

# Katse

## Member's Newsletter

1/2025



### IN THIS ISSUE

- **Meet the board**
- **Young Scientist Forum 2025**
- **Travel grants and reports**  
Read about the latest travel stories shared by your fellow researchers.
- **News from the Community**  
Tapio Salmi Dr honoris causa at Taltech  
ISCRE28 Special issue  
Doctoral thesis award
- **Researcher corner**  
Niko Kinnunen
- **Defenses in 2025**  
Upcoming and past defenses in 2025 in a field catalysis
- **Upcoming conferences, summer schools, and events**  
Finnish Catalysis Society Webinar Series hosted by prof. Dmitry Murzin

### Greetings from the board

Dear Finnish Catalysis Society members,

The layout of the Katse newspaper is now new, and the Society's webpages has been updated, as well. Our goal is to provide members up-to-date information about news and upcoming events. You can find us from [web](#) and also through [LinkedIn](#). *Be curious – take a look!*

*What's new* – I would like to highlight here a new webinar series, hosted by Prof. Dmitry Murzin from Åbo Akademi. Then we launch a new Researchers' corner where you can find short introductions about people behind the research.

The Finnish Young Scientist Forum was held in Jyväskylä 4<sup>th</sup> of April 2025. Huge thanks to organizers – The event was a success once again! The 16<sup>th</sup> EUROPACAT was arranged in Trondheim, Norway, and Katse proudly presents greetings of granted researchers' from Norway. *Enjoy the stories and photos of the venue.*

*Be curious,*

*Niko Kinnunen*



## Meet the new board members

The new board of the Finnish Catalysis Society was elected following the annual meeting in April 2025. Details about our newly appointed board members are provided below.

**Chair of the Board, Niko Kinnunen**, works on catalysis at LUT University, carbon capture and utilization (CCUS), biomass valorization, and Power-to-X solutions. Outside of work, he enjoys playing tennis and spending time with his family.

**Joakim Kattelus** has been appointed as **treasurer**. He is a doctoral researcher at the Catalysis group at Aalto University and is currently studying heterogeneous catalysts for waste polymer recycling and hydrotreatment of non-conventional feedstocks. In his free time, Joakim enjoys reading, hiking and downhill skiing.

**Jasmiina Palo** has been appointed **Secretary of the Board**. She is a research scientist at VTT with expertise in heterogeneous catalysis and is pursuing a PhD at Åbo Akademi University. In her spare time, Jasmiina listens to music and trains CrossFit.

**Dmitry Murzin** was selected as **Vice-Chair**. Dmitry got his PhD and D.Sc. at Karpov Institute of Physical Chemistry and worked in France, Finland and Germany (BASF) before coming back to Finland in 2000 is a Chaired Professor in Chemical Technology at Åbo Akademi.

## Members and alternate members

**Tiina Laitinen** is a project researcher in Environmental and Chemical Engineering at University of Oulu. Her research focuses on the development of catalysts and sustainable methods for utilising industrial emissions in the production of chemicals.

**Minttu Kauppinen** is an Academy Research Fellow at the Department of Chemistry, Nanoscience Center in University of Jyväskylä. Her expertise is in computational heterogeneous catalysis, and her current research focus is on chemical upgrading of lignin using computational methods such as density functional theory and microkinetic modelling. She is also a novice powerlifter, her (non-scientific and a bit ambitious) long-term goal is to bench press 100 kg.

**Sonja Kouva** is a Member of the Board, responsible for updating the Society website and LinkedIn. Sonja works at Neste and her focus is on catalysts and catalytic reactions. She likes to knit and she's interested in (especially road) cycling.

**Anne Heponiemi** is the vice member of the board. She is working as a university lecturer in the Degree Programme of Chemistry, Research unit of Sustainable Chemistry, University of Oulu. She is the responsible teacher in Physical Chemistry (laboratory exercises, Physical Chemistry I) and master level courses Advanced water treatment chemistry and Catalysis. In addition, she is the supervisor of several bachelor, master, and PhD level students. She is carrying out research in the field of circular economy and especially in the development of new water purification materials (adsorbents, catalysts) from industrial side streams and by-products.

## Finnish Young Scientist Forum on Catalysis 2025

The annual 'Young Scientist Forum in Catalysis' (YSF) brought together nearly 70 catalysis experts and young researchers on April 4th at Hotel Alexandra in Jyväskylä. This year marked the ninth edition of the YSF, and true to tradition, the event brought together participants from both academia and industry from all over Finland. The local organizers were the Computational Heterogeneous and Electrocatalysis group at University of Jyväskylä, led by Prof. Karoliina Honkala.

The event started at 11:00 with coffee and opening words from Prof. Honkala. Then it was time for the first invited speaker of the day, Assistant Professor Daniel Martín Yerga, from Aalto University. Prof. Yerga is a distinguished researcher in the field of electrochemistry, with a particular focus on the development of advanced materials for energy conversion and storage. In shared his latest insights and findings in his speech titled "Bimetallic electrocatalysts for electro-oxidation of alcohol-based chemicals".

