Program Short Course and Forum
30 contributions from 26 speakers (17 external)

Schedule 13.05.2019 – Short Course Monday
12:00 Registration and hand out of course material
12:30 Welcome and introduction
Prof. Dr.-Ing. W. Schabel / Dr.-Ing. P. Scharfer
13:15 Coating and printing fluids characterisation
Dipl.-Ing. Gilbert Gugler (iPrint, CH)
14:30 Coffee break
15:00 Rheology of coating fluids
Prof. Dr. Norbert Wilkenbacher (KIT)
16:15 Introduction to premetered coating methods
Dr. Peter Schweizer (Schweizer Coating Consulting, CH)
19:30 Social dinner at t.b.d. (t.b.d., Karlsruhe)

Schedule 14.05.2019 – Short Course Tuesday
09:00 Special issues on curtain and slide coating
Dr. Peter Schweizer (Schweizer Coating Consulting, CH)
10:00 Coffee break
10:30 Fluid flow in coating tools
Prof. Dr. Dr. h. c. mult. Franz Durst (FMP)
11:30 Knife and blade coating
Prof. Dr. Hadj Benkreira (University of Bradford, UK)
12:30 Lunch break
13:30 Gravure and roll coating
Prof. Dr. Hadj Benkreira (University of Bradford, UK)
14:30 Coffee break
15:00 Fundamentals of film drying technology
Prof. Dr.-Ing. Wilhelm Schabel (KIT)
16:15 Coffee break
16:30 Film drying phenomena and drying studies
Prof. Dr.-Ing. Wilhelm Schabel (KIT)

Schedule 15.05.2019 – Short Course Wednesday
08:30 Drying of particulate coatings and crack formation
Dr. Alex Routh (Cambridge, UK)
10:00 Sorption equilibrium in polymeric and porous films
Tobias Börnhorst M. Sc., Jochen Eser M. Sc. (KIT)
10:30 Coffee break
11:00 Simulation & design of industrial thin film dryers
Dr.-Ing. Philip Scharfer (KIT)
12:30 Homogeneous drying with comb nozzles
Dipl.-Ing. Philipp Cavadini (CN Drying Technology UG)
12:55 Lunch break
13:55 Industrial perspectives on curtain & slot die coating
Dipl.-Ing. Harald Döll (TSE, CH)
14:25 Precise and high-speed intermittent coating
Dipl.-Ing. Ralf Diehm (KIT)
14:45 Coffee break

Schedule 16.05.2019 – Short Course & Forum Thursday
09:00 Experimental workshop at the TFT coating and printing laboratory
- Rheology & wetting
- Pilot-scale coating trials
- Heat and mass transfer coefficients
- Experimental drying curves
Visit PVD Plasma Coating Lab @ IAM-AWP

12:40 TFT Forum get-together with finger food
13:40 Welcome with TFT anniversary intro (2009 - 2019)
Prof. Dr.-Ing. W. Schabel / Dr.-Ing. P. Scharfer
14:00 Welcome & Introduction to KIT
Prof. h.c. Dr. Joachim Knebel (KIT)
Head of Division 3 (Mechanical & Electrical Engineering)
14:10 Poster presentations on new research highlights
15:00 Multilayer printing and coating - interdiffusion and thermodynamic aspects
Lisa Merklein M. Sc. (KIT)
15:25 Coffee break (with posters and exhibition)
16:05 Advances in organic & printed electronics processing
Ir. Ike de Vries (Holst Centre, NL)
16:50 Advances in digital direct printing
Prof. Fritz Bircher (iPrint, CH)
19:30 Get-together at BESITOS (Karlsruhe town square)

Schedule 17.05.2019 – Short Course & Forum Friday
09:00 Challenges and advances in processing of battery cells
Prof. Dr.-Ing. Arno Kwade (TU Braunschweig)
09:30 Industrial production of lithium-ion battery cells
Dr. Armin Modlinger (Volkswagen AG)
10:00 Simulation approaches in mixing of battery slurries
Prof. Dr.-Ing. habil. Hermann Nirschl (KIT)
10:30 Advances in coating and drying of multilayer Li-ion battery electrodes
Dipl.-Ing. Ralf Diehm, Jana Kumberg M. Sc. (KIT)
11:10 Coffee break (with posters and exhibition)
11:50 Applications in solution-processed functional films
Prof. Dr.-Ing. Frank Kleine Jäger (BASF SE)
12:20 Shear-induced wetting phenomena of interfaces
Prof. Dr.-Ing. Cameron Tropea (TU Darmstadt)
12:50 Microfluidic and coating technology for biomedical film applications
Prof. Dr. An-Bang Wang (NTU, Taiwan)
13:20 TFT Forum closing session lunch (Finger Food)
## Introduction

