



## Members' Newsletter

### Nobel recognition to catalysis

The year 2020 is off to a dynamic start with an exceptionally mild winter in western Russia and many parts of northern Europe, Finland included, a hard winter in India and Bangladesh, exceptional floods in many parts of Europe, and huge forest fires in Australia. Moreover, a new government was appointed to Finland on the 10<sup>th</sup> of December headed by young Prime Minister Sanna Marin. The discussion around climate change is heating up, which is fueling attention on developing and applying novel technologies for mitigating the changes. We continue to wait for decisions related to funding allocations on the national and European level and hope that progressive scientifically based views are given their rightful place in the discussion.

This year will be a very exciting year for our society, as the 19<sup>th</sup> Nordic Symposium on Catalysis will be organized in Espoo, Finland 24–26 August 2020. This prestigious and traditional event is held on Finnish soil only every eight years. The organizing is far along and abstract submission has just opened. Moreover, the Olympic Games (17<sup>th</sup> International Congress on Catalysis) will be held on June 14–19 in San Diego, California, USA.

Finnish catalysis and the Finnish Catalysis Society have a new member as Dr. Pedro Camargo was rather recently appointed as Professor of Inorganic Materials Chemistry at the University of Helsinki. Welcome!

An honorary member of our society obtained the prestigious A.I. Virtanen prize on 10 December, as described in more detail in this newsletter. Warm congratulations to the

awardee and we all can be very pleased about the recognition given to the field of catalysis. The prize is named after Artturi Iivari Virtanen, who thus far is the only Finnish Nobel laureate in the fields of natural sciences. But who was Virtanen, what did he do and what can we learn from his story?

Upon a closer look, Virtanen was involved in many fields of research including chemistry, biochemistry, nutrition science and indirectly catalysis. He was awarded the Nobel prize for the discovery that animal feed obtained from fields can be conserved by limiting the amount of oxygen available and by acidifying the feed to a pH of 3–4 by applying inorganic (and later organic) acids. The acidification decreases the presence and prohibits the function of harmful enzymes in the feed. Moreover, it helps with digestion of the feed, which is due to the catalytic partial hydrolysis of the plant cell wall. So in conclusion, the award was given partly for discoveries in applied catalysis and catalyst inhibition.

Besides animal feed, Virtanen made other very important discoveries. Regulating the pH value of butter with the help of disodium sulfate and sodium carbonate, enabled the Finnish state-owned company Valio to produce and export the best and longest-lasting butter in the world. This advantage lasted for 14 years before rivals (Sweden and Estonia) figured out the innovation. The same original recipe called AIV salt (patented in 1926), was still used at the beginning of the 21<sup>st</sup> century and nowadays it can be enjoyed in the widely sold product Oivariini.

Despite these wonderful discoveries, probably his most widely known work is related to a cocktail named after, Vjatšeslav



Mihailovitš Molotov, foreign minister of the former Soviet Union. The development of this efficient and affordable weapon against tanks was contracted by the Finnish army and finalized before WWII. Virtanen added tar to the burning mixture as well as a detonation device consisting of chlorate and sulfuric acid resulting in a hot sticky burning mass accompanied by heavy smoke formation. The invention was key catalyst in Finland remaining independent.

Further, interesting and still relevant facts and examples can be found in Virtanen's work and life. When he signed his employment contract with Valio at the age of 24, he set as a prerequisite the possibility of visiting foreign research institutions. These visits to Central Europe and Sweden resulted in, among other things, him learning about modern pH measurement and importing the necessary equipment needed for it. His international activities were later key to his success as were his collaboration between university and industry. He often emphasized these factors. A cautionary tale can be found when, as a senior scientist, he almost lost his life while carelessly using a pesticide he developed for wartime use to get rid of unwanted visitors in his laboratory. There is also tragedy. Virtanen was ahead of his time researching the fixation of nitrogen directly from the atmosphere with the help of plants and bacteria. His theory was ultimately proved wrong to his huge disappointment. However, before that, a research assistant eager to please his supervisor, falsified related research results, which resulted in Virtanen presenting falsified data during his Nobel lecture. As a final example, A.I. Virtanen was nominated for the Noble prize 12 times before receiving the award. It was good that he did not give up after a dozen attempts.

I wish you all a bright continuation of the spring and hope to see you in Turku in April!