In the first session of short presentations, six young researchers shared their work covering topics such as phase diagrams of gold surfaces in aqueous electrochemistry, aldol condensation of cyclopentanone and furfural on cerium-based catalysts for sustainable aviation fuel precursors, plasmonic effects in gold-ruthenium core-shell catalysts for light-enhanced CO<sub>2</sub> methanation, platinum impregnation on P25 for visible light photocatalytic applications, and comparative assessment of proton-conducting electrolytes for solid oxide cells.

The participants then gathered at the hotel for lunch, providing an opportunity to

network and discuss the morning's presentations before continuing with the afternoon program.

After lunch, the afternoon session was kicked-off by the second invited speaker, Professor Jero Ahola. Prof. Ahola is a Professor of Energy Efficiency and serves as the Head of the Department of Electrical Engineering at LUT University, located in Lappeenranta. He gave an exciting speech with the title "How can technology research contribute to making green hydrogen more cost-effective?".



*Prof. Ahola giving his talk.*

Following Prof. Ahola's invited talk, the afternoon program featured five oral presentations from young scientists, covering topics such as redox materials for sustainable hydrogen production, sorption enhanced carbon dioxide methanation, effects of pH and potential on platinum-catalyzed glycerol oxidation, non-thermal plasma assisted catalytic oxidation of methane, and new bi-functional catalysts for novel continuous production of propylene oxide with in-situ generated hydrogen peroxide. The second session of the day ended with closing words from Prof. Honkala.

Later in the afternoon, a poster session was held featuring a total of 18 poster presentations and lively conversations, with refreshments from the hotel bar. After the poster session, while other participants had a

moment to prepare for the rest of the evening, the Catalysis Society's board held their annual meeting, where new members of the board were elected, including a new Chair.



*The paddle steamer Vellamo, with lake Jyväsjärvi still covered in ice.*

As the Catalysis Society's annual meeting concluded, participants boarded the paddle steamer Vellamo for an evening dinner in Jyväskylä harbour. During the dinner, a prize for the best poster presentation was awarded. The winner was selected by vote, and the prize went to doctoral researcher Ellen Järvinen (Aalto University) for her poster titled "Effect of the acidic properties of zeolite catalysts on glycerol aromatization". We also raised a toast to the newly elected Chair of the Catalysis Society, Associate Professor Niko Kinnunen from LUT.

With dinner over and many catching trains back to various corners of Finland it was time to say good night and goodbye until next year. However, a small group of catalysis enthusiasts braved the chilly spring night (some say they even saw snow flakes) and continued the conversations at the legendary Vakiopaine bar.

On behalf of the JYU organizing committee, we look forward to seeing you next year,

*Minttu Maria Kauppinen*

Organising committee: Karoliina Honkala, Marko Melander, Minttu Kauppinen, Toni Kiljunen, Bhumi Baraiya, Hanan Ibrahim, Rasmus Ikonen, Ville Korpelin, Shalini Mishra, Kayvan Moradi, Kuber Rawat, Timo Weckman

## Finnish Catalysis Society Travel Grants in 2025

[Read more about their experiences  
in Travel reports!](#)

Ten members of the Finnish Catalysis Society were awarded a travel grant for 16<sup>th</sup> European Congress on Catalysis (EuropaCAT 2025), which was held in Trondheim, Norway between 31<sup>st</sup> of August to the 5<sup>th</sup> of September, 2025.

Contributions of the grant recipients:

**Aitor Arandia Gutierrez:** "From biomass pyrolysis oils to BTXs via catalytic aromatization with zinc and gallium-doped ZSM-5 zeolites", oral. "Upgrading the chemical composition of plastic pyrolysis oils by hydrotreatment with metal supported catalysts", poster.

**Francesco Sandri:** "Production of green aromatics from ethanol and furfural over Zn and Ga modified zeolites", oral.

**Kimbi Yaah Velma Beri:** "Using TiO<sub>2</sub> NB/Bi<sub>3</sub>O<sub>4</sub>Br composite for photocatalytic degradation of paracetamol", oral.

**Enrico Marchi:** "Water Sorption by Zeolites in CO<sub>2</sub> Methanation: Enabling Pure Methane Production", poster.

**Abdul Rehman Khan:** "Sustainable Energy Solutions: Utilizing Plastic Waste for the Development of MOF-Based Photocatalysts for e-fuels", poster.

**Joakim Kattelus:** "The role of hydrogen-deficient species during alkylamine hydrotreating on Pt", poster.

**Laura Annunen:** "Aerogel catalysts for P2X applications", poster.

## Travel reports

### EuropaCat2025

Each year, the Finnish Catalysis Society supports young researchers to participate in major international events in catalysis.

At the 16<sup>th</sup> European Congress on Catalysis (EuropaCat 2025), held in Trondheim, Norway (August 31 – September 5, 2025), Finnish researchers contributed actively through oral and poster presentations on biomass conversion, plastic upgrading, photocatalysis, and sustainable reaction engineering.

