



CONFERENCE BOOK

8th European Coating Symposium

Advances in Coating and Drying of Thin Films



September 7-9, 2009

Novotel Karlsruhe City
Festplatz 2
76137 Karlsruhe
GERMANY

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Welcome to the 8th European Coating Symposium.

Since 1995 researchers from both academia and industry have been getting together at the European Coating Symposium to discuss advancements in liquid film coating science and related processes. The ECS Symposium is held biennially in rotation with the International Symposium of Coating Science and Technology (ISCST). The 8th European Coating Symposium – ECS 2009 – follows the series of symposia held for the first time at the University of Leeds, UK (1995) organized by M.D. Savage, followed by the University of Strasbourg (P. Bourgin, France, 1997), the Friedrich-Alexander University (F. Durst, Germany, 1999), van Karman Institute (J.-M. Buchlin, Belgium, 2001), Fribourg (P. Schweizer, Switzerland, 2003), University of Bradford (H. Benkreira, UK, 2005) and the University Paris Diderot (L. Limat, France, 2007). This year **ECS 09** takes place in Karlsruhe, Germany and is organized by the group Thin Film Technology (TFT) at the Karlsruhe Institute of Technology (KIT). Besides the organization of ECS, 2009 was a very eventful year for the TFT group, since the Chair “Thin Film Technology” was founded in 2009 at the Karlsruhe Institute of Technology. KIT is the merger of the Forschungszentrum Karlsruhe, member of the Helmholtz Association, and the University Karlsruhe. This merger has given rise to a research institution of international excellence in natural and engineering sciences with in total 8000 employees.

The scope of ECS 2009 – Advances in Coating and Drying of Thin Films – is to present latest developments and technologies, featuring contributions on fundamental science and applied research. The focus is on the topics: Organic and Printed Electronics, Mass Transfer in Thin Films and Membranes, Rheology of Complex Fluids, Contact Line and Wetting Dynamics, Diffusion and Thermodynamics, Fluid Dynamics with Interfaces, Micro- and Nano-Scale Film Structures, Multilayer Liquid Film Coatings, Bioactive Films and Sensors, Functional Films, and Thin Film Drying.

The domain of “Organic Electronics” is a particularly promising new market representing a challenging area in the field of Liquid Film Coatings and Drying. Products range from Organic Photovoltaics (OPV) to Organic Diodes (OLED), Organic Sensors and more. The first session of the Symposium starts with Invited Talks and contributions in this promising new field followed by more than 80 contributions as oral talks and poster contributions on the different topics. Extended abstracts of the contributions, between 2 and 4 pages long, are gathered in this Conference Book according to the program and the session numbers. Selected papers out of this book are peer reviewed by the Scientific Committee and the TFT group and will be published - after the conference - in a book with ISBN number.

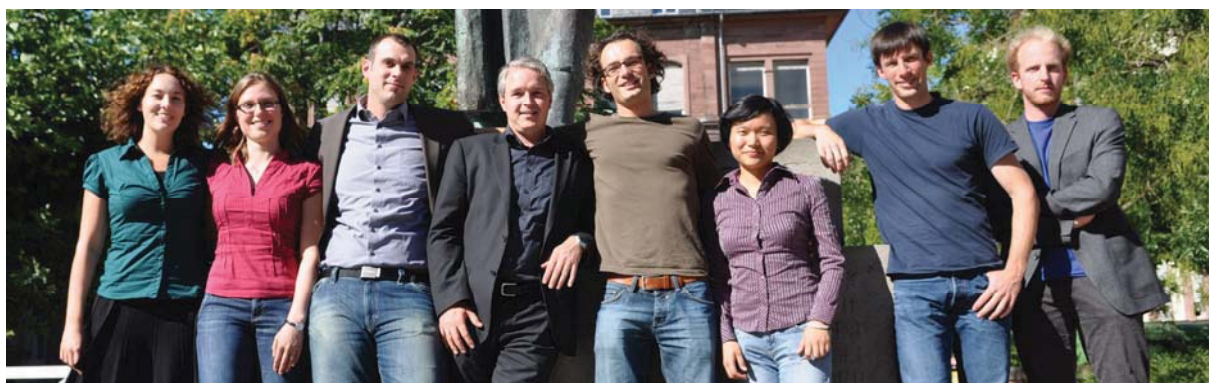
For the first time, we tried to give poster contributions both a 5-minute oral talk and a poster presentation. The poster session will take place at the KARLSRUHE CASTLE followed by a buffet with food and drinks, and listening to jazz music. The Symposium concludes with a post conference tour to the monastery (world cultural heritage) in Maulbronn, including a tour and regional wine tasting.

