EFCE Spotlight Talks

by the Working Parties and Sections

15-28 March 2024

11 webinars

EFCE
European Federation of Chemical Engineering

Welcome to the sixth Spotlight Talks Series

This year we have gathered eleven sessions of spotlight talks from eleven of the working parties and sections of the EFCE (Working Parties on Chemical Reaction Engineering, Crystallization, Drying, Education, Fluid Separations, Loss Prevention and Safety Promotion in the Process Industries, Process Intensification, Static Electricity in Industry, and Thermodynamics and Transport Properties, and the Sections on Food, and Membrane Engineering). While the organization of this series of online events has found its origin in the times of the Covid pandemic, also now that we are able to travel again, these sessions offer a valuable opportunity to learn more about very specific topics, without having to travel. We consider these Spotlight Talks as a low-barrier opportunity to get involved (or stay involved) in EFCE activities. Covering a wide range of working parties and sections, there will likely be one or more sessions with topics of your interest. We hope that you enjoy some of this year's Sessions!

15 March • 13:00	**How industry is using applied thermodynamics**
18 March • 9:30	**Challenges and opportunities in desalination**
18 March • 12:00	**Digitalization in chemical engineering education**
20 March • 10:00	**Protection of electrostatic charges and discharges: material web charging and lightning**
20 March • 14:30	**Electrically-driven dewatering and drying**
21 March • 14:00	**Optimal design and operation of next generation distillation processes**
22 March • 14:00	**Adaptation to climate change and impact on the process industry**
25 March • 10:00	**Machine learning and artificial intelligence applications in industrial crystallization**
25 March • 16:00	**Application of artificial intelligence to chemical reaction engineering and processes intensification**
26 March • 14:00	**Trays, packings, and dividing walls in distillation columns – design, innovation, construction and operation**
28 March • 14:00	**Electro-based processing technologies for high quality and sustainable foods**

EFCE Spotlight Talks

Working Party on Thermodynamics and Transport Properties

15 March 2024

13:00-15:30 CET

EFCE

How industry is using applied thermodynamics

When the Working Party prepared the publications of the industrial survey in 2020 [1], and the follow-up opinion paper in 2022 [2], the need became clear of a sharper insight on the industrial common practice in applied thermodynamics. This insight would create a better understanding of the needs and requirements by industry, and the opportunities and options offered by academia, possibly enhanced through the interface of software suppliers. It would improve the dialogue between the parties involved: academia, software suppliers and industry. Hence, the working party decided to organize these spotlight talks on how industry is using applied thermodynamics.

[1] Georgios M. Kontogeorgis, Ralf Dohrn, Ioannis G. Economou, Jean-Charles de Hemptinne, Antoon ten Kate, Susanna Kuitunen, Miranda Mooijer, Ljudmila Fele Žilnik, and Velisa Vesovic, Industrial Requirements for Thermodynamic and Transport Properties – 2020, Industrial & Engineering Chemistry Research (2021), 60, 13, 4987–5013

[2] Jean-Charles de Hemptinne, Georgios M. Kontogeorgis, Ralf Dohrn, Ioannis G. Economou, Antoon ten Kate, Susanna Kuitunen, Ljudmila Fele Žilnik, Maria Grazia De Angelis, and Velisa Vesovic, A View on the Future of Applied Thermodynamics, Industrial & Engineering Chemistry Research (2022), 61, 39, 14664-14680

PROGRAM

13:00 **Welcome and introduction**
Prof. Maria-Grazia de Angelis, Chair Working Party on Thermodynamics, U. Edinburgh – UK
Dr. Antoon ten Kate, Nouryon RD&I, Deventer - Netherlands
Prof. Boelo Schuur, EFCE Scientific Vice-President

13:15 **How to develop accurate and reliable simulations of chemical processes**
Dr. Paul Mathias, Fluor

13:45 **Applied thermodynamics as part of simulations supporting activities ranging from research to investment at Neste**
Dr. Susanna Kuitunen, Neste

14:15 **Systematic development and benchmarking of electrolyte thermodynamic models for solvent-based CO2 capture - and transportation**
Dr. Bjørn Maribo-Mogensen, Hafnium Labs ApS