The congress brought together around 1500 participants from academia, research institutes, and industry worldwide under the theme “Catalysis for a Sustainable Future.” It was organized by the European Federation of Catalysis Societies (EFCATS) in collaboration with the Nordic Catalysis Societies, NTNU, SINTEF, and the KinCat Gemini Centre.

The scientific program featured seven plenary lectures, sixteen keynote presentations, nearly 400 oral and 700 poster contributions, and several industrial exhibitions. Topics ranged from novel innovations in catalysis and process intensification to Fischer–Tropsch synthesis, C<sub>1</sub>-to-chemicals processes, photocatalysis, and the application of AI and machine learning in catalyst design.

In addition to the world-class scientific program, the congress offered memorable cultural experiences. Participants attended a magnificent organ concert at Nidaros Cathedral, featuring the historic Steinmeyer Organ, and joined a lively 5 km city run through Trondheim. The conference dinner combined excellent food and networking,

including awards for the best poster and the YEuCat contest.



*Nidelva river from the Gamla bybro. Photo by Francesco Sandri.*

#### **Aitor Arandia (VTT Technical Research Centre of Finland)**

Aitor Arandia presented two contributions on catalytic upgrading of renewable and waste-derived feedstocks:

- Oral: “From biomass pyrolysis oils to BTXs via catalytic aromatization with Zn-, Ga- and Fe-ZSM-5 zeolites” (GreenAro, Business Finland)
- Poster: “Upgrading of plastic pyrolysis oils by adsorption and catalytic hydrotreatment” (Treasource, EU-funded)

“It was an inspiring week of high-level science and fruitful discussions,” Aitor noted, expressing gratitude to the Finnish Catalysis Society. Beyond the sessions, participants witnessed the aurora borealis over Trondheim – a breathtaking finale to an inspiring week.



*Aurora borealis over Trondheim during EuropaCat 2025, a stunning natural backdrop to a week of cutting-edge catalysis science. Photo by Aitor Arandia.*

### **Enrico Marchi (Åbo Akademi University)**

Enrico Marchi presented a poster on catalytic reaction engineering and engaged actively with both academic and industrial participants. “The sessions were very well organized, and the discussions with industrial partners were insightful, giving new perspectives on practical applications,” he commented. Exploring Trondheim’s historic Nidaros Cathedral and hearing its magnificent organ added a cultural highlight to an inspiring scientific week.

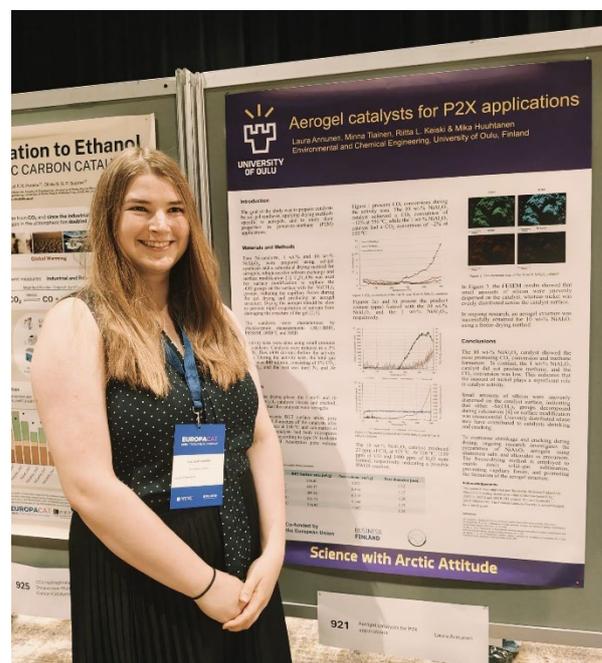


*Nidaros Cathedral in Trondheim. Photo by Enrico Marchi.*

### **Laura Annunen, Velma Kimbi Yaah & Abdul Rehman Khan (University of Oulu)**

The Oulu team represented Finland with three strong contributions. Velma Kimbi Yaah gave an oral presentation on solar-driven photocatalysts for removing pharmaceuticals from water and served as a jury member for the best-poster award. Abdul Rehman Khan presented a poster on photocatalysts from waste streams, attracting great interest and collaboration offers. Laura Annunen presented her poster on aerogel catalysts for P2X applications, which drew lively discussion and new ideas for future work.

“The atmosphere was truly motivating, leaving us with fresh ideas and energy for the future,” the group reflected, thanking the Finnish Catalysis Society, Business Finland, and ERDF for their support.



*Laura Annunen is presenting her poster.*

### **Francesco Sandri (Åbo Akademi University)**

Francesco Sandri contributed an oral talk, “Production of green aromatics from ethanol and furfural over Zn- and Ga-modified zeolites,” presenting results from the GreenAro project. He also chaired the session “Ammonia and Methanol Synthesis,” gaining valuable experience from both scientific and organizational perspectives. “Chairing a session at such a major conference was an enriching experience,” Francesco said. Well-planned social events, including visits to the Nidaros Cathedral and industry exhibitions, made the week both scientifically and culturally rewarding.



