



**“Membrane-assisted ethylene
synthesis over nanostructured
tandem catalysts”**

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www.memcatproject.eu

Welcome to the first Newsletter of the MemCat project

- **Welcome to the First Newsletter!**

The present newsletter is the first release of the biannual letter that will be published by MemCat presenting the progress on the project and highlighting information related to it.

Hope you will find the info in this newsletter interesting!

On our website www.memcatproject.eu you will find public presentations, all the public deliverables of the project and many other interesting news. Stay tuned!

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A talk with the Coordinator about the Project

- **Hello Mr. Yury V. Kolen'ko. You are the Coordinator of MemCat project, could you tell us more about yourself and your work?**



Hi, nice to meet you!

My name is Yury and I'm a research group leader at the International Iberian Nanotechnology Laboratory (INL) located in Braga, Portugal.

My group focuses on the synthesis and investigation of unconventional nanomaterials, with a particular emphasis on structure-property relationships in nanoparticles, nanocrystals, and nanostructures.

- **Sounds Interesting! What type of project is it? And why is it called MemCat?**

MemCat is a collaborative EIC Pathfinder Open project funded by the Horizon Europe.

The Consortium involves various partners, including universities, research organizations, and a SME. The name MemCat stems from the fact that the goal of the project is the development of a catalytic membrane reactor for the conversion of CO₂ to ethylene.



• What are the expected results?

Overall, the goal of MemCat is to deliver a proof-of-concept for converting CO₂ directly to ethylene using tandem catalysts within a membrane reactor.

To tackle this challenging goal, the partners are working on several activities: catalyst development, studying the catalytic processes through computational and experimental methods, the development of nanofillers and nanocomposite membranes, and building the membrane reactor prototype.

In addition, dissemination and outreach activities are important to share the goals and results of the project with the scientific community and industry as well as the general public.

• What is the project's critical path?

MemCat is a 4-year project!

At the end, we will have a prototype catalytic membrane reactor, which, through nanostructured tandem catalysts and nanocomposite membranes, will allow for the direct conversion of CO₂ to ethylene.

This will be possible through nanostructuring of the catalyst materials, which will enable consecutive CO₂ -to-methanol and methanol-to-ethylene conversions to occur in the same operational window.



In the long term, our vision is to give access to green e-polymers by providing carbon-negative plastic precursors using anthropogenic CO₂ and green H₂.

- **Going back to the partners involved in this project, can you be more specific? You said that there are some universities, researchers, institution...**

MemCat Consortium is interdisciplinary and made up of 4 universities, 2 research organizations and an SME.

At the INL, we're working on catalyst development. The catalytic studies are led by Prof. Annette Trunschke at The Fritz Haber Institute of the Max Planck Society, and the theoretical studies are carried out by Prof. Karoliina Honkala and team at the University of Jyväskylä.

The nanofillers will be synthesized at the University of Vigo by the team of Dr. Laura Salonen, and the nanocomposite membrane development, led by Dr. Sergio Santoro, will be carried out at the University of Calabria.

The membrane reactor prototype and testing will be carried out at Eindhoven University of Technology, led by Prof. Fausto Gallucci.



And last but not least, there is the dissemination activity, coordinated by Simona Scoppa from SME 1Cube.

- **How can we follow this project? And where could we see the results of the project?**

You can visit the MemCat [website](http://www.memcatproject.eu) (www.memcatproject.eu) and also follow us on [Linkedin](#) : “Memcatproject”.

Here we will share our newsletters, published articles, events, and any other developments of the project.

- **Thanks very much, Yury. It was a very interesting talk.**

Thanks to you. Let's chat again in the next years when we have new results!



Kick-Off Meeting

- **A strong start for MemCat project!**

Our MemCat Project was officially kicked off on 5th and 6th June at University of Jyväskylä in Finland.



A kick-off meeting is more than just a gathering!

it's an opportunity to align everyone on the mission, goals, and expectations of our upcoming project.

On the first day, the meeting began with a detailed overview of MemCat project, where we outlined its purpose, key objectives, and milestone.



And we had a great excellent social dinner on a cruise at MS Rhea...



Kick-Off Meeting

....that ended with a rainbow, wishing us good start of MemCat Project!