The success of this Symposium obviously hinges on the help and the efforts of the entire “ECS Local Organization Team” in Karlsruhe, namely myself and Philip Scharfer, Benjamin Schmidt-Hansberg, Sibylle Kachel, Joachim Krenn, Katharina Peters, Lukas Wengeler and Ying Zhou. We all would like to thank you for participating in the 8th ECS in Karlsruhe. It was an honor and pleasure for us to organize this Symposium.

We hope that each of you will benefit from this year’s Symposium and your time here in Karlsruhe.

Sincerely,

Prof. Wilhelm Schabel
(ECS 2009 Symposium Chair)



ECS 2009 Local Organisation Team



CONFERENCE PROGRAM

**ECS Short Course
Saturday – Sunday**

8:00 AM – 5:00 PM **Short Course „Thin Film Coating and Drying –
Fundamentals and Applications“**
Instructors: W. Schabel, P. Scharfer, E.-U. Schlünder,
T. Lightfoot, N. Willenbacher, H. Benkreira, P. Schweizer

**ECS Coating Symposium
Sunday – September 6, 2009**

5:00 PM **Start of Registration**

7:00 PM **Opening Reception**

Location: Anno 1516 in front of the Novotel Hotel Karlsruhe

- 8:00 AM **Reception and Registration**
- 9:00 AM **Welcome: H. Benkreira (ECS), T. Lightfoot (ISCST)
W. Schabel (ECS 2009)**
Congratulation/Laudation to E.-U. Schlünder (H. Martin)

General Session 1

Session Chairs: L. Francis, H. Benkreira

- 9:40 AM **Printable Organic Semiconducting Materials**
D. Müller
Merck Chemicals, UK
- 10:20 AM **R2R coating of polymer solar cells, demonstrations and first products**
F. C. Krebs
Risø DTU, DK
- 11:00 AM **Coffee break / Exhibition**
- 11:20 AM **R2R processing of Organic Light Emitting Diodes (OLEDs)**
I. de Vries, J. Gabel, S. de Winter, A. Langen
Holst-Centre, NL

- 11:40 AM **Morphology formation during drying of solution casted polymer-fullerene blends for solar cell applications**
B. Schmidt-Hansberg, P. Scharfer, M. Klein, U. Lemmer, M. Sanyal, E. Barrena, S. Walheim, W. Schabel
Karlsruhe Institute of Technology, DE
- 12:00 AM **Multilayer-coated fiber-based substrate for printed functional devices**
A. Määttänen, R. Bollström, D. Tobjörk, P. Ihalainen, M. Toivakka, J. Peltonen
Åbo Akademi University, FI
- 12:20 AM **Two-layer tensioned-web-over-slot die coating: effect of operating conditions**
J. Nam, M. S. Carvalho
University of Minnesota, US and PUC Rio, BR
- 12:40 AM **Coating drug-eluting materials onto endovascular stent – an implantable scaffolding medical device for treating vascular disease**
J. Q. Feng
Boston Scientific Corporation, US
- 1:00 PM **Lunch break**