*Francesco Sandri is giving his presentation. Photo taken by Narendra Kumar.*

### **Joakim Kattelus (Aalto University)**

Joakim Kattelus followed sessions on hydrotreatment, plastic-waste recycling, and AI in catalysis, noting the growing attention toward circular approaches. His poster presentation on the mechanism of amine hydrotreating drew significant interest and led to several in-depth discussions. Among the highlights was Prof. Bert Weckhuysen’s plenary lecture on operando spectroscopy and 3D synchrotron XRF imaging of zeolites – a truly inspiring

demonstration of advanced catalyst characterization. “I left Trondheim inspired and full of new research ideas,” Joakim summarised, thanking the Finnish Catalysis Society for making his participation possible.

### **Closing reflections**

EuropaCat 2025 showcased the diversity and vitality of catalysis research in Europe and beyond. Finnish participants presented innovative work across a broad range of topics, engaged in meaningful scientific exchange, and strengthened professional networks.

The Finnish Catalysis Society warmly thanks all travel-grant recipients for representing Finland at EuropaCat 2025 and sharing their experiences – and extends appreciation to the organisers for hosting an inspiring and memorable event in Trondheim.

## Tapio Salmi became *doctor honoris causa* in Tallinn



Tapio Salmi, academician Margus Lopp and Rector Tiit Laid.

Professor Tapio Salmi was conferred the title of *Doctor honoris causa* at Tallinna Tehnikaülikool (Taltech) which is the leading polytechnic university of Estonia. The rector of Taltech, professor Tiit Laid motivated the nomination as follows: “This honour recognises your distinguished leadership in chemical engineering and the long-standing collaboration with Åbo Akademi University’s Industrial Chemistry and Chemical Engineering group, which has been especially instrumental in advancing TalTech’s research and academic development. Your internationally respected contributions and mentorship continue to strengthen our university community and capacity. Congratulations on this distinction.”

The official ceremony took place 17<sup>th</sup> of September 2025 at the University’s Anniversary Ceremony. In total, 90 doctors and one honorary doctor were conferred. In his speech given in Estonian language, professor Salmi told the history of the collaborative efforts, particularly organizing common seminars, doctoral network, researchers’ exchange, and writing joint publications. He emphasized the role of science and technology as essential parts of human culture and his strong personal

coupling to Estonia, to Tallinn, and the beautiful island Saaremaa. The speech was ended with the words: “Estonia is not a foreign country for me; it is my second home country”.



## **Researcher Corner: Niko Kinnunen nominated as Tenure Track in LUT**

The Research Corner is an open platform for researchers to present their work to the catalysis community. We look forward to sharing many inspiring stories here in the future.

Dr. Niko Kinnunen has been appointed Associate Professor (Tenure Track) in *Chemical Reaction and Process Engineering* at LUT University. His research focuses on developing catalytic and sorbent materials for CO<sub>2</sub> capture and conversion into fuels and chemicals, as well as on valorizing biomass-derived side streams, such as lignin. His work bridges catalysis and process design to enable negative-emission technologies.

Reflecting on his new position, Kinnunen notes:

*"Catalysis and CCUS are at the heart of the energy transition. LUT offers an ideal setting to integrate catalytic science with renewable energy technologies and circular-carbon solutions."*

His appointment further strengthens LUT's expanding research platform in Power-to-X and carbon circularity, marking another important step in building a national network for catalysis and sustainable chemistry.

## **ISCRE 28 in Turku was a success – a special issue published!**

The International Symposium on Chemical Reaction Engineering (ISCRE) first convened in 1957, which makes it among the oldest ongoing events in chemical engineering. ISCRE is globally recognized as the most prestigious conference in reaction engineering – it is the forum to which scientists and engineers send their best work. ISCRE28 took place at the cultural and conference centre Logomo in Turku/Åbo. The themes of the three-day intensive event were (A) Fundamentals of chemical reaction engineering, (B) Bridging molecular modelling, thermodynamics and kinetics, (C) Multiphase reactors and new reaction media (D) New reactor structures: from micro to milli and macro, (E) Process dynamics and safety, (F) Process intensification in reaction engineering, (G) Reaction and bio-reaction engineering of renewables, (H) Reaction engineering crossing the boundaries, (I) Education session: what to teach today and in the future.

The event gathered around 450 participants all over the world. Four excellent plenary lectures reflecting the various aspects of Chemical reaction engineering were presented: Vemuri Balakotaiah (Houston), Carlo Perogo, Lynn Gladden (Cambridge), Andreas Seidel-Morgenstern (Magdeburg). Fifteen keynote lectures covered the current and future chemical reaction engineering in a perfect way – great thanks to the speakers! Around 200 oral presentations were provided by the participants in three days. The facilities of the Logomo centre were very good for interaction during the event,

particularly at the poster sessions where more than 200 posters were presented and discussed. Royal Society of Chemistry financed two poster awards (vouchers for books). The poster awards were given to Allis O'Shea et al., from Trinity College, Dublin for the work 'A hierarchical surrogate approach to biomass ethanolysis reaction kinetic modelling' and to Mirco Scanferla, Riccardo Sette, Paolo Canu from Università di Padova for the research work 'Sizing of a lab-scale microwave catalytic reactor via multiphysics modelling'.