The short course **Coating and Drying of Thin Films** addresses engineers, scientists and technicians working in the areas of coatings, functional films, direct printing, inkjet printing, sensors, adhesives, paints, automotive coatings, patches, optical foils, tapes, diagnostics, membranes, printed electronics, fuel cells and battery coatings, who intend to get insight into more fundamental aspects with industrial applications or to deepen their expertise. Leading national and international scientists and experts from academia and industry will report on topics of coating technologies, rheology, preparation of coating fluids and about fundamentals and industrial aspects of drying technology. Coating and printing processes and drying technology are explained interactively by easily accessible examples and in a practical workshop in the TFT Coating and Printing Lab instructed by TFT staff members (see photos below).

The 4th Thin Film Technology Forum will take place on the 4th and 5th day, where renowned scientists will present and discuss new trends in industry and academia with a focus on Printing, Batteries, Smart Processes & Coatings.

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## Registration fees

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<th>Early Bird (until 01.03.19)</th>
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<tr>
<td>General</td>
<td>€ 1625.–</td>
<td>€ 1775.–</td>
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<tr>
<td>GVT discount</td>
<td>€ 1575.–</td>
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<tr>
<td>Exhibition booth (5 days)</td>
<td>€ 950.–</td>
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**Payment**

According to §4 Nr. 22a USTG the registration fee is purchase tax free. Registration fees include a short course folder with documentation of lectures and workshop, coffee, refreshments, lunch and social dinner on Monday evening and the TFT Forum get-together on Thursday evening. A participation certificate will be distributed.

## Venue

The short course takes place at the KIT-Tagungszentrum (FTU), Seminarraum 157, Hermann-von-Helmholtz-Platz 1 in 76344 Eggenstein-Leopoldshafen.

## Hotel recommendations

- Hotel Kaiserhof, Hotel Novotel Karlsruhe City, City Partner Hotel Berliner Hof, Hotel Rio

## Further information

- www.thin-film-technology.de

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## Contact

**Registration:**  
Anna-Maria Hipp: gvt-hochschulkurse@gvt.org  
Phone: +49 69 7564-118

**Short course organisation:**  
Tobias Börnhorst M. Sc.: tobias.boernhorst@kit.edu  
Office TFT: margit.morvay@kit.edu

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## Further information and registration:

- http://www.tft.kit.edu/745.php
- http://www.gvt.org/Hochschulkurse.html
specifics of film cracking and the flows within thin films.

In 2014 he refused a Professorship offer (W3) to TU Dresden. Since 2018 he has been the first Professorship in Thin Film Technology in Germany, financially supported by an industrial consortium of BASF, BAYER and ROCHE. In 2015 he was appointed as the Chairmen of the next ECS Conference in Heidelberg-Karlsruhe.

Dr.-Ing. Philip Warnecke (KIT) is head of the TFT group at KIT together with Prof. Schabel. He received his PhD in process engineering from the University of Karlsruhe (TH) in 2009. Dr. Warnecke is an expert in the field of drying and thermodynamics of thin films. He deals with measuring methods for the investigation of polymer film drying and develops numerical simulation tools for industrial dryer applications. Since 2009, Dr. Warnecke is member of the scientific committee of the European Coating Symposium (ECS), since 2012 member of the Board of Directors of the International Society of Coating Science and Technology (ISCST). In 2014, he was awarded the L. E. Scriven Young Investigator Award by the ISCST. In 2019, Dr. Warnecke will be one of the Chairmen of the next ECS Conference in Heidelberg-Karlsruhe.

Prof. Dr. Norbert Willenbacher (KIT) is head of the Institute of Mechanical Process Engineering and Mechanics at Karlsruhe Institute of Technology (KIT) since 2004. He received his diploma degree in Physics and his PhD from the University of Stuttgart. After his dissertation at the Max-Planck-Institute for Polymer Research he joined BASF SE as a research associate in the fields of rheology of complex fluids and adhesion of soft polymers for 15 years. Prof. Willenbacher is president of the German Society of Rheology, assigned member of the ProcessNet Technical Committee on Rheology, and member of the Editorial Board of Rheologica Acta.

Dr. Alex Routh (Cambridge University, UK) received his PhD from Princeton University in the US in 2000. He has been lecturing in Chemical Engineering at the University of Cambridge since 2006 and was promoted to full professor in 2017. His position is a joint appointment in the BP Institute for Multi-Phase Flow; a multi-disciplinary research institute within the University, spanning the physical sciences. His research is in the field of colloid science and Prof. Routh has worked in the areas of encapsulation, dispersion stability, formulation and drying. Within the film drying topic, he has been active for the past 15 years and has published extensively in the specifically of film cracking and the flows within thin films.

Dipl.-Ing. ETH Gilbert Gugler (iPrint, CH) received his diploma in material science from the ETH Zurich in 1992. From 1992 to 1998 he worked in the area of chemical and physical deposition. From 1998 on he worked at Ifford Imaging Switzerland GmbH. Leading the Technology Center of Wifag-Polytype Technologies AG since 2014 he is responsible for all coating and process related topics. End of 2016 he joined the university of applied science and arts of Western Switzerland as deputy managing director of the iPrint institute. Gilbert Gugler is an expert in multi-layer curtain coating technology, starting from the preparation of coating fluids, characterisation, processing, to the multi-layer curtain coating and drying. Since 2017, he is heading his own company called Gugler Coating Consulting.

Dr. Peter M. Schweizer (Schweizer Coating Consulting, CH) received his PhD in Mechanical Engineering from the Swiss Federal Institute of Technology in 1979, and he did postdoctoral research in coating flows at the University of Minnesota with Prof. Schabel from 1979 – 1980. From 1981 – 1986, Dr. Schweizer worked in the Coating Flow Research Group at Kodak in Rochester, New York, and from 1987 – 1996, he worked at Ifford in Fribourg, Switzerland. From 1997 – 2000, Dr. Schweizer was Managing Director of TSE Troller Switzerland. From 2001 – 2016, he worked for Polytype Converting in Fribourg, Switzerland. Since 2016, he is heading his own company called Schweizer Coating Consulting GmbH.

Prof. Dr. Hadj Benkreira (Univ. of Bradford, UK) (BEng, MSc Chemical Engineering) obtained his PhD on the Fluidics of Coating Flows in 1980 under the supervision of Prof. Professor Williams (CBE, FRSE). Following five years of EPSRC postdoctoral research, he joined the academic staff of the University of Bradford in 1985 and was endowed a Personal Research Chair in 1998 for research in Thin Film Coating and in Polymer Processing and became in 2004-2009 Associate Dean for Research. Professor Benkreira is member of several learned societies including the UK EPSRC Peer Review College, the ISCST of which he was the Vice President in 2006-8 and the European Coating Symposium steering committee. He has published widely on coating science and technology and is the editor of the Special Issues of the ISCST conferences.

Prof. Dr. h. c. mult. Franz Durst (FMP TECHNOLOGY GMBH) graduated from Imperial College at the London University and received his doctor's degree in 1972 (PhD). In 1972, he returned to Germany and worked as subproject leader of various research projects at the Collaborative Research Center 80 at the University of Karlsruhe for ten years. Prof. Durst was offered a C3 professorship for Fluid Mechanics at the University of Karlsruhe in 1978 and was appointed Chair of the Institute of Fluid Mechanics at the University of Erlangen-Nuremberg in 1982. In 2006, Prof. Durst retired from the University of Erlangen-Nuremberg and founded the company FMP TECHNOLOGY GMBH, whose CEO he has been until 13 August 2018. He is now still one of the two shareholders of the company.

Dipl.-Ing. Philipp Cavadini (CN Drying Technology UG) graduated in Aerospace Engineering at the University of Stuttgart. In his PhD studies at KIT/TUFT until 2015 he investigated surface tension driven convection and the optimisation of impinging jet systems from the viewpoint of homogeneity of the distribution of the heat and mass transfer coefficient. Currently Mr. Cavadini works on cooling technologies in the department of “Methods and Technology” at Siemens Energy. In secondary employment, he is working on the spin-off creation “CN Drying Technology UG”, developing highly homogeneous cold nozzle dryers for lab applications.

Dr. Robert Beer (Polytype Converting AG, CH) completed his PhD in physical chemistry in 1988 at the University of Berne. After a postdoctoral stay at the Loughborough University of Technology, he returned to the University of Berne continuing the studies in photophysics and characterisation of coatings with the L. E. Scriven Young Investigator Award by the ISCST. In 2014 he was awarded the L. E. Scriven Y. I. Award 2008 by the ISCST. Within the field of complex fluids and adhesion of soft polymers for 15 years, Dr. Robert Beer increased his competence in coating technology at Polytype Converting AG and since 2016 he is co-heading the Technical Center.

Dr. Kai K. O. Bär (adphos) is the Managing Director/President of the adphos Digital Printing GmbH. He was one of the founders of the IndustrieSerVis GmbH (legal predecessor of AdPhos). Before he was the leader of the business segment “High Temperature Technology and Installations” at IABG, Ottobrunn. Dr. Bär was responsible for the Technology-Program “HERMES-Heatstructure-solutions” and graduated as Dr.-Ing. (with award) at the RWTH Aachen in Germany.

Prof. Dr. Steven Abbott (TCNF, UK) received his Oxford PhD in Chemistry from Harvard University in 1978 and was postdoc in the Nobel Prize winning lab of Prof. J.-M. Lehn in Strasbourg before working for ICI where he was Senior Manager before joining the high-tech coating company Autotype near Oxford as Research Director. He worked closely with coating experts at U. Leeds (appointed Visiting Professor in 2000) and co-created the TopCoat and TopWeb programs for the coating industry. He now teaches, consults and troubleshoots around the world on coating, solubility, surfactant and adhesion science, using his own apps and software to bring science to life.

Dipl.-Ing. Harald Döll (TSE, CH) successfully graduated from the Technical University in Darmstadt in Mechanical Engineering in 1989. After some year in web-guiding systems Harald Doell joined TSE Troller AG in 1997. In the beginning, he was the head of the engineering team; since 2008, he is in charge of the entire application technology. Design of die internals, experiments with customers, start-ups and technical customer support are part of his assignment. Furthermore, he is giving talks at several short courses and international conferences in the US, Europe and Asia.
Ir. Ike de Vries (HOLST CENTRE, NL) studied Chemistry and Agricultural Science at the Wageningen University, Netherlands. After graduation in 1985 he was for a period of 3 years a researcher at the Wageningen–gen University. From 1988 to 2006 Ike de Vries was a project leader and process/research engineer in the field of extrusion coating and substrate development for ink jet and photographic paper at Fuji Photo Film. Since 2006, he is a research scientist at the Holst Centre Institute in Eindhoven, The Netherlands. Inventing and developing new (R2R) processes and slot die coating technologies, especially intermittent coating, are his main core competences. This to enable large scale production for flexible electronics, like for example organic light emitting diodes (OLEDs) and photovoltaic (PV).

Fritz Bircher (iPrint, CH) studied electrical engineering at ETH Zurich. After graduating he worked as an R&D engineer for different companies developing mechatronic system solutions. In 1993 he was appointed professor at Bern University of Applied Sciences, where he started his research in inkjet printing, studying and exploring all possible jetting and dispensing principles with all kinds of materials in a wide range of applications. In 2012 he joined the University of Applied Sciences Western Switzerland in Fribourg, where he founded iPrint institute and iPrint Center for Digital Printing at the Marly Innovation Center. Fritz’s main research interests based on inkjet printing include: packaging printing, direct-to-shape printing, material printing including 3D printing and bio printing.

Prof. Dr.-Ing. Arno Kwade (TU Braunschweig) graduated from the Institute of Mechanical Engineering, Technische Universität Braunschweig and received his doctor’s degree (PhD) in 1996. Until 2005, he was Executive Director of Betonwerke Emsland GmbH and Kwade+Scheidewes Zerkleinerungstechnik. He is Professor at Technische Universität Braunschweig, head of the Institute for Particle Technology and one of the founders of the BLB (Battery lab Braunschweig). Prof. Kwade is a leading expert in battery processing technology, coordinator of the BMBF cluster “ProZell” and initiator of the annual International Battery Production Conference (IBPC).

Dr. Armin Modlinger (Volkswagen AG) graduated in Chemistry at the University of Bayreuth in 2000, followed by a doctoral degree in 2004 at the Technische Universität München. After a Postdoctoral fellowship at the University of Bristol he started his career in the chemical industry at Evonik Industries in 2006, working at different positions in R&D departments associated with Lithium-Ion Technology. 2013 he became head of process technology at Lit ion GmbH and later in 2017 he took over responsibility for Product and Process Development at Lit ion GmbH. In April 2018 he joined the Center of Excellence Batteriezelle within the Volkswagen Group.

Prof. Dr.-Ing. habil. Hermann Nirschl (KIT) received his Ph.D. in Fluid Mechanics from the Technical University of Munich in 1994. For his Habilitation in 1997 he worked on the numerical simulation of the particle loadan flows. He joined the 3M company in the dental division as the head of process engineering in the years between 1997 and 2002 where he worked as a project manager for different projects in Munich and St. Paul/Minnesota. Since 2003 he is Professor for Mechanical Process Engineering at the KIT in Karlsruhe. The focus of the research is on particle technology with a special emphasis on separation processes, numerical simulations and the development of particle analysis technology.

Prof. Dr.-Ing. Frank Kleine Jäger (BASF SE) is currently Senior Research Manager and Head of Solids Formulation and Handling Group at BASF SE in Ludwigshafen. In this role, he manages the global R&D activities in this field of Solids and Film Processing ranging from development of new process technologies and optimization to trouble shooting and debottlenecking in BASF’s global production plants. He is Chemical Engineer with Diploma and PhD degrees from RWTH Aachen University, Germany. He also received his Habilitation from RWTH Aachen in 2004. Since 2011 he holds a Professorship as apl. Prof. Dr.-Ing at RWTH Aachen.

Prof. Dr.-Ing. Cameron Tropea (TU Darmstadt) graduated from the University of Toronto in Engineering Sciences, followed by a Masters degree in Mechanical Engineering (1977). He completed his Dr.-Ing. in Civil Engineering at the Technical University of Karlsruhe (1982) and his Habilitation in Fluid Mechanics at the University of Erlangen-Nürnberg (1991) where he was appointed as Professor of Fluid Mechanics until 1997. This was followed by an appointment to his current position at the Institute of Fluid Mechanics and Aerodynamics at the TU Darmstadt. Currently Editor-in-Chief of the Springer journal Experiments in Fluids and past Director of the Center of Smart Interfaces (CSI) in the period 2007-2014, his research interests include optical techniques in Fluid Mechanics, Interfacial Transport Phenomena, Atomization and Spray Processes and Unsteady Aerodynamics. He has recently been appointed a member of the Scientific Commission of the Council of Science and Humanities in Germany.

Prof. Dr. An-Bang Wang (NTU, Taiwan) received the Dr.-Ing.-degree at the Institute of Fluid Mechanics (LSTM), University of Erlangen-Nürnberg, Germany in 1991 and is a full professor at the Institute of Applied Mechanics, National Taiwan University (NTU), Taiwan. He has served as the director of Optomechantronics Education Resource center, chairman of the display technology Education Program and counselor of advisory office, Ministry of Education, Taiwan; vice president of International Society of Coating Science and Technology. He was honored with the Distinguished Engineering Professor Award of Chinese Institute of Engineers, Taiwan. His current research interests include advanced coating & micro-fluidic platform for biomedical/industrial applications and biomimetics.

A total of 26 speakers, including 17 external and following PhD students of the TFT group at KIT:

Dipl.-Ing. Anna-Lena Walz completed her studies in Chemical Process Engineering at KIT in 2012, majoring in Thermal Process Engineering and Technical Thermodynamics. She conducted her diploma thesis as a Solvay scholarship student at the University of British Columbia in Vancouver where she investigated the formation of polymer stabilized nanoparticles for drugs applications. Further, a scholarship was granted her by the German National Academic Foundation during her studies. Since 2013 she is working as research assistant at the KIT/TFT. In her PhD she focuses on processing biosensor solutions, in particular on their special treatment during coating and drying due to sensitive components, on their sorption behavior as well as on the development of novel biosensor solutions containing conductive polymers.

Dipl.-Ing. Ralf Diehm graduated in Process Engineering at KIT in 2014, majoring in Thermal Process Engineering and Chemical Energy Sources. Already during his studies he started to specialize on thin film coatings of organic electronics in his student research project and of lithium-ion battery electrodes in his diploma thesis. Since 2014 he is working as research assistant at the KIT/TFT group, focusing on stability and mechanism of slot die coating and in particular of intermittent coating to provide a fundamental understanding of the process and its limitations. In 2015 he was awarded with the first price of the KIT “Neuland” award for his innovations in high speed intermittent slot die coating.

Additional speakers at the 4th TFT Forum on May 16-17

Dr. Armin Modlinger (Volkswagen AG)
Ir. Ike de Vries (HOLST CENTRE, NL)
Fritz Bircher (iPrint, CH)
Prof. Dr.-Ing. Arno Kwade (TU Braunschweig)
Prof. Dr.-Ing. habil. Hermann Nirschl (KIT)
Prof. Dr.-Ing. Frank Kleine Jäger (BASF SE)
Prof. Dr.-Ing. Cameron Tropea (TU Darmstadt)
Prof. Dr. An-Bang Wang (NTU, Taiwan)

Additional speakers and workshop instructors

Ilias Jovanovic (since 2016)
Jochen Eser (since 2015)
Max Tönsmann (since 2015)
Lisa Merklein (since 2016)
Jana Kumberg (since 2016)
Victor Gracia (since 2017)
Sandro Spiegel (since 2017)
Andreas Altvater (since 2018)