Session 2.1 „FLUID DYNAMICS“ Room 1

Session Chair: H. Benkreira, Assistance: B. Schmidt-Hansberg

- 2:20 PM **Linear and nonlinear resonance in viscous film flow over topography**
C. Heining, V. Bontozoglou, H. Uecker, A. Wierschem, N. Aksel
University of Bayreuth, DE
- 2:40 PM **Dynamics of thin film flow on flexible surfaces containing topography**
Y. C. Lee, H. M. Thompson, P. H. Gaskell
University of Leeds, UK
- 3:00 PM **Inertial two- and three-dimensional thin film flow over topography**
S. Veremieiev, H. M. Thompson, Y. C. Lee, P. H. Gaskell
University of Leeds, UK
- 3:20 PM **Dynamic morphologies of biphasic flows on a patterned surface**
A. Désert, H. Bodiguel,
Université Bordeaux 1, FR
- 3:40 PM **Competing geometric and inertial effects on local flow structure in thick gravity-driven film flows**
A. Haas, M. Scholle, N. Aksel, M. C. T. Wilson, H. M. Thompson, P. H. Gaskell
University of Bayreuth, DE

4:00 PM **Coffee break / Exhibition**

Session 2.2 „COATING TECHNOLOGY“ Room 2

Session Chair: I. de Vries, Assistance: L. Wengeler

- 2:20 PM **Liquid Slip/Stick over Hydrophobic/Hydrophilic Surfaces and their Implications in Coating Processes**
N. Dongari
TSE Troller AG, CH
- 2:40 PM **Production Technologies for flexible Photovoltaic-Trends and Technologies in 2009**
T. Kolbusch
Solarcoating Machinery GmbH, DE
- 3:00 PM **Maintaining Gap Uniformity in the Application of Liquid, Anti-reflective and CVD coatings onto Flexible and Flat Glass Solar Panels**
B. Manning, J. F. Doussin
CAPACITEC, FR
- 3:20 PM **Technique for delaying splashing in jet wiping process**
K. Myrillas, A. Gosset, P. Rambaud, J.-M. Buchlin, M. Anderhuber, J.-M. Mataire
von Karman Institute for Fluid Dynamics, BE
- 3:40 PM **Coating technologies and coating plant concepts for thin film liquid film coating layers**
A. Glawe
COATEMA Coating Machinery GmbH, DE

Session 3.1 „STRUCTURED FILMS“ Room 1

Session Chair: J.-M. Buchlin, Assistance: S. Kachel

- 4:20 PM **Microstructure Development in Consolidating Pigment Coatings Studied by Numerical Simulation**
A. Sand, J. Kniivilä, M. Toivakka, T. Hjelt
Åbo Akademi University, FI
- 4:40 PM **Influence of Stabilizers in ZnO nanodispersions on the solution processed FET device performance**
N. Mechau, S. Bubel, H. Hahn
Karlsruhe Institute of Technology, DE
- 5:00 PM **Inkjet Printed Electronics: wet-on-wet approach**
E. Varela, E. Armendáriz
CEMITEC, ES
- 5:20 PM **Formation of surface structures during thin film-drying**
J. Krenn, A. Adiwidjaja, P. Scharfer, W. Schabel
Karlsruhe Institute of Technology, DE
- 5:40 PM **The Fluid Mechanics of Narrow Stripe Coating**
C. F. Lin, D. S. H. Wong, T.-J. Liu
National Tsing Hua University, TW

