

Foreword

We cordially welcome you to the 12th European Coating Symposium (ECS). On behalf of the organizing committee it is our pleasure to present the program of the Symposium.

This year we celebrate the 22nd anniversary of ECS. Past symposia were organized at the:

- University of Leeds, UK, by M.D. Savage, 1995
- University of Strasbourg, France, by P. Bourgin, 1997
- Friedrich Alexander University, Germany, by F. Durst, 1999
- Von Karman Institute, Belgium, by J.M. Buchlin, 2001
- University of Fribourg, Switzerland, by P. Schweizer, 2003
- University of Bradford, UK, by H. Benkreira, 2005
- University of Paris Diderot, France, by L. Limat, 2007
- Karlsruhe Institute of Technology, Germany, by W. Schabel, 2009
- Abo Akademi University, Finland, by M. Toivakka, 2011
- University of Mons, Belgium, by J. de Coninck, 2013
- Eindhoven University of Technology and Holst Centre, The Netherlands, by A. Darhuber and I. de Vries, 2015

This year, for the second time, ECS takes place in Fribourg, Switzerland. Host is the iPrint Institute at the University of Applied Sciences and Arts of Western Switzerland in cooperation with Schweizer Coating Consulting.

For the continuity and success of the ECS, we would like to thank the founders of the symposium and the previous organizers of this biennial event. Due to their efforts, the ECS became a unique platform where a variety of researchers from universities, research centers and industry meet to present and discuss emerging findings and breakthroughs in the field of coating and drying technology. Like two years ago the focus of the symposium was extended in the direction of ink jet printing, because the organizing committee is convinced that ink jet printing is becoming an important technology, alone or in combination with traditional coating technology, for manufacturing emerging products. Therefore, a discussion of the possibilities of ink jet printing was deemed useful for the coating community.

We would like to thank the Scientific Committee members of the ECS for their continuing support, the keynotes lecturers Michael Mayer, Michael Biemann, Patrik Hoffmann and Fritz Bircher, who will enlighten us with presentations indirectly related to coating and drying, therefore challenging us with perspectives for future developments. We thank our sponsors for their generous support and of course all the participants for their contributions to the ECS17. We hope that the symposium will inspire new insights and ideas as well as new contacts and collaborations.

We wish you an exciting symposium and a pleasant stay in Fribourg.

With kind regards,

Fritz Bircher, Gilbert Gugler, Céline Renz and Peter Schweizer



The ECS 2017 organizing team

iPrint Institute (University of Applied Sciences and Arts of Western Switzerland) and Schweizer Coating Consulting

Conference program*

Day 1

Wednesday, 8th November 2017

08:00 - 08:45 Registration

08:40 - 08:45 Opening of the conference
Fritz Bircher, Conference Director

08:45 - 08:55 Information about conference organization
Gilbert Gugler & Peter Schweizer

08:55 - 09:00 Fribourg University of Applied Sciences - Welcome addresses
Jean-Nicolas Aebischer, Director

09:00 - 09:45 Key Note

Bio-Inspired Fluid Coatings of Nanopore Walls for Protein Detection
Michael Mayer; Adolphe Merkle Institute, University of Fribourg, Fribourg, Switzerland

09:45 - 10:15 Coffee break & Exhibition

10:15 - 12:15 Session 1 A – Slot coating technology

Session Chair: Harald Döll

10:15 - 10:35 Recent developments on intermittent coating
Ike de Vries; Holst Centre/TNO, Eindhoven, The Netherlands

10:35 - 10:55 Intermittent Slot Die Coating for Li-Ion Battery Electrodes
Ralf Diehm; Institute of Thermal Process Engineering, Thin Film Technology, Karlsruhe Institute of Technology, Germany

10:55 - 11:15 CFD modeling of Slot Die Coating of narrow stripes
Julien Boeuf; Roche Diagnostics GmbH, Mannheim, Germany

11:15 - 11:35 A theoretical perspective on the frequency response of slot coating flow
Semi Lee; School of chemical engineering, Sungkyunkwan University, Suwon, Gyeonggi-do, Korea

11:35 - 11:55 Slot Die Coating of Microcellulose on Paperboard
Douglas W. Bousfield; Laboratory of Paper Coating and Converting, and Center for Functional Materials, Åbo Akademi University, Turku, Finland

11:55 - 12:15 OLED lighting design to enable slot die coating technology
Arjan Langen; Holst Centre/TNO, High Tech Campus, Eindhoven, The Netherlands

Session 1 B – Surface modification

Session Chair: Hadj Benkreira

The Lotus effect: some recent breakthroughs
Joël De Coninck; University of Mons, Belgium