*Conference site.*

The participants were offered to submit their work to a Special issue of Chemical Engineering Journal – a top-level publication forum in chemical reaction engineering. It is our pleasure to announce that the special issue has been published recently; it contains 71 articles on the hard core of the subject. The special issue was edited by professors Angeliki Lemonidou (Thessaloniki), Juan García Serna (Valladolid) and Tapio Salmi (Åbo Akademi).

**The articles are available on the website**  
<https://www.sciencedirect.com/special-issue/10Q952C300K>.



## Doctoral thesis award

The seventh Doctoral thesis award of the Finnish Catalysis Society was open October 7<sup>th</sup>, 2025 – October 31<sup>st</sup>, 2025.

The Finnish Catalysis Society invited nominations for the Best Doctoral Thesis Award, which is given to an innovative and high-quality Doctoral Thesis accepted in a Finnish university. The purpose of the award is to increase the visibility of the Finnish catalysis research. The award covers all aspects of catalysis: heterogeneous, homogeneous, and biocatalysis. The award is worth 2000 €.

The nominated thesis must have been finalized during the three years preceding the application period (between January 1, 2022 and December 31, 2024) and it must have been accepted in a public defense no later than December 31, 2024.



## Finnish Catalysis Society Webinar Series

A series of webinars will be organized by the Finnish Catalysis Society, featuring prominent researchers in the field of catalysis.

The host, prof. Dmitry Murzin will interview the speaker first asking questions about the motivation to study chemistry/engineering, selection of catalysis as a discipline, the driving force to do research, career paths in academia and industry, personal view on “hot” areas.

This will be followed by ca. 30-35 min of a presentation on a holistic level but with

specific details and then 15 min of questions from the audience, moderated by the host.

The first speaker on **13<sup>th</sup> of November at 15 EET** will be Dr. Gerhard Mestl from Clariant presenting challenges in catalyst scaling up.

**Gerhard Mestl**  
Glariant AG  
**Effective strategies for scale-up of heterogeneous catalysts**  
13.11. 2025, 15.00 eet  
<https://aboakademi.zoom.us/j/69448054047>

**Finnish Catalysis Society Webinar series**  
hosted by Prof. Dmitry Murzin, Abo Akademi

The second speaker on **9<sup>th</sup> of December at 15 EET** will be Prof. Laura Prati, presenting Catalysis by gold.

**Laura Prati**  
Università degli studi di Milano  
**Catalysis by gold**  
9.12. 2025, 15.00 eet  
<https://aboakademi.zoom.us/j/62921232894>

**Finnish Catalysis Society Webinar series**  
hosted by Prof. Dmitry Murzin, Abo Akademi

Prof. Cathy Chin from University of Toronto and Prof. Javier Perez-Ramirez from ETH kindly agreed to be speakers on respectively January and February.

**Link to webinar series in the [Catalysis Society Website](#).**

## Catalysis related dissertations

**M. Sc. Niko Heikkinen**, Aalto University School of Chemical Engineering, Department of Chemical and Metallurgical Engineering, **June 17<sup>th</sup>, 2025**. The faculty opponent was Prof. J. Will Medlin, University of Colorado Boulder, United States. Prof. Riikka Puurunen acted as custos.

The title of the thesis is **"Porous media modification with atomic layer deposition: Catalyst performance protection with an inert coating on a Cobalt-based Fischer-Tropsch catalyst"**.

### Abstract

Atomic layer deposition (ALD) is a gas phase thin film preparation method with many practical applications, from planar surface microelectronics to porous and tortuous structures such as catalysts. Precise control of reactant deposition inside porous media is achieved with self-limiting chemisorption, where instead of the amount of introduced reactant, the surface itself controls the deposition process. At full reactant saturation, the thin film formation is limited by the number of surface reaction sites and all excess reactants and by-products are removed from the surface prior to the next chemisorption cycle. Although ALD is a method of preparing conformal coatings on even complex structures, the process conditions must be appropriate and designed for each deposition surface and set of structural properties (e.g. pore size and surface area).

One important consideration in ALD process design related to particulate materials such as heterogeneous catalysts is that the particle shape has a distinctive effect on the ALD reactant diffusion inside the particle. For this thesis the ALD process was studied for three particle geometries: slab, cylinder and sphere. Comparison of the different particle geometries was conducted with a one dimensional, coupled partial differential equation ALD diffusion–reaction model. The most significant finding was that in comparison to slab particles, only  $\sim 1/3$  and  $\sim 1/2$  the reactant exposure ( $\text{Pa}\cdot\text{s}$ ) was required to fully coat spherical and cylindrical particles, respectively. The lower exposure required to achieve fully coated particles is due to the spherical and cylindrical particles decreasing in volume towards the core.

