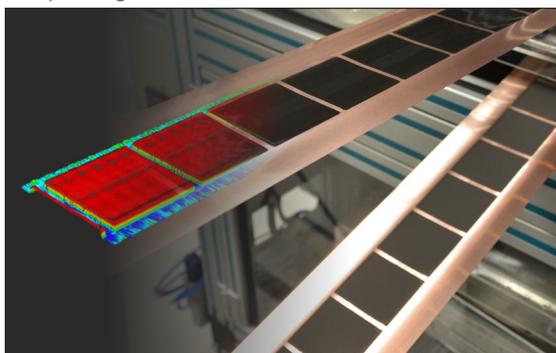




9th Short Course Coating and Drying of Thin Films

3(+2)-day short course on fundamentals and applications with practical workshop in the coating and printing lab



2nd Thin Film Technology Forum

2-day forum on June 1-2 on advances in printed electronics, battery and smart coatings



May 29-June 2, 2017

KIT-Tagungszentrum (FTU)

Seminar room 157 / lecture hall (TFT Forum)

**Hermann-von-Helmholtz-Platz 1
76344 Eggenstein-Leopoldshafen**



Organisation: Prof. Dr.-Ing. Wilhelm Schabel
Dr.-Ing. Philip Scharfer
with 19 experts from industry and academia

Program Short Course and Forum

31 contributions from 25 speakers (19 external)

Schedule 29.05.2017 – 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
- 13:00** *From theory to practice in coating technologies*
Dipl.-Ing. Wolfram Szczepaniak (Kroenert)
- 13:45** *Rheology of coating fluids*
Prof. Dr. Norbert Willenbacher (KIT)
- 15:00** *Coffee break*
- 15:30** *Coating / printing fluids characterisation*
Dipl.-Ing. Gilbert Gugler (iPrint, CH)
- 16:45** *Introduction to self- and premetered coating*
Dr. Peter Schweizer (Fribourg, CH)
- 19:30** *Social dinner at BESITOS (Karlsruhe town square)*

Schedule 30.05.2017 – Short Course Tuesday

- 09:00** *Curtain and slot die coating*
Dr. Peter Schweizer (Fribourg, 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 drying technology*
Prof. Dr.-Ing. Wilhelm Schabel (KIT)
- 16:00** *Film drying and drying studies*
Prof. Dr.-Ing. Wilhelm Schabel (KIT)

Schedule 31.05.2017 – Short Course Wednesday

- 08:30** *Drying of particulate coatings and crack formation*
Dr. Alex Routh (Cambridge, UK)
- 10:00** *Sorption and phase equilibrium in polymeric systems*
Dipl.-Ing. Anna-Lena Riegel (KIT)
- 10:20** *Coffee break*
- 10:50** *Drying characterisation of battery electrodes*
M. Sc. Jana Kumberg (KIT)
- 11:10** *Simulation & design of industrial thin film dryers*
Dr.-Ing. Philip Scharfer (KIT)
- 12:40** *Lunch break*
- 13:40** *Homogeneous drying with comb nozzles*
Dipl.-Ing. Philipp Cavadini (CND Solutions)
- 14:10** *Industrial perspectives of slot die coating*
Dipl.-Ing. Harald Döll (TSE)

14:40 *Coffee break*

15:10 *Applications of NIR-Drying Technology*
Dr. Kai K. O. Bär (adphos Digital Printing GmbH)

15:40 *Coating apps and web handling*
Prof. Dr. Steven Abbott (TCNF, UK)

Schedule 01.06.2017 – Short Course & Forum Thursday

09:00 *Experimental workshop at the TFT coating and printing laboratory*
- *Characterisation of material systems*
- *Pilot-scale coating trials*
- *Heat and mass transfer coefficients*
- *Experimental drying curves*

13:00 *TFT Forum get-together lunch (Finger Food)*

14:00 *Welcome & Introduction to TFT Forum*
Prof. Dr.-Ing. W. Schabel / Dr.-Ing. P. Scharfer

14:10 *Welcome & Introduction to KIT*
Prof. Dr. Thomas Hirth (KIT)
Vice President for Innovation and International Affairs

