7th European Drying Conference

Program

www.eurodrying2019.com
WELCOME MESSAGE

The Politecnico di Torino is proud to host the 7th edition of the European Drying Conference, EuroDrying’2019, the last of a series of events started in 1978 with the first meeting of the drying community, and supported by the Working Party on Drying (WPD), within the framework of the European Federation of Chemical Engineering (EFCE).

Main scope of this conference is to promote discussions and interactions on cutting-edge research topics in the drying field, enabling researchers and technicians, from academia and industry, to exchange ideas and innovation on drying methods, modeling and applications.

This year's conference theme “Drying for better life: food, pharmacy and art” highlights how drying processes represents a real challenge to improve the quality of life in all its aspects, from every day aspects to cultural and social issues.

Eurodrying’2019 deals with scientific sessions on fundamentals of drying, modelling and simulation, food, pharmaceutical, agricultural and biomaterials, as well as on all measurements and process control aspects. Particular attention has been paid to industrial process and innovative technologies and a special session devoted to industry has been organized. Eventually, with the idea of going toward new frontiers on drying processes, discussion on energy, environmental and cultural heritage applications have been promoted.

Eventually, special attention has been payed to encouraging the participation of MS and PhD students by organizing a Student Contest on Drying as a satellite event of the conference.

Special thanks to the Scientific Committee Members for their contribution to make this outstanding program possible, and to the authors whose research and development efforts are presented during the conference.

Hope you enjoy the conference in Torino!

Antonello Barresi, Politecnico di Torino

Chair of EuroDrying’2019
Organizing Committee

Chair
Antonello Barresi
Politecnico di Torino

Organizing Committee
Davide Fissore, POLITO
Sabrina Grassini, POLITO
Franco Pattarino, UPO
Roberto Pisano, POLITO

Scientific Committee
Based on Members of the EFCE Working Party on Drying, integrated with leading scientists in the field

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M. Schutyser (The Netherlands)
E. Tsotsas (Germany)
I. Zbicinski (Poland)
Opening and keynote lectures at EuroDrying’2019

Opening lecture: Ian Kemp.

**PRACTICAL APPLICATION OF DRYER MODELLING AND PROCESS UNDERSTANDING IN PHARMACEUTICAL AND RELATED INDUSTRIES**

Ian Kemp is currently a Senior Scientific Investigator at GSK R&D Stevenage, with specialist input on drying processes (including vacuum, spray and fluidised bed drying), coating and micronisation. Previously 5 years with GSK’s Manufacturing arm (GMS). National delegate in the WP on Drying for UK, Committee member of IChemE.

Keynote 1: Alberto Giacomello

**DRYING IN HYDROPHOBIC NANOPOROUS MATERIALS**

Alberto Giacomello graduated in Mechanical Engineering from Sapienza University of Rome and the Polytechnic Institute of New York University. He holds a PhD in Theoretical and Applied Mechanics from Sapienza and later moved as a PostDoc to the Max Planck Institute for Intelligent Systems in Stuttgart. He is currently Associate Professor in Fluid Mechanics at Sapienza University of Rome. His research focuses on the properties of fluids at interfaces and in confinement. In particular, he employs molecular dynamics simulations and macroscopic continuum models in order to investigate the fundamentals of wetting and drying in porous materials and rough (superhydrophobic) surfaces across different time and length scales. Since 2019, he has started an ERC project on the behavior of water confined in biological channels.

Keynote 2: Cordin Arpagaus

**NANO SPRAY DRYING OF BIOACTIVE FOOD INGREDIENTS**

Dr. Cordin Arpagaus is a process engineer and completed his doctoral studies in 2005 in the field of plasma treatment of polymer powders at the Institute of Process Engineering of the Swiss Federal Institute of Technology Zurich (ETH Zurich). He also holds a Master in Business Administration from ETH Zurich. From 2006 to 2011 he was product group leader for laboratory spray dryers and encapsulation systems at BÜCHI Labortechnik AG. His main focus was on the development of new nano spray drying technologies and the analysis of new market trends in the pharmaceutical, materials and food industries worldwide. From 2011 to 2015, he was team leader of technical support for sensors and laboratory products at Hamilton Bonaduz AG. Since April 2015, he has been Senior Research Engineer at the Institute for Energy Systems at NTB University of Applied Sciences of Technology in Buchs. His current research activities focus on thermal energy systems and energy efficiency in industrial processes, with a special interest in high temperature heat pumps.
Keynote 3: Angelique Leonard