Before the Fischer-Tropsch reaction experiments, a post-ALD annealing process was conducted to create porosity in the ALD coating and partially recover the coating-covered active metal (cobalt) sites. The experimental results show that with both the  $\gamma\text{-Al}_2\text{O}_3$  and  $\text{TiO}_2$ -supported catalysts the ALD coating decreased Co removal through leaching during the Fischer-Tropsch reaction. The extent of leaching was suppressed by increasing ALD cycles. However, increasing the number of ALD cycles reduced the cobalt active site recovery and active site availability. Also, a general trend in terms of catalyst selectivity was that increasing the number of ALD cycles decreased the desired  $\text{C}_5+$  hydrocarbon selectivity and increased undesired  $\text{CH}_4$  selectivity.

**M. Sc. German Rodrigo Araujo Barahona**, Åbo Akademi (ÅA), Laboratoriet för teknisk kemi och reaktionsteknik (TKR) / Universidad de Valladolid (UVa), Grupo de Tecnologías a Presión (Press Tech), **October 24<sup>th</sup>, 2025**. The faculty opponent was Professor Dr. Joris Thybaut, Gent Universiteit. Professor Dr. Dr h.c. Tapio Salmi acted as custos.

The title of the thesis is **“New technology for hydrogenation processes in the alimentary industry”**.

## Abstract

This doctoral thesis explores novel catalytic technologies for the selective hydrogenation of biomass-derived sugars into sugar alcohols, with high relevance for the alimentary industry. The work focuses on structured catalysts, particularly metallic solid foams, owing to their exceptional properties: high geometrical surface area, thin catalytic layers that suppress internal mass transfer resistance, and open structures that minimize pressure drop in the system. These features make solid foams promising alternatives to conventional catalyst particles and slurry systems, and suitable candidates for enabling the transition from semi-batch to continuous operation.

Three types of catalysts were investigated. First, ruthenium supported on mesoporous molecular sieves (MCM-41, SBA-15, and MCF) were synthesized as silicates and aluminosilicates, and tested in xylose hydrogenation. The incorporation of aluminium improved ruthenium dispersion and activity, although stability was limited by leaching. Second, Raney-type solid nickel foams, with and without Mo promotion, were studied. While active and selective, the typical stability issues of nickel catalysts were mitigated by addition of molybdenum, which doubled the activity and enhanced resistance to deactivation. Third, Ru/C solid foams were synthesized via carbon coating of aluminium foams using poly(furfuryl alcohol)

as precursor, with pore tailoring achieved through polyethylene glycol (8kDa) addition. These catalysts exhibited excellent activity, selectivity, and reusability, making them suitable for both semi-batch and continuous operation.

Extensive kinetic experiments were performed in semi-batch reactors with monomeric sugars and mixtures (xylose, arabinose, galactose). Mechanistic models based on non-competitive and semi-competitive adsorption provided excellent agreement with experimental data. The competitiveness factor ( $\alpha \approx 0.74$ ) of the semi-competitive adsorption model supported the predominance of sugar adsorption while leaving interstitial sites accessible for hydrogen, consistent with molecular size differences.

Continuous hydrogenation studies were conducted in a laboratory scale parallel screening reactor in trickle-bed regime. The effects of temperature, liquid flow rate, and concentration on conversion, selectivity, and space-time yield were quantified. Hydrodynamic measurements (residence-time distribution, liquid holdup) were coupled with kinetic modelling, demonstrating that gas-liquid and liquid-solid mass transfer resistances are of comparable magnitude under the low-interaction regime. At higher sugar concentrations and flow rates, liquid-solid hydrogen transfer emerged as the prevailing limitation.

Overall, this thesis demonstrates that structured foam catalysts overcome the internal diffusion and pressure drop limitations of conventional catalyst particles, while maintaining excellent activity and selectivity in sugar hydrogenation. The combined insights from material development, intrinsic kinetics, and transport modelling provide a robust framework for designing efficient three-phase catalytic systems. Future research should investigate reactor configurations and operating strategies that enhance wetting and interfacial mass transport, thereby unlocking the industrial potential of foam-based catalysts in biomass valorization.

**M. Sc. Luca Mastroianni**, Åbo Akademi (ÅA), Laboratoriet för teknisk kemi och reaktionsteknik (TKR) / Università di Napoli 'Federico II' (UniNa), Chimica industriale, **December 11<sup>th</sup>, 2025 (upcoming)**. The faculty opponent will be Professor Dr. Andrzej Stankiewicz, TU Delft and Politechnika Warszawska. Professor Tapio Salmi (ÅA) will act as custos.

The title of the thesis is "**Avantgarde structured catalysts and reactors**".

### Abstract

Process intensification (PI) is recognized as the key development pathway for addressing the current challenges of global warming, sustainability and circularity. Process intensification incorporates a range of fundamental strategies aimed at substantially reducing the environmental impact of existing chemical processes. To achieve intensification of a chemical process, the molecules should experience optimal processing conditions across multiple scales, from the molecular-level events to the reactor scale. Structured catalysts and reactors are hallmarks of process intensification, since they offer enhanced heat and mass transfer rates compared to classical packed bed reactors, improved flow patterns as well as low pressure drop in chemical reactors. In this doctoral thesis, two avant-garde technologies for structuring chemical reactors are discussed: microreactors and 3D printing of catalyst architectures.