14:45 **Advancing liquid formulation discovery and optimization through molecular modelling in applied thermodynamics**
Dr. Giuliana Giunta, BASF

15:15 **Discussion and conclusion**
Prof. Maria-Grazia de Angelis, Chair Working Party on Thermodynamics
Dr. Antoon ten Kate, Nouryon RD&I, Deventer - Netherlands

15:30 **Closure**

REGISTRATION

free of charge but mandatory

Contact: martine.poux@toulouse-inp.fr
antoon.tenkate@nouryon.com
grazia.deangelis@ed.ac.uk

EFCE Spotlight Talks

Section on Membrane Engineering

18 March 2024

9:30-11:30 CET

EFCE

CHALLENGES AND OPPORTUNITIES IN DESALINATION

The fresh water demand is continuous increasing in last years, due to the growth of population and of industrial productions, together with climate change which is exacerbating drought. The depletion of fresh water sources and the pollution of water streams further complicate the scenario. In this context, desalination is often applied to obtain fresh water from the sea, with reverse osmosis becoming the dominant technology. Typical fresh water recovery factors are up to 50% and, together with fresh water, a salty concentrated stream, called brine, is also produced. In most cases the brine is re-injected into the sea, with consequent impacts on the marine environment. In this webinar, possible strategies to exploit the brine are presented, like its use for CO2 capture or for recovery salts and metal compounds while increasing the overall fresh water recovery factor. The use of solar energy as renewable and "free" thermal energy source for the process is also discussed.

PROGRAM

09:30 **Welcome and introduction**
Enrico Drioli and Alessandra Criscuoli – Section on Membrane Engineering, Istituto per la Tecnologia delle Membrane (CNR-ITM) – Italy
Boelo Schuur, EFCE Scientific Vice-President

09:40 **Environmental impact of membrane distillation-crystallization for CO2 capture using desalination brines**
Patricia Louis Alconero, UCLouvain - Belgium

10:10 **Membrane crystallization for the recovery of metals compounds from seawater brines**
Francesca Macedonio, Istituto per la Tecnologia delle Membrane (CNR-ITM) – Italy

10:40 **Application of solar energy to desalination**
Guillermo Zaragoza, CIEMAT - Plataforma Solar de Almería – Spain

11:10 **Conclusion**
Enrico Drioli and Alessandra Criscuoli – Section on Membrane Engineering, Istituto per la Tecnologia delle Membrane (CNR-ITM) – Italy

REGISTRATION

free of charge but mandatory

Contact: martine.poux@toulouse-inp.fr
a.criscuoli@itm.cnr.it

EFCE Spotlight Talks

Working Party on Education

18 March 2024

12:00-15:15 CET

EFCE

DIGITALIZATION IN CHEMICAL ENGINEERING EDUCATION

Digitalization changes not only the workplace but also the way we teach and what needs to be taught. This spotlight will illuminate the how artificial intelligence can be incorporated into chemical engineering education as an asset. The second focus point will be the use of game concepts for teaching chemical engineering subjects. Both focus points will be complemented by strategic considerations and case studies for individual subjects

PROGRAM

12:00 **Welcome and introduction**
Dr. Hermann Feise, Chair Working Party on Education
Prof. Boelo Schuur, EFCE Scientific Vice-President

12:10 **Strategies for working with AI teaching assistants**
Dr. Stuart Prescott, Univ. New South Wales – Australia

12:35 **It's game time: Videogames and online active learning strategies for ChemE education**
Dr. Christopher Honig, Univ. Melbourne - Australia

13:00 **Introduction to mixed reality for training with flashlight on VR/AR techniques created in CHARMING MSCA-ITN**
Prof. Thies Pfeiffer, Hochschule Emden-Leer - Germany

13:25 **A new educational game on the soap-making process, with student evaluation and critical reflections**
Prof. Daniel Cermak-Sassenrath, IT University Copenhagen – Denmark

13:50 **Demonstration of CHENEXT's VR distillation plant learning environment**
Dr. Philippe Chan, CHENEXT - Belgium

14:15 **Digitalization in education**
Prof. Johannes Buyel, Univ. of Natural Resources and Life Sciences, Vienna - Austria