Session 3.2 „WETTING DYNAMICS“ Room 2

Session Chair: L. Limat, Assistance: K. Peters

- 4:20 PM **Contact line dynamics in forced wetting**
C. L. Moraila-Martinez, M. Cabrerizo-Vilchez, M. Á. Rodríguez-Valverde
University of Granada, ES
- 4:40 PM **Influence of solid-liquid interaction on dynamic wetting: a molecular dynamics study**
E. Bertrand, T. D. Blake, J. De Coninck,
Université de Mons, BE
- 5:00 PM **Dewetting of thin polymer films on viscoelastic substrates**
K. Kostourou, D. Peschka, A. Münch, B. Wagner, S. Herminghaus, R. Seemann
Max Planck Institute for Dynamics and Self-Organization, DE
- 5:20 PM **Dewetting of thin liquid films on viscoelastic substrates**
D. Peschka, K. Kostourou, A. Münch, B. Wagner, S. Herminghaus, R. Seemann
Weierstrass Institute for Applied Analysis and Stochastics, DE
- 5:40 PM **Advancing of contact line on a soluble polymeric coating**
A. Tay, C. Monteux, D. Bendejacq, F. Lequeux
ESPCI ParisTech, FR

7:30 PM **Scientific Committee meeting (dinner)**

Session 4.1 „FILM DRYING“ Room 1

Session Chair: E. J. Lightfoot, Assistance: P. Scharfer

- 8:30 AM **Experimental investigation of the drying process of water-based paints used in automotive industry**
 F. Brinckmann, P. Stephan
Technische Universität Darmstadt, DE
- 8:50 AM **Investigations of the Drying Process of a Water Based Paint Film for Automotive Applications**
 J. Domnick, D. Gruseck, K. Pulli, A. Scheibe, Q. Ye
University of Applied Sciences Esslingen, DE
- 9:10 AM **Spatially Resolved Stress Measurements on Drying Latex Films**
 A. M. König, K. von der Ehe, D. Johannsmann
Clausthal University of Technology, DE
- 9:30 AM **Film formation of adsorption-dependent silica/PVA suspension**
 S. Kim, J. H. Sung, K. H. Ahn, S. J. Lee
Seoul National University, KR

9:50 AM **Coffee break / Exhibition**

Session 4.2 „COMPLEX FLUIDS“ Room 2

Session Chair: N. Willenbacher, Assistance: J. Krenn

- 8:30 AM **Stability and flow induced aggregation of concentrated polymer dispersions**
 K. Georgieva, N. Willenbacher, D. Dijkstra
Karlsruhe Institute of Technology, DE
- 8:50 AM **A thin rivulet subject to a prescribed transverse shear stress at its free surface**
 S. J. M. Sullivan, K. Wilson, B. R. Duffy
University of Strathclyde, UK
- 9:10 AM **Invagination process induced by 2D desiccation of complex fluid**
 L. Pauchard, M. Mermet-Guyennet, F. Giorgiutti-Dauphiné,
Université Paris Sud, FR
- 9:30 AM **Unsteady flow of thin and slender rivulets of a power-law fluid**
 Y. M. Yatim, B. R. Duffy, S. K. Wilson
University of Strathclyde, UK

Session 5.1 „COATING“ Room 1

Session Chair: J. De Coninck, Assistance: M. Müller

- 10:10 AM **Influence of convective transport on the linear stability of films of binary mixtures with a free evolving surface**
 S. Madruga, U. Thiele
Universidad Politécnica de Madrid, ES
- 10:30 AM **An Investigation into Dissolution and Growth of Entrained Bubbles when Coating in a Gas under Reduced Pressure**
 H. Benkreira, J. B. Ikin
University of Bradford, UK
- 10:50 AM **Coating a surface with colloids, behind a receding, evaporative, contact line**
 G. Berteloot, A. Hohang, C. T. Pham, A. Daerr, P. Kavehpour, F. Lequeux, L. Limat, M. Receveur
Université Paris Diderot, FR