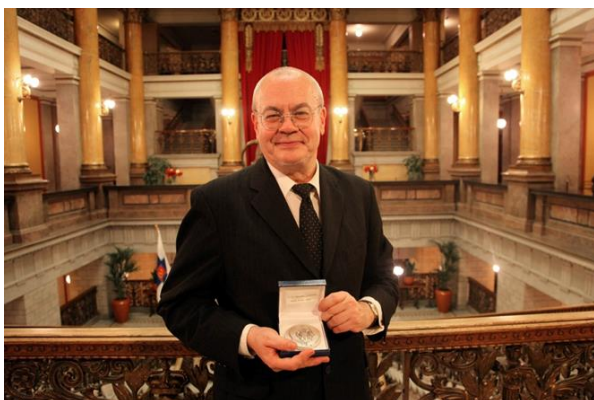
*Henrik Grénman*

Chairman



## A. I. Virtanen prize to Academy Professor Tapio Salmi

Tapio Salmi, twice appointed Academy Professor by the Academy of Finland and Professor of Chemical Reaction Technology at Åbo Akademi, received the 2019 A. I. Virtanen Prize at an official award ceremony held in Helsinki, past December, at the House of the Estates. This prestigious prize, one of the most highly ranked in Finland, is named for Artturi Iivari Virtanen, a seminal Finnish scientist and recipient of the 1945 Nobel Prize in Chemistry.



The prize is awarded biennially by the Finnish Chemical Society, the Foundation for Nutrition Research and Societas Biochemica, Biophysica et Microbiologica Fenniae to a Finnish or a foreign scientist for groundbreaking achievements in the fields represented by the three societies. Academy Professor Salmi, the first chemical engineer ever to receive the prize, was recognized for his internationally acclaimed achievements in catalysis, chemical kinetics and chemical reaction engineering.

In his scientific, yet truly entertaining award lecture, Professor Salmi enlightened the most attentive and well-dressed audience of the House of the Estates about his life-long

adventures in the world of transient kinetics of complex chemical reactions. While acknowledging the industrial relevance of such investigations, in his concluding remarks, Professor Salmi enthusiastically emphasized the importance of academic freedom to pursue curiosity-driven, fundamental basic research in natural sciences and engineering. Well said, and the A. I. Virtanen prize well deserved.

Reko Leino

Professor in Organic Chemistry,  
Åbo Akademi University

## Gadd Prize to Academy Professor Tapio Salmi

One day before receiving the A.I. Virtanen prize, Tapio Salmi was granted the Gadd Prize for excellence in research in the field of natural sciences and technology. The prize is named after the first professor in chemistry at Åbo Akademi University, Pehr Adrian Gaddin (1727–1797). Gadd was on the opinion that chemistry should be made familiar to everyone and that chemists should especially conduct nature based research for finding answers to important questions.





## You'll never walk alone: Young European Catalysis Network (YEuCat)

YEuCat? Really? What is it? This may be asked by those who did not attend EuropaCat 2019 that summer in Aachen. However, others, or more precisely 1350 conference participants most certainly know the answer, as they could not avoid the group of the young enthusiasts preaching about it in the corridors, between the posters and before oral sessions. YEuCat stands for Young European Catalysis Network, a new network for undergraduates, graduates, and young early-career professionals, from both academia and industry who are active in the field of catalysis.



The goal of the movement is to build a vivid and diverse network to share knowledge, get inspired, and connect current and future generations of young professionals in catalysis across Europe to jointly address societal and technological challenges. To enable these flows and become self-sustainable YEuCat focuses on individuals. Through peer-to-peer interactions, the network supports them in solving the issues they are facing in their careers.

The idea for YEuCat was born during the 1<sup>st</sup> Young Scientist Contest organized by the European Federation of Catalysis Societies (EFCATS) in July 2018 in the Netherlands. Among many other European nations, Finland had two representatives - Ricardo Pezoa Conte and Nemanja Vucetic, supported

by the Finnish Catalysis Society. This event was permeated with multi-national cross-disciplinary teams working and exchanging ideas, truly representing the values that Europe stands for. It became clear that what was experienced there had to be raised to a higher level. So since then, Tanja Franken (Zurich University, CH), Nemanja Vucetic (Åbo Akademi University, FI), Pedro Mendes (Ghent University, BE) and Lars Kiewidt (Wageningen University, NL) have been working on the concept for a young European network in catalysis. YEuCat was presented for the first time at EuropaCat 2019 and the kick-start for future expansion of activities commenced with many young individuals from different parts of Europe.