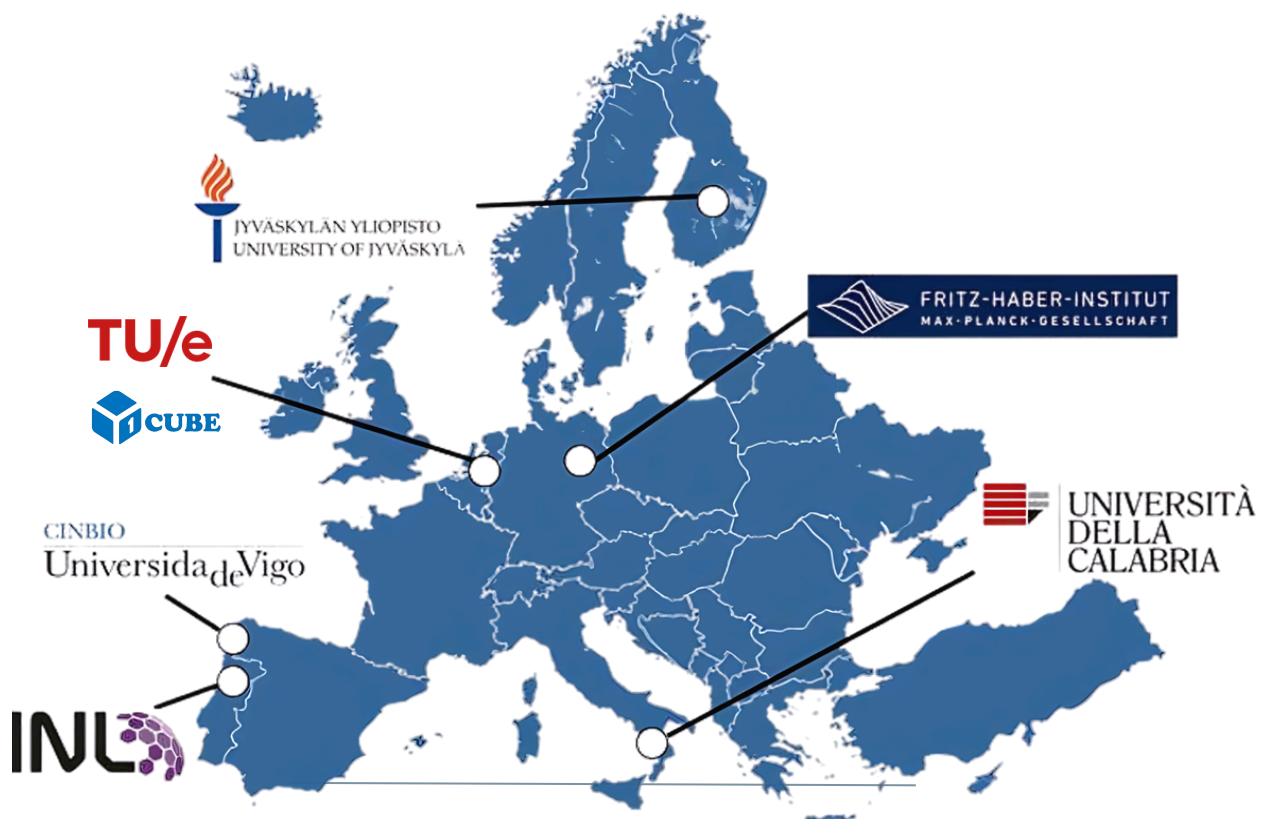


On the second day, MemCat Partners had Campfires to discuss separately each Work Package and, after that, we agreed to meet in the next M6 Consortium Meeting in Eindhoven.



Meet the Partners

In this first newsletter, we will spotlight the incredible Partners, who form the backbone of our MemCat project and who works tirelessly behind the scenes to drive our project forward.



Their success is driven by a team of dedicated professionals who bring their unique expertise, vision, and leadership to the table. We're thrilled to take you behind the scenes to introduce the partners who play a pivotal role in shaping the project's future. Each of these Partners will contribute significantly to the growth and the innovation of the project, and we're excited to share their stories with you in the next pages.





The International Iberian Nanotechnology Laboratory (INL), established in 2009 by Spain and Portugal, is a research and technology organization based in Braga, Portugal. INL conducts interdisciplinary research in nanotechnology, focusing on areas that support the United Nations Sustainable Development Goals, such as clean water, energy, and health. With a community of around 475 people, INL's mission is two-fold: to conduct excellent research and engage in technology transfer and public outreach.

Role of INL: In MemCat, INL is in charge of coordinating the project and will carry out the synthesis of nanostructured tandem catalysts for CO_2 hydrogenation.



JYVÄSKYLÄN YLIOPISTO
UNIVERSITY OF JYVÄSKYLÄ

The University of Jyväskylä (JYU) is an internationally recognized multidisciplinary research institution dedicated to advancing wisdom and well-being for individuals and society. The university is deeply integrated with both national and international research, business, and innovation communities. It hosts 14 000-degree students across 6 faculties, supported by a staff of 2 600.

The department of chemistry at JYU specializes on functional molecules and materials, chemical nanoscience, the circular economy and chemistry education. The department actively engage in interdisciplinary research, collaborating with industry, business and the public sector, providing extensive scientific expertise.

Role in MemCat:

As part of the MemCat project JYU will focus on computational aspects, specifically examining the reaction mechanisms of the studied chemistries and computational characterization of the prepared catalyst materials in close collaboration with the experimental partners.





TU/e is a research university specializing in engineering science & technology. Our education, research and knowledge valorization contribute to:

- science for society: solving the major societal issues and boosting prosperity and welfare by focusing on the Strategic Areas of Energy, Health and Smart Mobility
- science for industry: the development of technological innovation in cooperation with industry
- science for science: progress in engineering sciences through excellence in key research cores and innovation in education

The research group Sustainable Process Engineering is part of the faculty of Chemical Engineering and Chemistry at the Eindhoven University of Technology. The main objective of the research group is the development of novel integrated reactor concepts (such as Membrane Reactors, micro reactors, structured catalysts and reactors) based on improved fundamental knowledge using validated advanced (multi-phase) reactor models. This is achieved by employing a combination of state-of-the-art numerical models (at different levels of detail using the multi-level modelling approach), advanced (non-invasive) experimental techniques and experimental demonstration of novel reactor concepts (proof of concept).

Role in MemCat:

Development of carbon molecular sieve membranes and testing of the membrane reactor for intensified CO_2 hydrogenation to ethylene.



FRITZ-HABER-INSTITUT
MAX-PLANCK-GESELLSCHAFT



The Fritz Haber Institute of the Max Planck Society, in short FHI, is an international research place where scientists from all over the world investigate the basic principles underlying the chemical conversion of matter and energy at surfaces and interfaces.

Role in Memcat:

The FHI contributes to the development of a fundamental understanding of the catalytic mechanisms that determine the activity and selectivity of tandem catalysts for the conversion of carbon dioxide to ethylene in one step.



The analysis of the nanostructure of selected materials and catalytic tests will support the development of new active phases in the form of core-shell nanoparticles and fibers. In-situ and operando spectroscopic experiments, in particular using diffuse reflectance infrared Fourier transform (DRIFT) spectroscopy, will provide mechanistic information and thus input for DFT calculations and DFT-based microkinetic simulations to elucidate the active sites and analyze the reaction network. The aim of the work is to determine the optimal interplay of geometric factors at the atomic level, important electronic properties of the catalysts and critical reaction parameters that control performance. The underlying complexity is mastered through rigorous experimentation and collaboration with theory, leading to a targeted, rational catalyst design.



The University of Calabria (UNICAL), established in 1968 in Rende, plays a pivotal role in the development of the southern region of Italy. Renowned for its strong emphasis on research and innovation, it offers a diverse range of academic programs across various disciplines. Currently, UNICAL serves over 30,000 students and boasts 14 departments offering 80 Degree Programmes at Bachelor's and Master's levels, as well as 10 PhD schools. UNICAL is consistently ranked among the top three largest Italian state universities.

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The UNICAL campus is home to a vibrant international community, fostering a dynamic environment for scientific, cultural, and intellectual exchange. Research activities in membrane science and technology are conducted at the Department of Environmental Engineering (DIAM), which comprises 40 professors and researchers, 15 technical-administrative units, and numerous PhD and postdoctoral students.

With over 3,000 m² of laboratory space and decades of experience, DIAM is internationally recognized for its expertise in membrane technology.



Role in MemCat:

In the MEMCAT project, the University of Calabria (UNICAL) serves as the leader of WP3, which focuses on developing highly selective carbon molecular sieve membranes (CMSMs). This work aims to design, develop and scale-up two types of CMSMs: water-gas selective membranes and ethylene purification membranes. The water-gas selective membranes are designed to remove water produced during reactions, thereby shifting the equilibrium to prevent the reverse water-gas shift reaction and increase olefin yield at lower temperatures. The purification membranes will separate smaller gases (H_2 , CO_x , CH_4) from larger C_xH_y gases, ensuring access to pure ethylene (ET). Advanced nanomaterials developed in the MEMCAT consortium will be employed to improve the selectivity of the CMSMs.



1CUBE operates as a comprehensive consultancy specializing in EU projects, offering a range of services tailored to diverse needs. Their expertise includes crafting compelling project proposals that meet EU standards and stand out for innovation. They excel in communication and dissemination strategies, ensuring effective engagement with stakeholders through various channels.

Continuously updating their knowledge of EU regulations and funding frameworks, they navigate the complex EU landscape adeptly.

Moreover, they prioritize understanding clients' unique needs, fostering collaborative relationships to maximize project success.

Role in MemCat:

1 Cube, leading WP5, is responsible for the Dissemination and Communication





CINBIO is a public multidisciplinary research center, under the umbrella of Universidade de Vigo (UVigo), focused on developing groundbreaking research in two main areas: nanomaterials and biomedicine. CINBIO was created in 2009 and hosts more than 170 staff members distributed in 15 different research groups that clusters chemists, physicists, biologists and material scientists with extensive experience in research and academic tasks.

Since 2016, CINBIO has been acknowledged as a Research Centre of Excellence by the Regional Government receiving financial support with a three/four-year framework to implement strategic improvements in personnel and infrastructure, enhancing its recognition at the local, regional, national and international levels. After a consolidation period, CINBIO has designed a strategic research program to be implemented during 2023-2026, to achieve a consolidated interaction between the two main research areas. By bringing together experts from various disciplines, the center strives to drive innovation in nanotechnology and biomedicine, aiming to make outstanding contributions to society and improve the lives of people around the world.

Role in MemCat:

Development of nanofillers based on porous framework materials for nanocomposite membranes for ethylene separation





For more information about our MemCat project...

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