11:10 AM **Coffee break / Exhibition**

Session 5.2 „FUNCTIONAL FILMS“ Room 2

Session Chair: T.-J. Liu, Assistance: Y. Zhou

- 10:10 AM **Native proteins in ultrathin dried trehalose films on titanium coated glass slides and cyclo-olefine polymer foils for the Laser-Induced-Forward Transfer process**
 S. Genov, M. Baier, D. Riester, K. Borchers, G. Tovar, T. Hirth, A. Weber
University of Stuttgart, DE
- 10:30 AM **Water sorption into thin films of semicrystalline polymer**
 S. Jeck, P. Scharfer, W. Schabel, M. Kind
Karlsruhe Institute of Technology, DE
- 10:50 AM **Laser Micro-Rheology using Multi-Speckle Diffusing Wave Spectroscopy**
 U. Bötcher, C. Tisserand, L. Brunel
Formulaction, FR

11:30 AM **6.1 SHORT PRESENTATION OF POSTERS 1 to 12 Room 1 (for details see next page)**

Session Chair: P. Scharfer, Assistance: J. Krenn

11:30 AM **6.2 SHORT PRESENTATION OF POSTERS 13 to 24 Room 2 (for details see next page)**

Session Chair: W. Schabel, Assistance: B. Schmidt-Hansberg

12:30 AM **Lunch break**

General Session 7

Session Chairs: M. Carvalho, E. J. Lightfoot

- 2:00 PM **Spin Coating of Polymer Blends: Self-Stratification, Polymer Blend Lithography and Anti-Reflection Coatings – a Live Experiment**
 S. Walheim
Karlsruhe Institute of Technology, DE
- 2:40 PM **Predicting and Characterizing Microstructure Development During Drying of Particulate Coatings**
 C. M. Cardinal, Y. D. Jung, K. H. Ahn, L. F. Francis
University of Minnesota, US
- 3:10 PM **Drying Issues and Process Scale up of Solvent Casted Films for Flat Panel Displays and Organic Electronics**
 W. Schabel, P. Scharfer, M. Müller, J. Krenn, B. Schmidt-Hansberg, L. Wengeler, K. Peters
Karlsruhe Institute of Technology, DE
- 3:40 PM **Coffee break / Exhibition**

4:00 PM **Wave interactions on a viscous film coating a vertical fibre: formation of bound states**

C. Duprat, F. Giorgiutti-Dauphiné, D. Tseluiko, S. Saprykin, S. Kalliadasis
Université Paris Sud, FR

4:20 PM **Influence of Non-Volatile Additives on the Diffusion of Solvents in Polymeric Coatings**

M. Müller, P. Scharfer, M. Kind, W. Schabel
Karlsruhe Institute of Technology, DE

4:40 PM **Scaling properties of deposition induced by evaporation at a moving contact line**

G. Jing, H. Bodiguel, E. Sultan, F. Doumenc, B. Guerrier
Université Paris-Sud, FR

POSTER SESSION AT THE KARLSRUHE CASTLE

6:30 PM **Reception at the Karlsruhe Castle**

Please join us for drinks and hear about the history of the Castle.

7:30 PM **Poster session in the Garden Ballroom**

Enjoy our buffet with food and drinks and listen to jazz music.

6.1 SHORT PRESENTATION OF POSTERS 1 to 12 Details

11:30 AM, Room 1

Session Chair: P. Scharfer, Assistance: J. Krenn

P1: Feasibility Studies on Solution-processed Hole Injection Layers for Organic LEDs

K. Peters, B. Schmidt-Hansberg, L. Wengeler, P. Scharfer, W. Schabel
Karlsruhe Institute of Technology, DE

P2: Processing of nanoparticle polymer mixtures for organic photovoltaic films - A project outline and first results

L. Wengeler, B. Schmidt-Hansberg, P. Scharfer, W. Schabel, F. Rauscher, W. Hoheisel
Karlsruhe Institute of Technology, DE

P3: Technology Development for Roll-to-Roll Production of Organic Photovoltaics

Y. Galagan, I. de Vries, R. Andriessen, S. Veenstra, J. Kroon
Holst Centre, NL

P4: The effect of solid particles on curing behavior of UV curable powder coatings containing IPNs