On 20<sup>th</sup> of August 2019 YEuCat held its first session titled "You'll never walk alone". More than 150 young professionals attended the session, which started with an introduction followed by the passionate talk of Alice Solda, former chair of European Young Chemist Network. She managed to excite the interest in attendees to take a part in raising a new community.

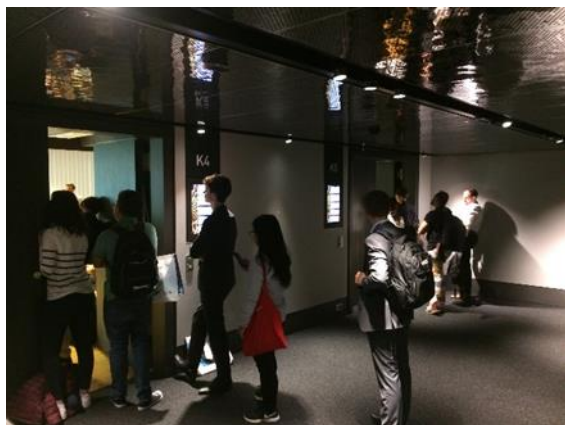


# Katse

1/2020

Suomen katalyysiseura  
Finska katalyysällskapet  
Finnish Catalysis Society

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Afterwards, invited young guests from academia, industry, publishing houses, and consulting shared their experiences regarding research, career and personal development in a speed-dating format. Participants used the chance to learn from the successful professionals and maybe reflect on their experiences.

At the end of the day, more than 30 young volunteers from universities, research institutes, and companies from all over Europe joined the YEuCat teams.

Overall, the kickoff was a great first step for YEuCat and formed a diverse group of young enthusiastic individuals that will continue building YEuCat in the future to unite young generations in catalysis. More than 30 active members from 14 European countries are paving the road of YEuCat. With an average age of 29, most certainly they will hang around for a while.



One of the ongoing activities is a new web platform that is expected to be launched in 2020, where young professional will have the opportunity to meet, share and discuss all the interesting topics related to catalysis. Also, many new webinars, events and activities are



on the agenda for the upcoming two years. To stay tuned, visit [www.youngcatalysis.net](http://www.youngcatalysis.net).

With the valuable support from EFCATS, national societies, and individuals, YEuCat starts its journey, which we all hope lasts for a long time. YEuCat invites you to become a part of the network and to #getactive! Create a living framework to organise self-development possibilities!

Nemanja Vucetic  
YEuCat, Events & Sponsors team

## 14th European Congress on Catalysis

August 18-23 2019, Aachen, Germany

The 14th European Congress on Catalysis, EuropaCat 2019, was organized at the Eurogress congress centre in Aachen, Germany, from the 18<sup>th</sup> to the 23<sup>rd</sup> of August 2019. The conference is a major European conference in the field of catalysis, this year gathering more than 1500 participants from both academia and industry. During the conference, scientific discussions took place at more than 400 oral presentations split into six parallel sessions and 800 posters presented at two sessions. The motto of the conference was "Catalysis without Borders".

The Finnish Catalysis Society granted five participants from Finnish universities, namely, Aitor Arandia Gutierrez (Aalto University), Atte Aho (Åbo Akademi University), Minttu Maria Kauppinen (University of Jyväskylä), Nemanja Vucetic (Åbo Akademi University) and Ramakrishna Jogi (Åbo Akademi University) economic support to travel to the EuropaCat and present their work as oral and poster presentations. Aitor Arandia Gutierrez gave a talk about the kinetic modelling of the aqueous-phase

reforming of Fischer-Tropsch water over nickel-copper on ceria-zirconia catalyst. Atte Aho and Nemanja Vucetic had flash oral presentations with topics on biohydrogen from waste wood hemicellulose hydrolysate and preparation and characterization of a new supported ionic liquid catalyst (SILCA) with remarkable activity in the Heck reaction. Minttu Maria Kauppinen presented her work on Computational Insights into Hydrodeoxygenation of Biomass-derived  $\gamma$ -Valerolactone on Ru(0001) and Rh(111) and acted as a co-author in the work about water-gas-shift reaction on ZrO<sub>2</sub>-supported Rh from first principles microkinetics. Ramakrishna Jogi presented his work on the Kinetics of the Formation of Phenolic Compounds during Wood Fractionation under Supercritical Ethanol in the main conference hall. The financial support from the Finnish Catalysis Society is highly appreciated by the young researchers.