Deicing performance of water-repellent metal substrates
Francisco J. Montes Ruiz-Cabello; Biocolloid and Fluid Physics Group, Applied Physics Department, Faculty of Sciences, University of Granada, Granada, Spain

Plasma-Jet printing of nanoparticles for anti-bacterial coatings
Markus Geuss; iPrint, Fribourg, Switzerland

Reducing contact angle hysteresis for anti-bacterial coatings
Kristina Davitt; Laboratoire de Physique Statistique, Ecole Normale Supérieure UPMC Univ Paris 6, Université Paris-Diderot, CNRS, Paris, France

Surface treatment with starch using foam coating technique
Eija Kenttä; VTT Technical Research Centre of Finland, Finland

Surface tension-driven self-alignment of double-surface radio-frequency integrated circuits
Lorenzo Pirrami; iPrint and Department of Electronics and Telecommunication Politecnico di Torino

12:15 - 13:45 Lunch & Exhibition

13:45 - 15:45

Session 2 A – Coating Flows, Processes and Technology

Session Chair: Ike de Vries

13:45 - 14:05

Experimental characterization of the jet wiping instability

Anne Gosset; University of A Coruña, Department of Naval and Oceanic Engineering, Ferrol, Spain

14:05 – 14:25

Numerical Modal Analysis of the Jet Wiping Instability

Miguel A. Mendez; EA Dep., von Karman Institute for Fluid Dynamics, Brussels, Belgium; Naval and Oceanic Engineering Department, University of A Coruña, Ferrol, Spain

14:25 - 14:45

New Approach to reduce misting effect in roll coating

Robert Beer; Polytype Converting, Fribourg, Switzerland

14:45 - 15:05

Fluid mechanics of high speed deformable roll coating

Dr Sreedhara Sarma; University of Bradford, School of Engineering, Bradford, West Yorkshire

15:05 - 15:25

Curtain Coating – Development with minimized use of resources

Harald Döll; TSE Troller AG, Murgenthal, Switzerland

15:25 - 15:45

New electroluminescent products through multilayer coating

Moritz Graf zu Eulenburg; Inoviscoat GmbH, Monheim am Rhein, Germany

Session 2 B – Drying, Stress Build-up and Crack Formation

Session Chair: Wilhelm Schabel

Tunable cracking by polymer adsorption on nanoparticle surface

Masato Yamamura; Department of Applied Chemistry, Kyushu Institute of Technology, Tobata, Kitakyushu, Fukuoka, Japan

Drying stresses and cracking of carbon black/ionomer layers

Eva Hoffmann; Institute of Particle Technology, FAU Erlangen-Nuremberg, Germany

Cracking and stress change in the drying film of highly concentrated silica suspensions

Yoshiyuki Komoda; Department of Chemical Science and Engineering, Kobe University, Japan

Drying dynamics of a charged colloidal dispersion in a confined drop

Anne Bouchaudy; CNRS, Solvay, LOF, Université Bordeaux, Pessac, France

The Influence of the Thermal Properties of the System on the Lifetime of an Evaporating Droplet

Stephen K. Wilson; Department of Mathematics and Statistics, University of Strathclyde, Glasgow, Scotland, UK

Interfacial Effects Decelerating Diffusional Mass Transport in Nanolayers by Orders of Magnitude

Tobias Fritzensmeier; Institute of Thermal Process Engineering, Thin Film Technology, Karlsruhe Institute of Technology, Karlsruhe, Germany

15:45 - 16:15

Coffee break & Exhibition

16:15 - 20:30

Poster session

16:15 - 16:40

Poster session information

Presentation of iPrint, Prof. Fritz Bircher

Presentation of Polytype Converting, Ernst Meier

16:45 - 17:15

Transport to the Marly Innovation Center (MIC)

17:15 - 20:30

Poster session / Free visit of iPrint / Aperitivo

19:00 - 20:30

Meeting of ECS Committee

20:00 / 20:30 / 21:00

Bus Transport back to Fribourg (Au Parc Hotel)

Day 2

Thursday, 9th November 2017

09:00 - 09:45

Key Note

The ebeam (r)evolution: when size matters and access drives a renaissance

Michael Biemann; eBeam Technologies, COMET Group, Flamatt, Switzerland

09:45 - 10:15 Coffee break & Exhibition

10:15 - 12:15

Session 3 A – Flow of Thin Liquid Films I

Session Chair: Joël De Coninck

Session 3 B – Drying, Morphology, Binder Migration

Session Chair: Philip Scharfer

10:15 - 10:35

Manipulation of thin liquid films with deep-UV irradiation

Anton Darhuber; Mesoscopic Transport Phenomena Group, Department of Applied Physics; Eindhoven University of Technology, Eindhoven, The Netherlands