14:40 **Contents under Pressure**
Dr. Cheryl Bodnar, Rowan University, Glassboro – United States

15:05 **Conclusion**
Dr. Hermann Feise, Chair Working Party on Education

REGISTRATION

free of charge but mandatory

Contact: martine.poux@toulouse-inp.fr
hermann.feise@basf.com

EFCE Spotlight Talks

Working Party on Static Electricity in Industry

20 March 2024

10:00-11:30 CET

EFCE

WP Static Electricity in Industry

PROTECTION OF ELECTROSTATIC CHARGES AND DISCHARGES: MATERIAL WEB CHARGING AND LIGHTNING

Static Electricity in Industry has two faces: risks and applications. In the series of EFCE Spotlight Talks proposed during the last years by the Working Party Static Electricity in Industry, we have explored both aspects. In this edition we will focus on the risks of electrostatic charges and electrostatic discharges.
Electrostatics risks evaluation and remediation involve a large knowledge on the physics and nature of the phenomena. Besides, the scale of electrostatic discharges in industry can range from some micrometers to several kilometers as in lightning protection. Obviously, the ways to detect, avoid or protect from them are very different.

The first talk in this Webinar will address the topic of charging of material webs in the process industry. A deep knowledge on materials properties, triboelectric charging, charge accumulation, dissipation and neutralization is required to avoid disturbances or accidents. Wolfgang Schubert will give a talk on how charging happens on material webs, how to measure it and how to correctly neutralize the charge. He is an expert in the printing industry, but all the methods are applicable to any industry where material webs are handled.
The second presentation concerns very large-scale discharges: lightning protection of chemical industry. Lightning can be considered as an extremely long electrostatic discharge completely out of our control. Thus, protection is the only approach to this challenge. Understanding the physics of the problem and the basis of the technical solutions is necessary to achieve a good protection and risks reduction. Prof. Istvan Kiss, with a very large experience in lightning protection, will provide the rules for lightning protection of chemical industries and give some case examples.

PROGRAM

10:00 **Welcome and introduction**
Pedro Llovera, Chair Working Party on Static Electricity in Industry
Giorgio Veronesi, EFCE President

10:10 **Charging of Material Webs in the Process Industry**
Wolfgang Schubert, Schubert GMD - Germany

10:55 **Lightning Protection of Chemical Industry**
Dr. Istvan Kiss, Department of Electric Power Engineering, Deputy Head of Department - Hungary

11:25 **Conclusion**
Pedro Llovera, Energy Technological Institute, Polytechnic University of Valencia - Spain

REGISTRATION

free of charge but mandatory

Contact: martine.poux@toulouse-inp.fr
pedro.llovera@ite.es

EFCE Spotlight Talks

Working Party on Drying

20 March 2024

14:30-17:00 CET

EFCE

ELECTRICALLY-DRIVEN DEWATERING AND DRYING

Nowadays, drying technologies account for 12-15% of all energy consumed in the industry of the developed world. Water removal using electrical driven rather than thermal driving forces may be much more energy efficient and facilitates easy use of renewable energy sources. First developments on electrical-driven dewatering and drying technologies show that the use of electric fields can save 50 – 90% of the energy for water removal. In this webinar you will be updated on research on some emerging electrically-driven dewatering and drying principles including their future applications.

PROGRAM

14:30	**Welcome and introduction** Maarten Schutyser, Chair Working Party on Drying Boelo Schuur, EFCE Scientific Vice-President
14:40	**Electro-osmotic dewatering for semi-diluted feed streams** Sarthak Mehta, Msc – TU Eindhoven - The Netherlands
15:10	**Electrohydrodynamic (EHD) drying: Experimental characterization of an EHD drying set-up** Judith Ham, Msc – Wageningen University - The Netherlands
15:40	*break*
15:50	**EHD drying and the prospects of its practical applications** Alex Martynenko – Dalhousie University - Canada
16:20	**Electrostatic spray drying of whey protein isolate and lactose dispersion** Doll Chutani, Msc – Teagasc Food Research Centre, Moorepark - Ireland
16:50	**Discussion and conclusion** Marteen Schutyser, Chair Working Party on Drying

