

Newsletter

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

Word from the coordinator

by Unni Olsbye, University of Oslo

With a year in the books, the COZMOS project can look back on a successful start to the project. Catalyst testing is well underway, and the TRL 4 KPI targets for C3 productivity and selectivity seem within reach. A number of new catalyst systems have been synthesized for targeting improvements in both the MeOH yield from CO₂ and H₂ and also the selectivity toward C3 products. The process schemes and reactor development are continuing on time, and the specifications for the TRL 5 reactor to be built at the Tüpraş site have been agreed upon. Results from the process modelling show that it may be feasible to access a broader range of processing conditions than anticipated at the start of the project. A pre-screening of TEA and LCA – hot spot analysis and review of the known environmental risks of the CCU technologies has been completed, indicating the main issues and shortcomings of current technologies in terms of sustainability, and the need to harmonize LCA methods in analyses of CCU systems.

As project coordinator, I am very pleased to experience the team's dedication, lively discussions and knowledge sharing at the project meetings and in follow-up correspondence – merging scientific and industrial approaches to the task and reaching across the work packages. As we enter the second year of the project, I remain optimistic about the successful outcome of COZMOS.

First Italian Conference on Carbon Dioxide Capture and Utilization

by Pierfrancesco Ticali, University of Torino

On December 5-6, 2019, I attended at the first Italian Conference on Carbon Dioxide Capture and Utilization (IC-CCU), which took place in at University of Bari, in the south of Italy. Among several talks concerning the economics around carbon dioxide, some presentations were focused on catalytic approaches to convert CO₂ into different products, including some that were 'bizarre'. I did not expect that CO₂ could be used to produce mattresses: CO₂ is the precursor of polyols,



crucial components of polyurethane foam used in mattresses' manufacture (*Covestro Deutschland AG, Germany*).

Besides 'bizarre' applications, some presentations focused on materials like those involved so far in COZMOS project, i.e. Zn-based oxidic phase supported on zeotype materials. Indeed, *Sotacarbo S.p.A.* patented a Cu/ZnO/ZrO₂@SBA-15 nanocomposite with great performances in CO₂ hydrogenation to methanol.

CO2Chem Winter School

by Melek Selcen Basar, Tüpraş

At Tüpraş, Turkey's leading refinery and largest corporation, we give utmost significance to R&D and environmental studies, in line with our target to be one of the top refineries with low emission values in Europe. Tüpraş carries out several R&D projects with the objective of enhancing the characteristics of oil products, developing environmentally friendly products and alternative fuel production technologies.

Tüpraş, as one of the project partners of COZMOS, builds collaborations with universities and research centers worldwide to strengthen its global network in the field of CCUS. With this in mind, we attended the "CO2Chem Winter School - Exploring CO₂ Utilization" event organized by the UK Centre for Carbon Dioxide Utilization, as part of CO2Chem Network at the University of Sheffield (also a partner of COZMOS) on January 20-23, 2020.

The three-day Winter School brought together leading experts and industry professionals to present the latest updates and research developments in CO₂ utilization. The event had an extensive agenda on production of alternative fuels, chemicals and minerals from CO₂ feedstock.



From left to right: Dr. Melek Selcen Başar, Tüpraş R&D Center, Dr. Volkan Orhan Tekin, Tüpraş Environment Department and Çisem Yigit Berkem, Tüpraş Environment Department.

Key technical takeaways from the program

New approaches to use carbon dioxide as a feedstock in the development of building materials through a mineralization process is capturing increasing attention as an alternative CCS option for long-term storage of CO₂.

Interactive Life Cycle Assessment sessions provided a solid understanding on target, process and product selection. The sessions also displayed a creative approach on how to proceed with a systematic thinking, by taking all sorts of environmental interactions into account.

We will apply these methodologies in our ongoing research projects. Adopting a more environmentally sound approach towards alternative fuels and chemicals production will contribute to our efforts to minimize greenhouse gas emissions at Tüpraş.