Besides the interesting scientific programme of the conference offered also social program such as the conference dinner and the young scientist party with live music and refreshments.



Photo by Minttu Maria Kauppinen

Conference dinner.





Photo by Jyothsna Devi Jogi  
*Researchers from Åbo Akademi University.*



Photo by Nemanja Vucetic  
*Young Scientist Party.*

The trip to Aachen went smoothly. Already on the plane from Helsinki-Vantaa to Düsseldorf one could meet several Finnish conference participants from different universities and research centers. A train connection was used to get from the Düsseldorf airport to the city of Aachen. One small mishap happened when arriving to the hotel, the lock on the outer door was broken and after standing more than one hour out in the rain the door was removed from the frame and it was possible to enter the hotel.

Wander Perez, Matias Alvear  
and Ole Reinsdorf

## Preparations for Nordic Symposium on Catalysis 2020 progressing

Preparations for the 19th Nordic Symposium on Catalysis (NSC2020), to be organized in Espoo 24<sup>th</sup> - 26<sup>th</sup> August, 2020, have progressed well.

The Scientific Committee consists of members from all four participating countries. There are 3-4 members per country from Denmark, Norway and Sweden. From Finland, there is a balanced number of members mainly from various universities active in the area of catalysis.

High-class plenary and keynote speakers have been secured. Plenary speakers will be:

- Professor Gabriele Centi, University of Messina, sharing views on "A new catalysis for a changing scenario to address climate change mitigation",
- Professor Regina Palkovits, RWTH Aachen University, addressing "Catalyst design as important element towards a circular carbon economy", and
- The new Berzelius Prize winner, yet to be decided.

Nordic keynotes will be delivered by Prof. Jan Rossmeisl ("Electrocatalysis at the atomic scale"), Prof. Pedro Camargo ("Addressing activity and selectivity in plasmonic catalysis with designer nanoparticles"), Prof. Zhixin Yu ("In-situ study of CO methanation over NiFe bimetallic catalysts") and Dr. Sara Blomberg ("X-ray spectroscopy in the service of catalysis for renewable chemicals and fuels").

Abstract submission is now open. You can find the abstract template, registration link,



etc, at the website <http://nsc2020.fi>. Submission will close at the end of March.

Continuing the tradition of the conference series, a special issue in Topics in Catalysis has been agreed with Springer publisher.

We are looking forward to many abstract submissions and a very interesting event. Symposium website: <http://nsc2020.fi>, Twitter account: @nsc2020, #NordicSympCat.

Welcome!

Juha Lehtonen & Riikka Puurunen

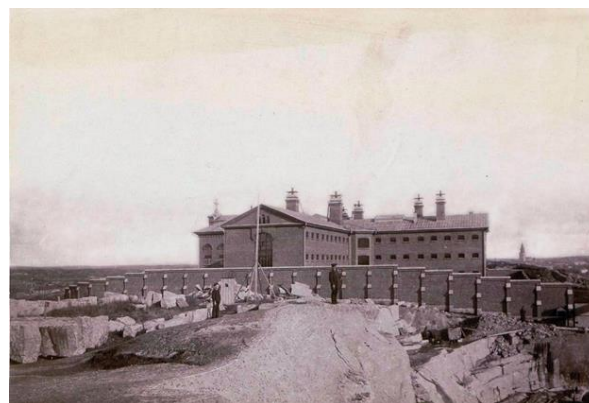
## Young Scientist Forum

The next Young Scientist Forum and annual meeting of the Finnish Catalyst Society will be organized on April 3<sup>rd</sup> in Turku/Åbo. The event is going to be held in Kakola, which is within walking distance from the market square.

### Brief history of Kakola

Kakola Prison opened in central Turku in the 1840s, taking the place of the city's former central prison in Turku Castle. The prison later included a mental hospital for prisoners, held political prisoners during the Finnish Civil War, and incarcerated international spies during World War Two. It housed some of Finland's most notorious criminals, including bank robber Volvo Markkanen, who received his name as he used Volvo cars as his getaway vehicles, and Toivo Koljonen, who was the last person in Finland to be sentenced to death. All of these contributed to giving Kakola a dark and grisly reputation. Kakola closed down in 2007 when the prison was moved to a modern building. The vacated

facilities are now a prime location for hosting scientific events.



## Catalysis related dissertations

### M.Sc. Adriana Samantha Freites

**Aguilera** from Laboratory of Industrial Chemistry and Reaction Engineering, Åbo Academy University defended her thesis on 15<sup>th</sup> of January, 2020. The title of her thesis is

**“Epoxidation of vegetable oils – process intensification for biomass conversion”**

*Opponent:* Directrice de recherche Doctor Carine Julcour, Université de Toulouse, France

*Custodian:* Acad. Prof. Tapio Salmi, Åbo Academy University

### Abstract:

Oils extracted from plants, algae, seeds and wood are one of the vast biomass resources which can be used to elaborate a wide range of products. Tall oil obtained from forest biomass is a good source of vegetable oils, because it is a non-edible by-product of Kraft pulping process and it represents an abundant feedstock, particularly in Nordic countries.





Epoxidized vegetable oils and fatty acids are used for developing PVC-derived plasticware and as intermediates for the synthesis of biolubricants, polyols, glycols, olefinic compounds and stabilizers for polymers. In other words, epoxidized vegetable oils are green platforms by excellence for the development of products and present an alternative to its derivation from non-renewable fossil resources.

This work has focused on the study of the Prilezhaev epoxidation of plant oils as a green process, since it uses renewable raw materials and produces biodegradable products through a non-toxic synthesis route. An important aspect of this thesis was the application of process intensification in the form of microwave irradiation, heterogeneous catalysis and new mixing technology (a rotating bed reactor) for a more energy-efficient process with higher product yields, compared to more conventional approaches.

The reaction was executed by peracetic acid formed in situ from acetic acid and hydrogen peroxide. Epoxidation of oleic acid as a model compound and tall oil mixtures was performed in a batch loop reactor. The core of the reactor system was a vigorously stirred tank which was coupled to a loop with a microwave cavity and a heat exchanger. The microwave effect was compared with the results obtained with conventional heating. The reactor system was equipped with a special mixing device (Spinchem<sup>TM</sup>), which allowed to immobilize solid resin catalysts and to minimize mass transfer limitations of the oil-aqueous-solid system. An extensive series of kinetic experiments was carried out in the presence and absence of microwave irradiation and heterogeneous catalysts. Typical reaction temperatures were 40-70°C. From the separated aqueous and organic phases, the concentrations of acetic acid,

hydrogen peroxide, peracetic acid as well as double bonds in the reactant oil and epoxidized oil were determined by titrimetric analysis. The kinetics of ring opening reactions was studied separately and some of the ring opening products were identified by NMR analysis.

The results showed that an increased temperature, as well as higher concentrations of acetic acid and hydrogen peroxide accelerated both the epoxidation and the ring opening processes. The epoxidation of oleic acid occurs spontaneously in the absence of the catalyst, but the reaction yield can be considerably improved by exposing the system to microwave irradiation and incorporating a solid catalyst. Several heterogeneous catalysts were screened to find the highest performance. However, the microwave effect was not visible in the presence of heterogeneous catalysts and microwave irradiation showed to be detrimental for the yields of tall oil epoxidation.

Detailed mathematical modelling of the multiphase system was carried out, starting from first principles. Detailed kinetic models based on reaction mechanisms were derived and the model parameters were estimated by non-linear regression analysis. The models for epoxidation with conventional heating and microwave irradiation in the presence and absence of a solid catalyst had a good correspondence between the experimental and calculated concentrations of the reaction components. The rate constants and activation energies for the perhydrolysis, epoxidation and ring opening reactions were obtained as a result of the parameter estimation.



## Conferences and Symposia

**17<sup>th</sup> International Congress in Catalysis (17ICC)** “2020 Vision for Catalysis”  
June 14-19, 2020, San Diego, CA, USA  
<https://2020icc.com/>

**19<sup>th</sup> Nordic Symposium on Catalysis (NSC2020)** “Catalysis in the climate change mitigation and Catalysis in the Nordic Countries”  
August 24-26, 2020, Espoo, Finland  
<http://nsc2020.fi>

**See also e.g.**

[www.conference-service.com](http://www.conference-service.com)

[www.iacs-catalysis.org](http://www.iacs-catalysis.org)

## Web pages

<http://www.katalyysiseura.org>

<http://www.kemianseura.fi>

<http://www.efcats.org>



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*The Board of the Finnish Catalysis Society wish to get feedback about the Katse newsletter from the members of the society.*

*In addition, please send news and information of activities e.g. doctoral dissertations, national and international events, prizes, and courses to be published in the Katse. The feedback and news can be sent to the Board members.*

*Thank you.*