REGISTRATION

free of charge but mandatory

Contact: martine.poux@toulouse-inp.fr
maarten.schutyser@wur.nl

EFCE Spotlight Talks

Working Party on Fluid Separations

21 March 2024

14:00-16:00 CET

EFCE

OPTIMAL DESIGN AND OPERATION OF NEXT GENERATION DISTILLATION PROCESSES

Distillation is the most important separation process in the chemical process industry despite being highly energy-intensive. Any attempt to optimize its design and operation may therefore potentially have a significant impact both financially and in terms of environmental impact. The optimization of a distillation system is a Mixed Integer Nonlinear Programming (MINLP) problem, as well as a highly non-convex problem, and finding global optimal solutions is both challenging and time consuming. This webinar will, through a number of industrially relevant examples, highlight strategies for how to set up and solve challenging optimization problems and, in particular, discuss the benefits of systematic considerations for design and operation for advanced distillation processes including dividing wall columns, reactive distillation and hybrid separation systems.

PROGRAM

14:00 **Welcome and introduction**
Prof. Jens-Uwe Repke, Vice-Chair Working Party on Fluid Separations
Prof. Boelo Schuur, EFCE Scientific Vice-President, Secretary of the WP on Fluid Separations

14:10 **Synthesis of energy efficient distillation processes with and without heat pumps**
Prof. Rakesh Agrawal, Purdue University - USA

14:40 **Towards systematic design of distillation-based separation processes for non-ideal and azeotropic mixtures**
Prof. Mirko Skiborowski, Technical University Hamburg (TUHH) - Germany

15:10 **Optimal design and operation of hybrid reactive dividing wall distillation columns**
Prof. Eva Sorensen, University College London - UK

15:40 **Discussion and conclusion**
Prof. Jens-Uwe Repke, Vice-Chair Working Party on Fluid Separations

REGISTRATION

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Contact: martine.poux@toulouse-inp.fr
e.sorensen@ucl.ac.uk

EFCE Spotlight Talks

Working Party on Loss Prevention and Safety Promotion in the Process Industries

22 March 2024

14:00-16:30 CET

EFCE

ADAPTATION TO CLIMATE CHANGE AND IMPACT ON THE PROCESS INDUSTRY

The world is changing driven by climate change, energy transition and digitalization, so the traditional boundaries of engineering are merging, while novel risks are appearing. It is expected a sharp increase of NaTech risk in the next years since most of the natural events that can trigger technological hazards are influenced by climate change (i.e. extreme temperatures, floods, heavy rains, storms, etc.). Within this context, efforts are performed by national and international authorities worldwide, to introduce strategies of adaptation and mitigation, including reliable assessment procedures and emergency planning for local communities.

This webinar will provide you with a vision of new approaches, advanced techniques, good practice, and applicative results illustrating the interdisciplinary features of the problem.

World-class experts in the field will address a comprehensive discussion on selected themes focusing on the following challenges:

- direct and indirect impacts of climate change on industrial facilities, expected damage patterns, and failure mechanisms due to extreme heat, cold, wildfire, and permafrost thawing;

- wildfires created problems for the process industry and the map of the wildland-industrial interface in Europe;

- evolution and new paradigms toward a more reliable and comprehensive NaTech risk assessment;

- ensuring the resilience of critical infrastructure systems against vegetation, an underlying risk factor possibly compromising power grid reliability during Natech scenarios.

Participants from both academia and industry are very welcome.

PROGRAM

14:00	**Welcome and introduction** Bruno Fabiano, Chair of Working Party on Loss Prevention - DICCA Univ. of Genova -Italy Jarka Glassey, EFCE Executive Vice-President
14:10	**Natech risks due to climate change and extreme temperatures** Kyriaki Gkoktsi and Elisabeth Krausmann, European Commission JRC, Ispra - Italy
14:40	**Current and future impact of wildfires on the process industry** Eulàlia Planas - Universitat Politècnica de Catalunya - Spain
15:10	**A new paradigm for Natech risk assessment** Valerio Cozzani, University of Bologna - Italy
15:40	**Examining vegetation-induced risks in the context of Natech** Dimitrios Tzioutzios - NTNU, Trondheim - Norway
16:10	**Concluding remarks** Bruno Fabiano, Chair of Working Party on Loss Prevention - DICCA Univ. of Genova -Italy