3rd Science for Sustainable Development event

by Guillermo García-García, University of Sheffield

I was delighted to be invited to present at the 3rd Science for Sustainable Development event on 3rd March 2020. This event was organised by the Network of Early-Career Sustainable Scientists and Engineers (NESSE) and held in the University of Warwick. The schedule included fascinating presentations from academics and industrialists that covered a wide range of sustainability topics, for instance, multiple criteria-decision making, corporate sustainability, urban resilience and sustainable business entrepreneurship.



My presentation was entitled "Life-Cycle Assessment as a tool to improve sustainability performance". I introduced the main concepts of LCA, some of the software tools most widely utilised, the current challenges in the LCA field, and future directions in this research area. I also explained how we are using the LCA methodology to assess the sustainability performance of the COZMOS technology. The event concluded with an interesting panel discussion in which some of the speakers discussed how businesses currently understand the sustainability concept. Clearly, sustainability can help companies becoming not only more environmentally friendly but also economically successful!

COZMOS is co-organizing the 19th International Symposium on Relations between Heterogeneous and Homogeneous Catalysis (ISHHC-19)

by Unni Olsbye, University of Oslo

[Conference webpage](#)

The ISHHC series, inaugurated by Prof. Bernard Delmon, who sadly passed away earlier this year, was first held in Brussels in 1974 as the "International Symposium on the Relations between Heterogeneous and Homogeneous Catalytic Phenomena". The conference has since gathered scientists,

engineers and technologists from around the world every 2-3 years. During the last decade, the scope of the ISHHC has gradually expanded to embrace enzymatic catalysis.

In line with previous editions, ISHHC-19 aims to link the three fields of catalysis, with the goal to understand catalytic phenomena at the molecular level, and by doing so uncover new aspects as well as similar concepts overarching the three fields. Conference sessions will span the synthesis, characterisation, surface science, application and theory of all types of catalysis, including thermo-, electro- and photocatalysis.

The event is designed to inspire the next generation of researchers and research, with presentations that cover the latest advances in our understanding of the relations between homogeneous, heterogeneous and enzymatic catalysis. ISHHC-19 aims to assemble around 400 participants from across academia and industry.

We warmly invite you to Oslo, 27-30 June 2021, to experience great science and inspiring discussions, make new friends and enjoy Norway's Green capital and its surroundings.

Scientific Dissemination

In the first year of the project, COZMOS partners have presented the project at two conferences and submitted two papers. Richard Heyn, SINTEF, gave an overview of the project at the 17th International Conference on Carbon Dioxide Utilization in Aachen, Germany, in June 2019. Marta Cruz Fernandez, Tata Steel, gave a similar presentation with emphasis on the LCA and social acceptance aspects of the project, at the CO2Chem Winter School (see above).

The first publication from the project, a joint publication from the University of Oslo, University of Torino, and CNRS on composite PdZn and H-ZSM-5 catalysts, has now been published in [Catal. Sci. Technol.](#) A joint publication from the Institute of Coal Chemistry and the University of Oslo has been submitted and is currently undergoing peer review.

COZMOS Workshop for Stakeholders

The COZMOS project will be jointly organizing a workshop and information session for stakeholders together with the three sister projects funded by the European Commission under the same call ([C2Fuel](#), [CO2Fokus](#) and [eCOCO2](#)) in February, 2021. Updates on the date and format for this Workshop will appear on the COZMOS website, its LinkedIn page, and its Twitter feed.

Other upcoming Events

The KAUST Research Conference on "Carbon Capture and Utilization – Challenges and Opportunities", originally scheduled for February, 2020, has been moved to December 2020. The conference is open to all. More information is on [the conference webpage](#).

The 18th International Conference on Carbon Dioxide Utilization (ICCDU-18), originally planned for this July in Daejeon, Korea, has been postponed until summer 2021.

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