S. Bastani, S. Moradian
Institute for colorants, paint and coatings, IR

P5: Functional Nano Color Coatings: Preparation and Examples

M. Belzner, Y. Georgieva, R. Domnick
Ara-Coatings GmbH & Co. KG, Erlangen, DE

P6: Development of new polymeric OLED and OSC materials

T. Baumann, T. Grab, M. Bächle, M. Schwander, U. Lemmer
cynora GmbH, DE

P7: Corrosion Protection of Magnesium AZ31 alloy by Coating with poly(ether imide) PEI

T. F. da Conceicao, N. Scharnagl
GKSS-Forschungszentrum Geesthacht GmbH, DE

P8: A comparison of the efficiency of ADI and Multigrid solvers for three-dimensional thin film free surface flows

N. P. Cowling, P. H. Gaskell, Y. C. Lee, H. M. Thompson
University of Leeds, UK

P9: Dewetting of a bilayer thin film on a solid substrate

S. Merabia, J. Bonet Avalos
LPMCN Université Lyon I, FR

P10: Extending the capabilities of the CaBER with highly sensitive force measurements

C. O. Klein, I. F. C. Naue, J. Nijman, F. Hetzel, M. Wilhelm
Karlsruhe Institute of Technology, DE

P11: Contact Line Friction Coefficient: A new tool for Industry?

S. Ray, R. Sedev, C. Priest, J. Ralston
National Physical Laboratory, Teddington, UK

P12: Optical film formation analysis

H. Dihang, L. Brunel, U. Bötcher
Formulation, FR

6.2 SHORT PRESENTATION OF POSTERS 13 to 24 Details

11:30 AM, Room 2

Session Chair: W. Schabel, Assistance: B. Schmidt-Hansberg

P13: Dip-coating of chemically patterned surfaces

B. J. Brasjen, A. A. Darhuber
Eindhoven University of Technology, NL

P14: Evaporation of liquids on chemically patterned surfaces

J. A. Vieyra Salas, A. A. Darhuber
Eindhoven University of Technology, NL

P15: Anomalous diffusion close to glass transition temperature of solvents in polymer films

I. Mamaliga, W. Schabel
Technical University of Iasi, RO

P16: Moving through the phase diagram: Drying of solution casted polymer-fullerene films

F. Buss, S. Jaiser, B. Schmidt-Hansberg, J. Pfeifer, S. Walheim, P. Scharfer, W. Schabel
Karlsruhe Institute of Technology, DE

P17: Water vapor sorption of amperometric biosensor films

S. Kachel, S. DuVall, H. Groll, P. Scharfer, W. Schabel
Karlsruhe Institute of Technology, DE

P18: Coating a liquid with another liquid

J. Sébilleau, L. Lebon, L. Limat, L. Quartier
Université Paris Diderot, FR

P19: A transient triple layer leads to a purely lateral morphology of a spin-cast polymer blend film

C. Huang, A. Weis, F. Zhang, O. Marti, S. Walheim, T. Schimmel
Karlsruhe Institute of Technology, DE

P20: Transient waviness of polymer films during spin-coating

J. Pfeifer, S. Walheim, T. Schimmel
Karlsruhe Institute of Technology, DE

P21: Maintaining Gap Uniformity in the Application of Liquid, Anti-reflective and CVD coatings onto Flexible and Flat Glass Solar Panels

B. Manning, J.-F. Doussin
CAPACITEC, FR

P22: A critical review on diffusion coefficients in polymer-solvent systems measured by means of gravimetric sorption experiments and spectroscopic methods

K. Peters, M. Müller, P. Scharfer, W. Schabel
Karlsruhe Institute of Technology, DE

P23: Local Heat and Mass Transfer in Slot Nozzle Driers for Organic Photovoltaic (OPV) and Organic Light Emitting Diode (OLED) Thin Films on Foil

