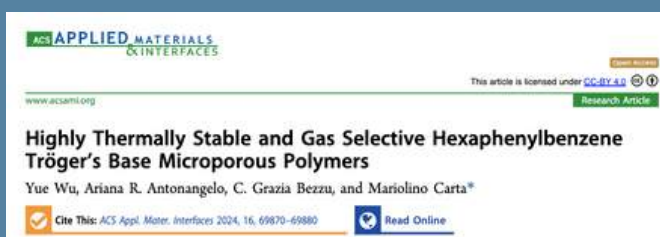


ARTICLE PUBLISHED & UNDER REVIEW

PUBLISHED



“Nitrogen Enriched Tröger's Base Polymers of Intrinsic Microporosity for Heterogeneous Catalysis”, ACS Appl. Polym. Mater. 2025, 7, 1, 220–233 (<https://doi.org/10.1021/acscapm.4c02952>)



“Highly Thermally Stable and Gas Selective Hexaphenylbenzene Tröger's Base Microporous Polymers”, ACS Appl. Mater. Interfaces 2024, 16, 50, 69870–69880 (<https://doi.org/10.1021/acscami.4c15333>)



From the journal:
Journal of Materials Chemistry A

Unravelling the origin of enhanced CO₂ selectivity in amine-PIM-1 during mixed gas permeation



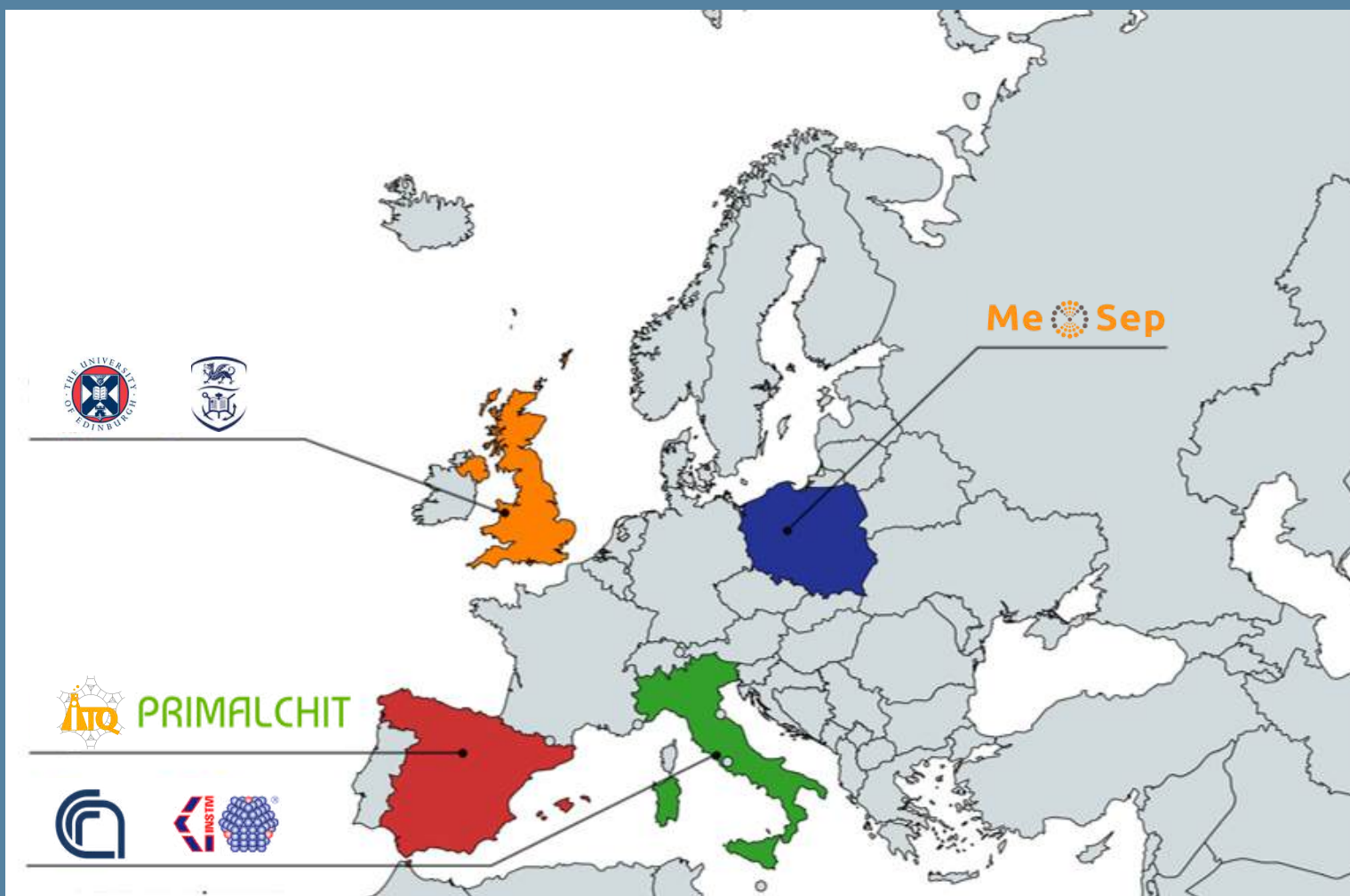
Carmen Rizzuto, Francesca Nardelli, Marcello Monteleone, Lucia Calucci, C. Grazia Bezzu, Mariolino Carta, Elena Tocci, Elisa Esposito, Giorgio Deluca, Bibiana Comesaña-Gándara, Neil B. McKeown, Bekir SAYGINER, Peter Martin Budd, Johannes Carolus Jansen and Alessio Fuoco

“Unravelling the origin of enhanced CO₂ selectivity in amine-PIM-1 during mixed gas permeation”, just accepted in J. Mater. Chem. A. Carmen Rizzuto, Francesca Nardelli, Marcello Monteleone, Lucia Calucci, C. Grazia Bezzu, Mariolino Carta, Elena Tocci, Elisa Esposito, Giorgio De Luca, Bibiana Comesaña-Gándara, Neil B. McKeown, Bekir Sayginer, Peter M. Budd, Johannes C. Jansen, and Alessio Fuoco
DOI: <https://doi.org/10.1039/D4TA08839E>

UNDER REVISION/SUBMITTED

“ π -Extended Dihydrophenazine Based Redox Responsive Polymers of Intrinsic Microporosity”. C. Grazia Bezzu, Beatrice Bartolomei, Yue Wu, Martina Vaccaro, Alessio Fuoco, Maurizio Prato, Mariolino Carta, Jacopo Dosso

“Tuning flexibility in Metal-Organic Frameworks via linker per-fluorination: revisiting the adsorption-induced breathing of MIL-53(AI)”. Virginia Guiotto, Maria Sole Notari, Jacopo Perego, Diletta Morelli Venturi, Francesca Nardelli, Silvia Bordiga, Susana Garcia, Marco Taddei, Matteo Signorile, Angiolina Comotti, Lucia Calucci, Ferdinando Costantino and Valentina Crocellà



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 **UK Research and Innovation**

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