Latex Films with Composition Gradients Caused by Lateral Drying

Heike Römermann; Institute of Physical Chemistry, Clausthal University of Technology, Clausthal-Zellerfeld, Germany

10:35 - 10:55

Instability of thin liquid films compressed between soft solids

Maciej Chudak; Mesoscopic Transport Phenomena Group, Department of Applied Physics; Eindhoven University of Technology, Eindhoven, The Netherlands

Investigation of morphology and intermixing behavior of nano-multilayers for organic electronics

Lisa Merklein; Institute of Thermal Process Engineering, Thin Film Technology, Karlsruhe Institute of Technology, Karlsruhe, Germany

10:55 - 11:15

Dynamics of wetting for two liquid systems

J.C. Fernandez-Toledano; University of Mons, Belgium; Presented by Joël De Coninck

Cryo SEM morphology characterization and drying research on Li-ion battery electrodes

Jana Kumberg; Institute of Thermal Process Engineering – Thin Film Technology, Karlsruhe Institute of Technology, Germany

11:15 - 11:35

Static and dynamic contact lines on a deformable coating of controlled thickness

Laurent Limat; Laboratoire MSC, Matière et Systèmes Complexes, CNRS UMR 7057, Université Paris-Diderot, SPC Research University, Paris, France

NIR Technology - Drying at the Speed of Light

Dr. Kai K. O. Bär; adphos Digital Printing GmbH

11:35 - 11:55

Stability of a radially spreading film with steady liquid supply

Håkon B. Line; Institute of Fluid Mechanics & Heat Transfer, TU Graz, Graz, Austria

Drying of a polymer solution in a receding meniscus

Ber Wedershoven; Mesoscopic Transport Phenomena Group, Department of Applied Physics Eindhoven University of Technology, Eindhoven, The Netherlands

11:55 - 12:15

Film flow with geometrically induced unsteady effects

Markus Scholle; Institute of Automotive Technology and Mechatronics, Heilbronn University, Heilbronn, Germany

Effect of Film Preparation Conditions on Crack Morphology in Polymer Nanocomposite Thin Films by Solution Casting Method

Naoto Kobayashi; Department of Chemical Engineering, Tohoku University, Japan

12:15 - 14:00

Lunch & Exhibition

14:00 - 15:20

Session 4 A – Flow of Thin Liquid Films II

Session Chair: Anton A. Darhuber

14:00 - 14:20

Thickness of films on a multilayer slide die: theory and experiments

Hadj Benkreira; Advanced Materials Engineering R & KT Centre, School of Engineering, University of Bradford, UK

14:20 – 14:40

Gravity-driven thin-film coatings under curved geometries

Gioele Balestra; Laboratory of Fluid Mechanics and Instabilities, EPFL, Lausanne, Switzerland

14:40 – 15:00

Numerical analysis of thermocapillary flow in the liquid layer coated on the uneven substrate

Jae Hyun Yoo; School of Chemical and Biological Engineering, Institute of Chemical Process, Seoul National University, Seoul

15:00 - 15:20

Film flow over periodic wavy inclined heated substrate

Sergii Veremieiev; School of Engineering and Computing Sciences, Durham University, Durham, United Kingdom

Session 4 B – Mechanical and Electrical Material Properties, Biofouling

Session Chair: Laurent Limat

Drying of multi-component solutions - experimental and numerical investigation by means of Inverse Micro Raman Spectroscopy

Philip Scharfer and Wilhelm Schabel; Institute of Thermal Process Engineering, Thin Film Technology, Karlsruhe Institute of Technology, Germany

Bidisperse suspensions with concentrated non-Brownian particles in Couette-Poiseuille flows: Shear-induced particle migration in slot coating bead flows

Byoungjin Chun; Department of Chemical and Biological Engineering, Korea University, Seoul, Republic of Korea

Preventing biofouling with non-toxic films - A green solution

Olga Ferreira; Centro de Química e Bioquímica, Faculdade de Ciências, Lisboa, Portugal

Influence of Elongational Flow Behavior of Automotive Coatings on their Atomization with a High-Speed Rotary Bell Atomizer

Walter Oswald; Institute for Mechanical Process Engineering and Mechanics, Karlsruhe Institute of Technology, Germany

15:20 - 15:50 Coffee break & Exhibition

15:50 - 17:10 Session 5 – Rheological Properties, Stress Measurement and Continuous Mixing