L. Wengeler, I. de Vries, P. Scharfer, W. Schabel
Karlsruhe Institute of Technology, DE

P24: Modelling of micro-scale thin film and droplet flow problems

C. D'Albaret, J. Sicard, Y. C. Lee, P. H. Gaskell
Ecole Nationale Supérieure de Mécanique et d'Aérotechnique, FR

General Session 8

Session Chairs: P. Schweizer, J. Uhlemann

- 8:30 AM **New methods for the rheological characterisation of materials**
M. Wilhelm
Karlsruhe Institute of Technology, DE
- 9:10 AM **Dewetting Problems of Ultra Thin Coatings**
G. Reiter
University of Freiburg, DE
- 9:30 AM **Form and function – Three-dimensional photonic nanostructures**
G. von Freymann, M. Thiel, M. Hermatschweiler, M. Wegener
Karlsruhe Institute of Technology and Nanoscribe GmbH, DE
- 9:50 AM **Operative limits of curtain coating due to edges**
G. Gugler, R. Beer, M. Mauron
ILFORD, CH
- 10:10 AM **Annular jet wiping in wire galvanizing**
A. Gosset, J.-M. Buchlin, R. Branders
von Karman Institute of Fluid Dynamics, BE
- 10:30 AM **Coffee break**

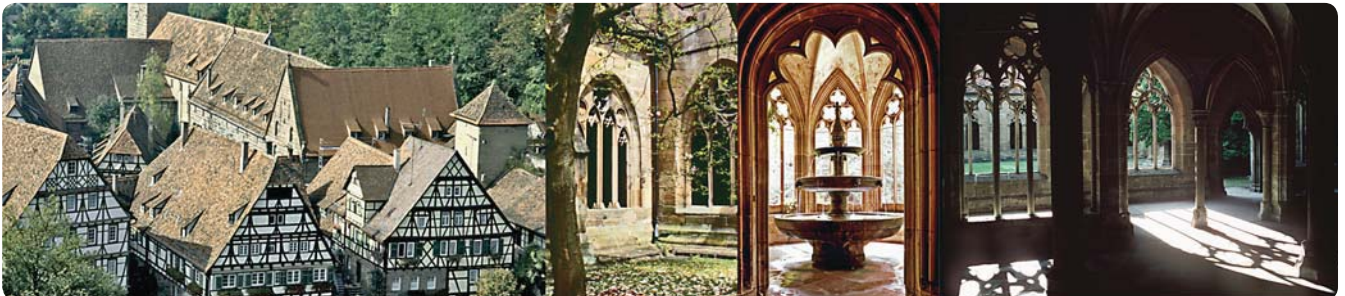
General Session 9

Session Chairs: M. Toivakka, W. Schabel

- 11:00 AM **Simple views on cornered contact lines near the coating transition**
L. Limat, J. H. Snoeijer, A. Daerr, I. Peters
Université Paris Diderot, FR
- 11:20 AM **Meniscus coating with hard and elastic contra-rotating rolls**
E. Hoeschele, A. Muench, B. Wagner
Weierstrass Institute for Applied Analysis and Stochastics, DE
- 11:40 AM **Stability of Viscoelastic Liquid Curtain**
M. Becerra, M. S. Carvalho
Pontificia Universidade Catolica do Rio de Janeiro, BR
- 12:00 AM **Influence of local gas phase mass transport coefficients on the drying rate of polymer films – a fundamental study**
Y. Zhou, J. Krenn, P. Scharfer
Karlsruhe Institute of Technology, DE
- 12:20 AM **Laminar thermal mixing in coating flows**
M. Scholle, A. Haas, N. Aksel, H. M. Thompson, R. W. Hewson, P. H. Gaskell
University of Bayreuth, DE
- 12:40 AM **Closing Remarks**

Wednesday Afternoon

- 2:00 - 7:00 PM **Post conference tour**
to Maulbronn monastery (world cultural heritage) including regional wine tasting



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Notes: