

## Newsletter

**COZMOS - Efficient CO<sub>2</sub> conversion over multisite Zeolite-Metal nanocatalysts to fuel and Olefins****Word from the coordinator**

by Unni Olsbye, University of Oslo

With over four productive years behind us, the COZMOS project period is approaching the end. As such, last year's activities have focused on TRL 5 activities: catalyst scale-up, pilot plant testing, process design, technical-economic and life cycle analysis. A cross-disciplinary team met virtually every three weeks to discuss recent progress and further choices to be made, across the TRL 5 activities.

Among the highlights of the past year, I would like to praise the Tüpraş team, who completed the installation and site acceptance test of the pilot plant in less than two months, thereby greatly compensating for the COVID-induced delay in pilot plant delivery.

Another highlight of the past year, on the professional and personal level, was the opportunity to meet in person again, after two years of virtual project meetings. As such, we met first at Topsoe's R&D center in Lyngby, Denmark, in September 2022, and second, at Tüpraş's refinery site in Izmit, Turkey, in April 2023. The latter meeting included a guided visit to the COZMOS pilot plant, where tests of the 1<sup>st</sup> and 2<sup>nd</sup> generation COZMOS catalysts were - and are still - ongoing.

CCU is a central element in a post-fossil circular economy. In that context, the collective output and prospects of the COZMOS process will soon be presented in a White Paper. Leaving the final conclusions to the White Paper, I would take this opportunity to thank each partner for their enduring support and priority to COZMOS project activities, and each and all team members for their invaluable contributions.

**COZMOS TRL 5 pilot plant operational**

The COZMOS TRL 5 pilot plant was been successfully completed by Zeton and delivered to the COZMOS partner Tüpraş. The pilot plant has been operational for several months and has tested the project's upscaled catalysts for production of propane (1<sup>st</sup> generation catalyst) and propene (2<sup>nd</sup> generation catalyst) from CO<sub>2</sub> and H<sub>2</sub>. The consortium was given a tour of the pilot plant at the recent consortium meeting, held at Tüpraş's Izmit refinery facility.

You can read more about the COZMOS pilot plant in the Spring 2023 Newsletter from Zeton BV, the company who built the pilot plant.

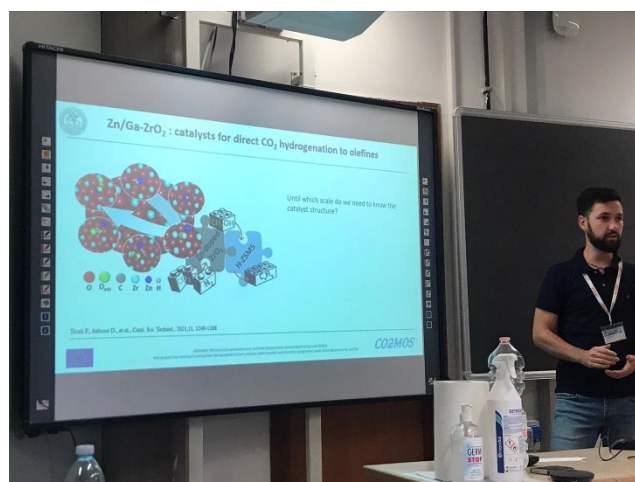
<https://www.zeton.com/horizons-newsletter/spring-2023/>.

**COZMOS students awarded**

Three COZMOS Ph. D. students and post-doctoral researchers from the Univ. of Torino were awarded last fall for their research in the project. Davide Salusso (below) was awarded



the "best talk prize" at the 4<sup>th</sup> Joint Conference of the Italian Crystallographic Association and the Italian Synchrotron Radiation Society (AIC-SILS) in Trieste last September.



Alessia Airi (next page) received the award for "Best Doctoral Thesis in the field of Catalysis" for the 2022 from the Inter-divisional Group of Catalysis of the Italian Chemical Society.

She received her award in September 2022 at the Italian Congress on Catalysis in Riccione.



Pierfrancesco Ticali (below) received a travel grant to the aforementioned Italian Congress on Catalysis in Riccione, where he gave both an oral and a poster presentation on his work on the COZMOS project.



Congratulations to these talented students for all their hard work on the COZMOS project!

### Scientific Dissemination

The COZMOS partners continue to be very active disseminating the scientific results from the project. The pro-

ject is now up to 16 publications total. Publications since the last newsletter have appeared in *Nature Catalysis*, *Journal of CO<sub>2</sub> Utilization*, *ACS Applied Materials and Interfaces*, *Applied Catalysis A* and *Chemical Reviews*. Over 30 oral or poster presentations have now been given at scientific conferences or workshops.

The project's publications during the past year include

- Highly selective hydrogenation of CO<sub>2</sub> to propane over GaZrO<sub>x</sub>/H-SSZ-13 composite, *Nature Catalysis*, doi: [10.1038/s41929-022-00871-7](https://doi.org/10.1038/s41929-022-00871-7)
- A CO<sub>2</sub> valorization plant to produce light hydrocarbons: Kinetic model, process design and life cycle assessment, *Journal of CO<sub>2</sub> Utilization*, doi: [10.1016/j.jcou.2022.102337](https://doi.org/10.1016/j.jcou.2022.102337)
- From Lab to Technical CO<sub>2</sub> Hydrogenation Catalysts: Understanding PdZn Decomposition, *ACS Applied Materials and Interfaces*, doi: [10.1021/acsami.2c19357](https://doi.org/10.1021/acsami.2c19357)
- PdZn/ZrO<sub>2</sub>+SAPO-34 bifunctional catalyst for CO<sub>2</sub> conversion: Further insights by spectroscopic characterization, *Applied Catalysis A: General*, doi: [10.1016/j.apcata.2023.119100](https://doi.org/10.1016/j.apcata.2023.119100).
- The Oxygenate-Mediated Conversion of CO<sub>x</sub> to Hydrocarbons – On the Role of Zeolites in Tandem Catalysis, *Chemical Reviews*, doi: [10.1021/acs.chemrev.3c00058](https://doi.org/10.1021/acs.chemrev.3c00058).

The COZMOS website has links to all the open-access publications generated during the project, under the heading "Outcomes – Publications" and also under the News/Events feed. Keep an eye on our Twitter feeds, LinkedIn page and web site for announcements on the publication of more papers from the COZMOS project.

### Final COZMOS Workshop and Public Deliverables

The final COZMOS Workshop was held as a digital event on 18 September. In addition to COZMOS, three other EU projects, C2FUEL ([c2fuel-project.eu/](https://c2fuel-project.eu/)), TAKE-OFF ([takeoff-project.eu/](https://takeoff-project.eu/)) and 4AirCRAFT ([4aircraft-project.eu/](https://4aircraft-project.eu/)), with focus on the thermal catalytic conversion of CO<sub>2</sub> and H<sub>2</sub> to hydrocarbons, gave presentations. The presentations and a recording of the Workshop will be made available on the COZMOS website once all permissions have been received.

Several Public Deliverables featuring overall conclusions from the COZMOS project will be made available in the coming weeks. Three of these Deliverables will describe the optimised and fully integrated process scheme, the pilot plant operation and the social readiness of the COZMOS process. There will also be a White paper on CCU realisation and perception. Stay tuned to the COZMOS website and LinkedIn and Twitter feeds for news on the publication of these Deliverables.

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