Session Chair: Stefan Schüttel

15:50 - 16:10

Fully Continuous Mixing Process for Lithium-Ion Battery Slurries

Phillip Stoessel; Bühler AG, Grinding & Dispersing Technologies, Uzwil, Switzerland

16:10 - 16:30

Simultaneous stress and weight measurements for particulate films made from capillary suspensions

Steffen B Fischer; Soft Matter, Rheology and Technology group, KU Leuven, Leuven, Belgium

16:30 - 16:50

Unsteady Flow of Thixotropic Fluid in a Slowly Varying Pipe

Andrew I. Croudace; Department of Mathematics and Statistics, University of Strathclyde, Glasgow, Scotland, UK

16:50 - 17:10

How Rheological Properties Affect Fine Line Screen Printing of Pastes: a Combined Rheological and High-speed Video Imaging Study

Chenhui Xu; Group Applied Mechanics, Institute for Mechanical Process Engineering and Mechanics, Karlsruhe Institute of Technology, Karlsruhe, Germany

18:00 - 23:00 Conference dinner

18:00 - 19:00

Bus transfer to Gruyères

19:00 - 22:00

Dinner

22:00 - 23:00

Bus transfer to Fribourg

Day 3

Friday, 10th November 2017

08:30 - 09:15 Key Note

Is Atomic Layer Deposition (ALD) a specialized type of Chemical Vapor Deposition (CVD)?
Patrik Hoffmann; EMPA, Laboratory for Advanced Materials Processing, Duebendorf, Switzerland

09:15 - 09:45 Key Note

Coating goes digital
Fritz Bircher; iPrint, Fribourg, Switzerland

09:45 - 10:15 Coffee break & Exhibition

10:15 - 12:15 Session 6 – Ink Jet Printing, Printed Electronics

[Session Chair: Fritz Bircher](#)

10:15 - 10:35 Inkjet printing – Controlling the surface topography of small printed structures

Max Tönsmann; Institute of Thermal Process Engineering, Thin Film Technology, Karlsruhe Institute of Technology, Germany

10:35 - 10:55 Nanoimprinting of self-organizing inks for transparent and flexible electronics

Robert Strahl; Leibniz Institute for New Materials, Saarbrücken, Germany

10:55 - 11:15 Variation of pinned and depinned three-phase contact line by different solvent ratios on glass to create uniform layer thicknesses

Lena Janßen; Bergische Universität Wuppertal, Germany

11:15 - 11:35 Printed batteries – towards eco- and cost friendly mass production

Jürg Schleuniger; Centre Suisse d'Electronique et de Microtechnique, MuttENZ, Switzerland

11:35 - 11:55 Development of edible inks to print on chocolate

Mathieu Soutrenon; iPrint, Fribourg, Switzerland

11:55 - 12:15 Printed electronic components for hybrid integration; case study – sun sensor

Nenad Marjanović; Centre Suisse d'Electronique et de Microtechnique, MuttENZ, Switzerland

12:15 - 12:35 ECS closing

12:35 - 13:30 Light lunch

Trains leaving Fribourg:

- 12h26 in direction of Geneva (every 30 minutes)
- 12h34 in direction Bern/Zurich (every 30 minutes)

Poster Session

Author Affiliation	Title Key Words
Bryan Manning Capacitec Europe, Creteil, France	Qualification of Gap Measurements (300°C) for Coater/Extruder Dies
Anne Bouchaudy CNRS, Solvay, Université Bordeaux, Pessac, France	Steady Microfluidic Measurements of Mutual Diffusion Coefficients of Liquid Binary Mixtures <i>microfluid measurements, diffusion</i>
H.M.J.M. Wedershoven Mesoscopic Transport Phenomena Group, Department of Applied Physics, Eindhoven University of Technology, Eindhoven, The Netherlands	Controlled solution-deposition by modulating gas phase convection <i>solution deposition, evaporation, coffee-stain effect</i>
Jana Kumberg Institute of Thermal Process Engineering, Thin Film Technology, Karlsruhe Institute of Technology, Germany	Going the next step: Coating and Drying of Multilayer Electrodes for Li-Ion Batteries <i>multilayer, electrodes, slot die coating, process stability, film drying, adhesion force, lithium-ion batteries</i>
Ralf Diehm Institute of Thermal Process Engineering, Thin Film Technology, Karlsruhe Institute of Technology, Germany	HighEnergy - Production and Simulation of High Capacity and Structured Electrodes
Charles Lousert 1 CNRS, Solvay, Université Bordeaux, Pessac, France 2 Laboratoire FAST, Univ. Paris-Sud, CNRS, Université Paris-Saclay, Orsay, France 3 Sorbonne Universités, UPMC Univ. Paris 06, Paris, France 4 Service de Physique de l'État Condensé, CNRS, Université Paris-Saclay, CEA Saclay, Gif-Sur-Yvette, France	Role of vapor transfer on flow coating of colloidal dispersions in the evaporative regime <i>coating, evaporative regime, film deposition, vapor transfer, colloids</i>
Jin Seok Park Department of Chemical and Biological Engineering, Korea University, Seoul, Korea	Operability windows and frequency response of viscoelastic slot coating flows <i>operability window, Viscoelastic coating liquids, Slot coating, Frequency response</i>
Da Young Lee Department of Chemical and Biological Engineering, Korea University, Seoul, Republic of Korea	Microrheological analysis of boehmite slurry using multi-speckle diffusing wave spectroscopy <i>boehmite, Catalyst washcoat slurries, MSDWS, Suspension micro-rheology</i>
Sun-Woo Kwak School of Material Science & Engineering, Chungnam National University, Daejeon, Korea 2Printed Electro-Mechanical System Co. Ltd., Daejeon, Korea	All-Solution processed inverted polymer solar modules using solution shearing process <i>solution shearing, All-solution process, Silver nano ink, Polymer solar cells (PSCs)</i>
Ta-Jo Liu Dept. of Chemical Engineering National Tsing Hua University, Taiwan	Drug Loading on a Microneedle Patch through Dip Coating Operation <i>microneedle patch, drug loading, dip coating, flow visualization, numerical simulation</i>
Ta-Jo Liu Dept. of Chemical Engineering National Tsing Hua University, Taiwan	Rheological Analysis of Glycerol-Based Biodegradable Polymers <i>waste glycerol, glycerol-based polymers, biodegradable polymers, rheological properties, shear-thinning</i>
Semi Lee School of chemical engineering, Sungkyunkwan University, Seobu-ro, Jangan-gu, Suwon, Gyeonggi-do, Korea	Dimensionless vacuum coating window for slot coating flows <i>slot coating method, dimensionless vacuum coating window, flow visualization</i>

Author Affiliation	Title Key Words
<p>Tobias Fritzensmeier 1 Institute of Thermal Process Engineering, Thin Film Technology, Karlsruhe Institute of Technology, Karlsruhe, Germany 2 Innovation Lab, Heidelberg, Germany</p>	<p>Experimental and Theoretical Approach to Diffusion in Nanolayers – Increased Intermixing of Organic Double Layers due to Solvent Residue <i>diffusion, organic electronics, nanolayers, solution-processed, Raman spectroscopy, drying, polymers</i></p>
<p>Kaoru Ishibashi 1 Department of Chemical Science and Engineering, Kobe University, Kobe, Japan 2 Organization of Advanced Science and Technology, Ikeda, Japan</p>	<p>Particle packing process of cathode slurry of Li-ion battery during drying <i>battery slurry, packing</i></p>
<p>J. Eser Institute of Thermal Process Engineering, Thin Film Technology, Karlsruhe Institute of Technology, Karlsruhe, Germany</p>	<p>Investigation of the influence of drying parameters on the performance of sorption thermal storage systems <i>sorption thermal storage systems, adsorption, drying</i></p>
<p>J. Eser Institute of Thermal Process Engineering, Thin Film Technology, Karlsruhe Institute of Technology, Karlsruhe, Germany</p>	<p>Sorption equilibrium and diffusional resistance in compounds of Li-Ion batteries <i>li-ion batteries, adsorption, drying</i></p>
<p>Hirokazu Yoshihara Dai Nippon Printing Co., Ltd. 1, Department of Applied Chemistry, Kyushu Institute of Technology, Japan</p>	<p>Drying and curling of thin liquid films with photo-curing reactions: a confocal Raman spectroscopy <i>drying, UV curing, polymerization, diffusion, Raman spectroscopy</i></p>
<p>Min-Jung Son 1 Department of Printed Electronics, Korea Institute of Machinery & Materials, Daejeon, Korea 2 School of Advanced Materials Science and Engineering, Sungkyunkwan University, Suwon, Korea</p>	<p>Effects of Particle Size Distribution on Electrical and Mechanical Properties of Solder Paste for Reverse Offset Printing</p>
<p>Kanitha Kamonchaivanich Department of Chemistry and Materials Science, Institute of Technology, O-okayama, Meguro-ku, Tokyo, Japan</p>	<p>Enhanced Mechanical Properties of Construction Materials by Using Polyurea Coating <i>polyurea, coating, FEM simulation</i></p>