**X-RAY COMPUTED TOMOGRAPHY: AN OUTSTANDING VISUALIZATION TOOL FOR DRYING RESEARCH**

Prof. Angélique Léonard obtained her Chemical Engineering degree (1998) and PhD in Applied Sciences (2003) from University of Liège. She was appointed by the Belgian Fund for Scientific Research (FNRS) from 1998 to 2009. She then became Professor within the Department of Chemical Engineering at the University of Liège, in the chair “Chemical processes and sustainable development”. She was the head of this Department from 2011 to 2015. She then became the director of the Research Unit in Chemical Engineering. She obtained the "Frédéric Swarts Prize" of the Division of Sciences of the Royal Academy of Belgium, 33rd two-year period, 2002-2004 and the "Award for the Best Scientist under the age of 35 years” given by the "World Forum for Crystallization, Filtration and drying” during IDS2008 - 16th International Drying Conference, Hyderabad, India, November 9-12, 2008. She organized in 2008 the first edition of the European Conference on Sludge Management at University of Liège. She is the Belgian delegate in the International Drying Symposium advisory board. From January 2016, she is the chairwoman of the European Federation of Chemical Engineering (EFCE) Working Party on Drying.

Her research interest are: convective drying of deformable porous materials (including sludge), sludge treatment (dewatering and drying), X-ray microtomography as a tool to characterize the texture of porous materials. She also leads a Life Cycle Assessment (LCA) team with more than 10 years expertise. LCA related works includes environmental product declarations (EPDs), LCA of processes, training in various fields: chemical and energy industry, waste management, biofuels, agrofood sector, building materials, batteries. She has authored/ co-authored over 70 refereed research publications and about 120 conference proceedings. She cooperates as Referee for about 15 international scientific Journals.

Keynote 4: Philippe Coussot

**IMBIBITION-DRYING IN MODELS SYSTEMS OBSERVED BY MAGNETIC RESONANCE IMAGING - APPLICATION TO A POULTICE/POUROUS MEDIUM SYSTEM FOR DESALINATION OF HISTORICAL MASONRY**

Philippe Coussot is a researcher in Laboratoire Navier depending on Ecole des Ponts, IFSTTAR and CNRS, and located in Université Paris-Est (France). His researches initially concerned the rheology of debris flows (in mountain streams), and later extended to the intrinsic properties and flow characteristics of various natural or industrial yield stress fluids (pasty materials). More recently he developed another axis of research concerning flow and transfers in porous media, such as drying, imbibition, colloid transport, taking advantage of Magnetic Resonance Imaging measurements. He has published about 175 papers and several books, among others, Mudflow Rheology and Dynamics (Balkema, 1997), Rheometry of pastes and suspensions (Wiley, 2005) and Rheophysics – Matter in all its states (Springer, 2014). He has received several awards, among others, the Silver Medal from CNRS and the Weissenberg Award from the European Society of Rheology.
Technical Sessions - Table of Contents

Wednesday July 10 (Valentino Castle)

09:00  Opening ceremony
09:50 - 10.30  Salon of Honor: “Drying: ideas and challenges for a sustainable world” - Video presentation of the selected student teams
10:30 - 12:00  Salon of Honor: Workshop on sustainability and resilience for the territories and cultural heritage
Sala delle Colonne: Table presentation of the conceptual ideas
12:00  Jury evaluation of presentation
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Wednesday July 10 (Politecnico di Torino, sede centrale)

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- 73  STATIONARY AND TRANSIENT ASPECTS OF AIR FLOW IN A NOVEL
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- 91  DRYING OF A SHRINKING PORE MEDIUM SATURATED WITH A
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- 100  DRYING OF AQUEOUS SOLVENT SUPPORTED BY A THIN POLYMER
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- 154  RESORCINOL FORMALDEHYDE HYDROGEL DRYING BEHAVIOR:
  EXPERIMENTAL AND NUMERICAL STUDY
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17:55 - 18:05  Technical Presentation
BUCHI

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  ceremony
18:20  Excellence Award on Drying and Freeze-Drying: Ceremony
18:40  Courtesy transfer to Valentino Castle
19:30 - 21:00  Welcome Cocktail with flag waver show (Valentino Castle, Sale delle
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Thursday July 11

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**FOOD AND AGRICULTURAL MATERIALS: PART B**

*Chairs: A. Mulet, I. Farkas*

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*Chairs: M. Adami, R. Pisano*

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