Microreactor technology was applied to study the intrinsic kinetics and product distribution in the gas-phase oxidative dehydrogenation of primary alcohols promoted by Au/Al<sub>2</sub>O<sub>3</sub>. The channels of the microreactor elements were coated with a thin catalyst layer prior to the kinetic studies. The catalyst washcoating was stable in the investigated operating conditions. The kinetic experiments were designed to reveal the role of the alkyl chain length in the oxidative dehydrogenation reaction. Mechanistically sound rate expressions were applied for the quantitative

description of the experimental data via mathematical modeling, and useful kinetic and adsorption parameters were derived. A mathematical model incorporating reaction and diffusion in the porous catalyst layer was implemented to simulate the concentration profiles in the catalyst layer, highlighting the superiority of microreactors in suppressing internal mass transfer limitation for rapid gas-phase processes. Ultimately, DFT calculations were performed to improve the molecular-level understanding of the oxidative dehydrogenation mechanism, with a particular focus on the role of the alkyl chain length and water in promoting the key elementary steps for the aldehyde formation.

A new shaping method was developed to manufacture alumina catalyst architectures with high resolution i.e., 3D printing via Digital Light Processing (DLP). A ceramic resin comprising the catalyst particles and photoactive components was formulated to produce alumina bodies in structured form. A qualitative force balance for the DLP 3D printing process was provided to address the main manufacturing challenges. Post-processing methods were proposed to enhance the mechanical strength of the printed bodies while preserving high surface area. Deposition of metal nanoparticles (Au and Pd) was conducted with wet deposition methods, and the distribution of the metal nanoparticles in the catalyst walls was monitored. The catalytic activity of the obtained catalytic bodies was benchmarked, both in gas and in liquid phase chemical processes. Neat alumina bodies were applied to study the effect of the catalyst geometry on the catalytic performance in the gas-phase ethanol dehydration to diethyl ether. An advanced 1-D heterogeneous mathematical model employing geometrical features of the catalyst structures was proposed to describe the experimental data. The model included local variations of contact perimeters and cross-section areas to describe the periodic architectures. Au/Al<sub>2</sub>O<sub>3</sub> catalyst architectures were printed and utilized in the oxidative dehydrogenation of ethanol to acetaldehyde, revealing the critical impact of the distribution of the gold nanoparticles in both catalytic activity and product distribution. Finally, Pd/Al<sub>2</sub>O<sub>3</sub> catalyst structures were applied in the low-temperature

hydrogen peroxide decomposition in a loop reactor system. For this application, the influence of the oxidation state of palladium nanoparticles and the type of reduction method were investigated in depth. Mathematical modeling was applied to describe the experimental data, deriving important kinetic and deactivation parameters.

The outcomes of this research highlighted the potential of structured catalytic systems to overcome transport limitations and to improve flow pattern within chemical reactors. In the case of DLP 3D printing, a complete workflow for catalyst manufacturing was provided. The proposed method formed a solid basis for further development of a technique that can lead to revolutionary process intensification.

## Conferences and Symposia

### Young Scientist Forum 2026

**The Young Scientist Forum is scheduled for Helsinki during the Chembio event on April 16, 2026.**

**Stay tuned!**

<http://www.katalyysiseura.org>

### Welcome to UCRA4!

UCRA4 – 4th International Conference on Unconventional Catalytic Reactors and Applications. **Åland Islands, Finland | 2026.**

Following the successful UCRA3 meeting in Warsaw (2024), the next conference, UCRA4, will be held in 2026 on the Åland Islands, an autonomous Finnish region located between Finland and Sweden. Åland is known for its beautiful archipelago landscape, rich cultural heritage, and historic sites such as Kastelholm Castle and Bomarsund Fortress.

The conference will take place at the Alandica Culture and Conference Centre in downtown Mariehamn, easily reached by short flights from Stockholm, Turku, and Helsinki, or by daily ferry connections from Finland and Sweden.

**The abstract submission is now open (deadline January 2026). Templates and information are available at [www.ucra4.org](http://www.ucra4.org).**

The program will include plenary and keynote lectures, oral presentations, and poster sessions covering topics such as novel reactor and catalyst structures, process intensification, multifunctional catalysis, catalytic systems for health and

sustainability, and advanced technologies for combating climate change.

For more information about Åland, visit [www.visitaland.com](http://www.visitaland.com), and for the venue, see [www.alandica.ax](http://www.alandica.ax).

Scientific Committee (UCRA1–UCRA4 Organizers): Jesus Santamaria (ES), Evgeny Rebrov (NL/UK), Andrzej Stankiewicz (PL/NL), Georgios Stefanides (GR), Dionysios Vlachos (US), Tapio Salmi (FI). Invited Members: Alessandra Beretta (IT), Kevin van Geem (BE), Olaf Hinrichsen (DE), Juan Garcia Serna (ES), Carine Julcour (FR), Efthymios Kantarelis (SE), Riitta Keiski (FI), Sébastien Leveneur (FR), Miguel Madeira (PT), Vincenzo Russo (IT), Markus Schubert (DE).