REGISTRATION

free of charge but mandatory

Contact: martine.poux@toulouse-inp.fr
Bruno.Fabiano@unige.it

EFCE Spotlight Talks

Working Party on Crystallization

25 March 2024

10:00-12:00 CET

EFCE

MACHINE LEARNING AND ARTIFICIAL INTELLIGENCE APPLICATIONS IN INDUSTRIAL CRYSTALLIZATION

Artificial intelligence (AI) and machine learning (ML) are now omnipresent in chemical engineering applications. In industrial crystallization they are employed for performing several tasks, such as: inferring the size and three-dimensional shape of crystals from images, identifying parameters of kinetic models and formulating hybrid predictive models for thermodynamic properties, notably solubility. In this webinar three innovative applications from academia and industry will be presented.

PROGRAM

10:00 **Welcome and introduction**
Daniele Marchisio, Chair Working Party on Crystallization
Boelo Schuur, EFCE Scientific Vice-President

10:10 **Online 3D characterization of crystals in suspension with Machine Learning**
Anna Jaeggi, ETH Zurich - Switzerland

10:40 **Artificial intelligence in crystallization development: automated process monitoring using image analysis**
Akeem Olaleye, APC – Ireland

11:10 **Machine Learning algorithms in population balance-based crystallization modeling**
Álmos Orosz, Budapest University of Technology and Economics - Hungary

11:40 **Discussion and conclusion**
Daniele Marchisio, Chair Working Party on Crystallization

REGISTRATION

free of charge but mandatory

Contact: martine.poux@toulouse-inp.fr
daniele.marchisio@polito.it

EFCE Spotlight Talks

Working parties on Process Intensification and Chemical Reaction Engineering

25 March 2024

16:00-18:30 CET

EFCE

APPLICATION OF ARTIFICIAL INTELLIGENCE (AI) TO CHEMICAL REACTION ENGINEERING AND PROCESSES INTENSIFICATION

In recent years, application of Artificial Intelligence (AI) in different fields of chemical engineering has rapidly grown as game-changer and driver for process and products innovation, improved energy and materials resource efficiency and sustainable chemical manufacturing. This webinar will present diverse examples of use of AI and Machine Learning (ML) techniques for improved chemical reaction engineering and process intensification, including optimization of chemical syntheses, accelerated prediction of molecular properties, rapid screening of programmable catalysts to optimize periodic steady states and operating protocols, as well as simulation and control of the dynamics of complex crystallization process.

PROGRAM

16:00 **Welcome and introduction**
Prof. Georgios Stefanidis, Chair of Working Party on Process Intensification
Prof. Kevin Van Geem, Chair of the Working Party on Chemical Reaction Engineering
Prof. Jarka Glassey, EFCE Executive Vice-President

16:10 **Programmable Catalysts: Algorithmic optimization of periodic steady states for enhanced productivity and selectivity**
Ass. Prof. Michael Kavousanakis, National Technical University of Athens - Greece

16:40 **Speeding up molecular property predictions for reaction engineers using machine learning**
Prof. Istvan Lengyel and Maarten Dobbelaere, University of Gent - Belgium

17:10 **Exploring the role of artificial intelligence and machine learning in enhancing pharmaceutical crystallization processes**
Dr. Christos Xiouras, Janssen Pharmaceutica NV – Belgium

17:40 **AI for chemical synthesis as a path toward process intensification**
Ass. Prof. Connor Coley, Massachusetts Institute of Technology - USA

18:10 **Closing remarks**
Prof. Georgios Stefanidis, Chair of Working Party on Process Intensification
Prof. Kevin Van Geem, Chair of the Working Party on Chemical Reaction Engineering

REGISTRATION

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Contact: martine.poux@toulouse-inp.fr
gstefani@mail.ntua.gr

EFCE Spotlight Talks

Working Party on Fluid Separations

26 March 2024

14:00-16:00 CET

EFCE

TRAYS, PACKINGS, AND DIVIDING WALLS IN DISTILLATION COLUMNS – DESIGN, INNOVATION, CONSTRUCTION AND OPERATION

Despite being the most mature industrial separation technology, still many exciting developments take place in distillation research and development, and not only in academia. In this Spotlight Session, three speakers from industry talk about (1) design of trays and operation of tray columns, (2) latest developments in structured packings and packed columns, and (3) how to design and construct dividing wall columns.

