

Newsletter

COZMOS - Efficient CO₂ conversion over multisite Zeolite-Metal nanocatalysts to fuel and Olefins

Word from the coordinator

by Unni Olsbye, University of Oslo

Two years into the COZMOS project, the positive developments from the first year have continued. The catalyst KPIs (Key Performance Indicators) have improved every semester, and the best tandem catalyst is approaching the per-pass C3 yield target set for TRL5. Catalyst scale-up studies are on-going.

While the efforts of the first year focused on synthesis and testing of new catalysts, the second year has been characterized by increased focus on catalyst performance optimisation by changing process conditions. Furthermore, two process design options have been presented, and the first Life Cycle Analysis study of the COZMOS concept was recently completed. Currently, the project focus is shifting from catalyst studies towards catalyst-process integration, and the pilot plant design and selection process of contractor is nearing completion.

Although the project is progressing well, the Corona pandemic did not leave us untouched. Restricted laboratory access at the partner sites, as well as the generally longer lead times from providers has impacted the catalyst development work in particular. Our mitigation action has been an increased effort on literature studies, discussion and publication writing, in times of little or no laboratory access. As reported elsewhere in this Newsletter, the publication record of the project is largely exceeding our original expectations. As coordinator, I am proud of the Team's achievements. Furthermore, I find the accumulated number of the Team's patent applications highly encouraging, as evidence of a strong belief among both industrial and academic partners that the COZMOS concept and technology may have an impact in the circular, post-fossil economy.

COZMOS TRL5 pilot plant

by Melek Selcen Basar, Tüpraş

Tüpraş, Turkey's leading refinery and largest corporation, will be hosting COZMOS's TRL5 pilot plant for demonstration of CO₂ conversion into fuels and high added-value chemicals, namely propane and propylene, as the target products.

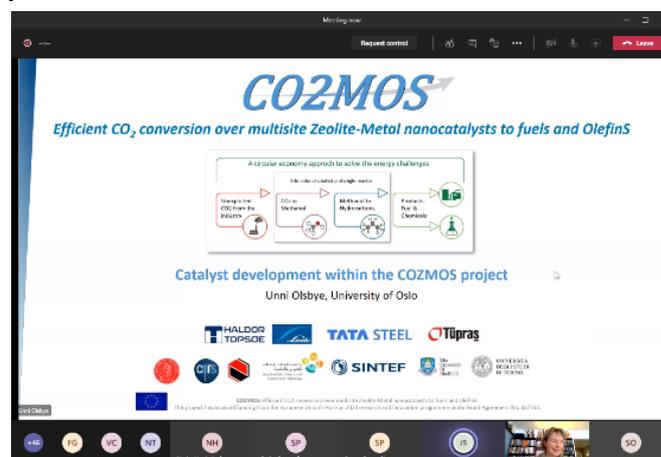
The expertise of Tüpraş in commissioning and operating several pilot plants will pave the way for efficient design and operational management of the COZMOS pilot plant. The pilot plant will mainly comprise gas and liquid feeding sections together with a mixed gas compressor, reactor and online analysis sections with a dedicated control system to

ensure 24/7 continuous operation.

After engineering, construction and testing phases, a highly versatile pilot plant is expected to start-up in 2022. Efficiency of the most promising catalysts developed in the COZMOS project will be tested at different operational parameters by also simulating real industrial conditions, which in turn will provide significant outcomes for leveraging more mature technologies matching with end users' needs.

International Workshop on Carbon Capture and Utilization

On February 16-17, 2021, the COZMOS project jointly organized the International Workshop on Carbon Capture and Utilization (IWCCU), as an on-line event, with 10 other H2020 projects involved in research on carbon capture and utilization (CCU) and alternative fuels. Over 250 participants from more than 25 countries worldwide enjoyed 30 oral presentations from the 11 H2020 projects and invited plenary lectures from AccelorMittal, CO2 Value Europe, SPIRE/Processes4Planet and the Northern Lights project. COZMOS had three oral presentations, an update on the COZMOS catalyst development by the COZMOS coordinator Unni Olsbye, an update on the LCA work within the project by Guillermo García-García of Univ. Sheffield, an overview of the project by Richard Heyn, and a poster presentation from Marta Cruz-Fernandez, Tata Steel, also on LCA. COZMOS and the other H2020 projects would like to thank the Workshop sponsors, the Dutch Research Council (TWO) and the MDPI journal *Processes*.



All the Workshop sessions were recorded. Links to these recordings (Youtube) and a link to a PDF containing slides from all the oral presentations can be found on the Workshop website (<https://iwccu.org/>), under the heading Documents,

Posters & Videos). The PDF with the presentations can also be found on the COZMOS website under "Technology Watch".

Faraday Discussions on CO₂ Utilization

by Peter Styring, U. Sheffield

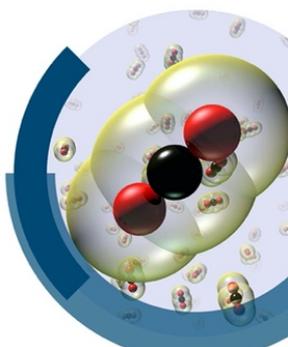
Originally planned to take place in Sheffield, UK, the 2nd Faraday Discussion on Carbon Dioxide Utilisation took place in a very successful online format. Faraday Discussions has a unique, very dynamic format in that new research papers are submitted to participants for advance review, the author presents the paper for five minutes and the paper is then discussed with the participants in around 20 minutes.



Carbon Dioxide Utilisation

Faraday Discussion

7-9 April 2021
Sheffield, UK
rsc.li/cdu-fd2021



COZMOS was well represented with Peter Styring (U. Sheffield) chairing the conference and the Scientific Committee including Unni Olsbye (U. Oslo) and Katy Armstrong (U. Sheffield). Ph. D. student Pierfrancesco Ticali from Univ. Torino had a poster presentation on Zn-based catalysts for CO₂ hydrogenation to methanol. The meeting covered the whole system in CDU from state-of-the-art catalysis, reaction optimisation, advanced mineralisation, capture agents and life cycle, techno-economic and social impact analysis. The online discussions were complemented by Poster Sessions and virtual breakout rooms where informal discussions could take place. Fantastic discussions resulted across the participants which were recorded by the excellent team from the RSC and will be published in the journal that contains all the research papers. The Discussions are available online.

<https://pubs.rsc.org/en/journals/journalissues/fd#!recentarticles&adv>.

The event was discussed at the Climate Exp0 event in May (<http://www.climateexp0.org>), and the success of the meeting was such that we will be looking to hold a 3rd edition in 2026. So, get that new research rolling if you plan to submit a paper!

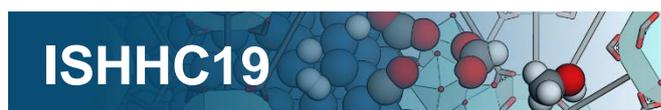
Scientific Dissemination

The COZMOS partners have been extremely active over the past year disseminating results. Five papers from the project have been published, and two of these papers have decorated the covers of *Angew. Chem. Int. Ed.* and *Catal. Sci. Technol.* Four of the papers address catalysts developed within the project, while the fifth paper reviews the life-cycle environmental impacts of CCU technologies. The COZMOS website has links to all five open-access publications, under the heading "Outcomes – Publications". Four other manuscripts from the project are currently under review or revision. Keep an eye on our Twitter feeds, LinkedIn page and web site for announcements on the publication of these papers.



In addition to the presentations at the IWCCU (see above), COZMOS also had two presentations at the on-line conference Chemistry as Innovating Science (CHAINS) in December 2020.

Upcoming Events



The 19th International Symposium on Relations between Heterogeneous and Homogeneous Catalysis (ISHHC-19), which is organized by U. Oslo and in part the COZMOS project, was to be held June 2021. However, this conference, like nearly everything else, was postponed due to the COVID-19 pandemic. The conference is now planned to take place 26-29 June, 2022, as a live event, with the theme of "Overarching Concepts in Catalysis". The conference website is [here](#).

The 18th International Conference on Carbon Dioxide Utilization (ICCDU-18), originally planned for July 2020 in Daejeon, Korea, will now be held July 2021 completely on-line. The conference website is <http://iccd2021.org/>.

COZMOS Website: <https://www.spire2030.eu/cozmos>

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