## Welcome to the 21<sup>st</sup> Nordic Symposium on Catalysis!

**June 8–10, 2026 in Göteborg**

The Nordic Symposium on Catalysis is a biannual event, which in 2026 is organized by the Competence Centre for Catalysis at Chalmers, within the framework of the Nordic Catalysis Society. The conference is an important event for dissemination of new findings and techniques as well as for networking between researchers and catalysts developers from academia and industry.

The conference will cover all aspects of catalysis within heterogeneous and homogeneous catalysis, thermal catalysis, electrocatalysis and photo(electro)catalysis. Read more about the conference here.

Looking forward to seeing you in Göteborg in June 2026!

Link: [Nordic Symposium on Catalysis](#)



## 4<sup>th</sup> International Conference on Reaction Kinetics, Mechanisms and Catalysis (RKCM 2026)

**June 4–6, 2026 in Budapest**

In 2026, two major conference series will unite for the first time: the 4th International Conference on Reaction Kinetics, Mechanisms and Catalysis (RKCM 2026), following its successful editions in Budapest (2018, 2024), online (2021), and the 3rd Forum of Young Researchers on Heterogeneous Catalysis (YOURHETCAT 2026), building on the successes of Szeged (2022, 2024). By uniting these two communities, RKCM+YOURHETCAT 2026 will provide a unique opportunity for scientists at all career stages to interact, inspire one another, and foster meaningful collaborations across the fields of kinetics, mechanisms, and catalysis.

Link: <https://akcongress.com/rkmc/>

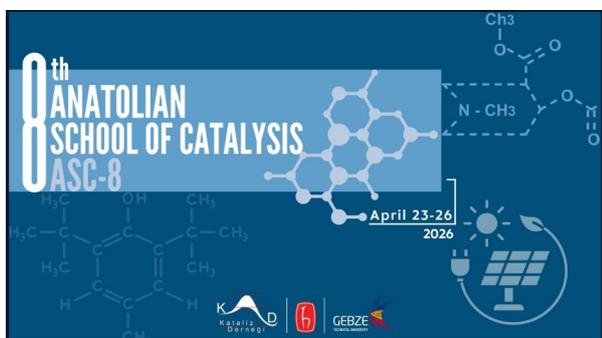


## Summer schools

### 8<sup>th</sup> Anatolian School of Catalysis 23-26 April 2026, Angora Beach Resort, Gümüldür

Stay informed about updates on the Scientific program for the 2026 summer school organized in Turkey.

Link: <https://www.katalizdernegi.org/asc-8-clone/>



# Board of Finnish Catalysis Society 2025

## **Chair**

Associate Professor, Ph.D., Doc. Niko Kinnunen  
Lappeenranta University of Technology  
Department of Separation Science  
Yliopistonkatu 34, POB 20, FI-53851  
Lappeenranta, Finland  
tel: +358 50 5797510  
e-mail: niko.kinnunen@lut.fi

## **Vice-Chair**

Professor Dr. Dr. Habil. Dmitry Yu. Murzin  
Åbo Akademi University  
Henriksgatan 2, 20500  
Turku/Åbo, Finland  
+35822154985  
e-mail: dmurzin@abo.fi

## **Secretary**

M.Sc. (Chem. Eng.) Jasmiina Palo  
VTT Technical Research Centre of Finland Ltd  
POB 1000, FI-02044 VTT  
tel: +358 40 670 4106  
e-mail: jasmiina.palo@vtt.fi

## **Treasurer**

M.Sc. (Chem. Eng) Joakim Kattelus  
Department of Chemical and Metallurgical  
Engineering  
Aalto University  
tel: +358 40 040 6189  
e-mail: Joakim.kattelus@aalto.fi

## **Members of the board**

Dr. Sonja Kouva  
Neste Oyj, Research & Innovation  
POB 310, FI-06101 Porvoo  
e-mail: Sonja.kouva@neste.com

M.Sc. (Eng.) Tiina Laitinen  
Environmental and Chemical Engineering  
PO Box 4300, FI-90014 University of Oulu  
Tel. +358 50 4753 166  
e-mail: tiina.laitinen@oulu.fi

## **Alternate members**

Dr Minttu Maria Kauppinen  
University of Jyväskylä  
PI 35, 40014 Jyväskylän yliopisto  
e-mail: minttu.m.kauppinen@jyu.fi

University lecturer, Dr Anne Heponiemi  
Research unit of Sustainable Chemistry  
POB 4300, FI-90014 University of Oulu  
tel: +358 50 5715560  
e-mail: anne.heponiemi@oulu.fi



## **Feedback and news**

The Finnish Catalysis Society's Board seeks feedback on the Katse newsletter and welcomes news and information on activities (e.g. prizes, events, courses, dissertations) for publication. Please send feedback and news to the Secretary of the Board. Thank you.

## **WEBPAGES TO FOLLOW**

<http://www.katalyysiseura.org>

<http://www.kemianseura.fi>

<http://www.efcats.org>