While design of trays and packings is in many academia not a topic of research anymore, industrial developments discussed in this spotlight session show that improved trays and packings can lead to very significant reductions in energy demand, and hence, in CO2-footprint. Next to developments on internals level, also column configuration changes can help realize dramatic energy savings.

Dividing Wall Columns are a proven technology to save a considerable amount of energy, but even today, opinion persists that dividing wall columns are only a marginal phenomenon in distillation and that even the mechanical challenges are too great to bring dividing wall columns to a wider range of applications. To counter this view, we will present two case studies featuring a packed and a trayed dividing wall column. These case studies will show that for almost every theoretical obstacle to the design of a dividing wall column, a mechanical solution already exists which has also been tested and proven on an industrial scale.

PROGRAM

14:00	**Welcome and introduction** Boelo Schuur, Secretary Working Party on Fluid Separations, EFCE Scientific Vice-President
14:10	**Distillation tray design and operation** Greg Spencer, CEng FIChemE, Koch-Glitsch UK Div. Koch Engineered Solutions Ltd - UK
14:40	**Structured packing, important design aspects and latest product developments** Mario Roza (MSc), President Roza Process Technology Consulting and Retired VP Technology Management and Process Innovation, Sulzer Chemtech
15:10	**Design and construction of dividing wall column distillation processes** Dr. Robin Schulz, Julius Montz GmbH - Germany
15:40	**Discussion and conclusion** Boelo Schuur, Secretary Working Party on Fluid Separations, EFCE Scientific Vice-President

REGISTRATION

free of charge but mandatory

Contact: martine.poux@toulouse-inp.fr
b.schuur@utwente.nl

EFCE Spotlight Talks

Section on Food

28 March 2024

14:00-16:00 CET

EFCE

ELECTRO-BASED PROCESSING TECHNOLOGIES FOR HIGH QUALITY AND SUSTAINABLE FOODS

Application of electric energy in food and how it can help during food production and processing has been studied for decades. Different approaches and distinctive technologies have been developed and investigated, mostly on how to extend the shelf-life, increase the level of safety, or improve food product quality and increase process efficiency. While gas is a major driver for energy price increase, electrical energy is considered an important alternative that can be produced from a variety of sources. The scope of this webinar, comprising talks from academic and industrial speakers, is to give an update on research status of selected electro-based technologies, their potential for food production and their upscaling possibilities, as well as current market situation. Furthermore, consumer acceptance and potential legal barriers will be addressed.

PROGRAM

14:00 **Welcome and introduction**
Prof. Henry Jäger, BOKU – Univ. Natural Resources and Life Sciences, Vienna - Austria
Prof. Kemal Aganovic, DIL German Institute of Food Technologies, Quakenbrück; Univ. of Veterinary Medicine, Hannover - Germany
Giorgio Veronesi, EFCE President

14:10 **Application of Pulsed electric fields technology for improving food quality, structure and increasing process efficiency**
Prof. Stefan Töpfl, University of applied science, Osnabrück - Germany

14:30 **Potential of Ohmic heating for food production**
Ass. Prof. Felix Schottrhoff, BOKU, Univ. Natural Resources & Life Sciences, Vienna - Austria

14:50 *Break*

14:55 **Application of Radio frequency and Microwave heating for food applications**
Ugo Nicoletti, Stalam S.p.A Nove - Italy

15:15 **Possible applications of shockwave technology in food production**
Prof. Kemal Aganovic, DIL German Institute of Food Technologies, Quakenbrück; University of Veterinary Medicine, Hannover - Germany

15:35 **Discussion and conclusion**
Prof. Henry Jäger and Prof. Kemal Aganovic

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Contact: martine.poux@toulouse-inp.fr
K.Aganovic@dil-ev.de