14:20 *Advances in organic & printed electronics processing*
Ir. Ike de Vries (Holst Centre, NL)

15:20 *Multilayer polymer LEDs from solution*
Prof. Dr. Paul Blom (MPI Polymer Research)

16:05 *Coffee break*

16:35 *Multilayer coating of organic electronics*
Dipl.-Ing. Sebastian Raupp (KIT)

16:55 *Printed Perovskite Photovoltaics*
Dr. Ulrich Paetzold (KIT)

17:25 *Drying and diffusion in printed nanofilms*
Prof. Dr.-Ing. Wilhelm Schabel (KIT)

19:30 *Get-together at BESITOS (Karlsruhe town square)*

Schedule 02.06.2017 – Short Course & Forum Friday

08:45 *Advances in digital direct printing*
Prof. Fritz Bircher (iPrint, CH)

09:30 *Self-cleaning antireflective optical coatings*
Dr. Stefan Guldin (University College London, UK)

10:00 *Solvent-borne acrylic pressure-sensitive adhesive films*
Dr. Stephan Zöllner (tesa SE)

10:30 *Powerdrop: Jetting difficult materials*
Dr. Guy Newcombe (Archipelago Tech., Cambridge UK)

11:00 *Coffee break*

11:30 *Industrial production of Li-ion battery cells*
Dr. Armin Modlinger (Litarion)

12:15 *Industrial experiences in production of Li-ion cells*
Dr. Andreas Huth (VW-VARTA Microbattery)

12:45 *Limitations in industrial coating of battery electrodes*
Dipl.-Ing. Ralf Diehm (KIT)

13:05 *Cryo SEM morphology characterisation and drying research on Li-ion battery electrodes*
Dr.-Ing. Philip Scharfer (KIT)

13:25 *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 **2nd 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 **Printed Electronics, Battery and Smart Coatings**.



Registration fees

	Early Bird (until 15.03.17)	later
General	€ 1550.–	€ 1700.–
GVT Members	€ 1500.–	€ 1650.–

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.tft.kit.edu – TFT Courses

Feedback about the last TFT courses

- “Excellent introduction in coating and drying of films. Demonstrates the complexity, offers better understanding of processes.”
- “Very interesting course, lots of information on all coating application! Building bridge from university to industrial applications.”
- “Well built-up structure, wide range of theory and application covered, too short time for discussion/break.”
- “High level talks with broad range of topics but with good scientific and practical depth, also on application.”
- “Good structure.”

and workshop

- “Good to see how the theory of the courses works in real life”
- “Experiments were very well prepared and perfectly organized”
- “Interesting, well organized”

Further information and registration:

<http://www.tft.kit.edu/745.php>
<http://www.gvt.org/Hochschulkurse.html>



Contact

Registration:

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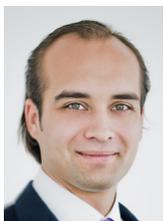
Prof. Dr.-Ing. Wilhelm Schabel (KIT) holds a professorship in Thin Film Technology at KIT since 2009. He studied process engineering and his doctor thesis in the field of drying of thin films was honored with the Carl-Freudenberg Award. In 2007 he gained industrial experiences in coating technology as R&D engineer at LONZA High Tech Film. He was honored with the Arnold Eucken Award from VDI (2007), the L.E. Scriven Award from the International Society of Coating Science and Technology (2008) and a honorary doctorate from TU Iasi for his research achievements. Prof. Schabel is active in national and international coating, printing, drying and heat and mass transfer committees as chairman, director and past vice president. He is author and co-author of more than 170 listed scientific contributions in these research fields.



Dr.-Ing. Philip Scharfer (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. Scharfer is an expert in the fields 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. Scharfer 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 with the L. E. Scriven Young Investigator Award by the ISCST.



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 Mainz. 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 and assigned member of the ProcessNet Technical Committee on Rheology. He is section editor of Current Opinion in Colloid and Interface Science and member of the Editorial Board of Rheologica Acta.



Dipl.-Ing. Philipp Cavadini (CND Solutions) graduated in Aerospace Engineering at the University of Stuttgart. In his PhD studies at KIT/TFT 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 "Comb-Nozzle drying solutions".



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 vapour deposition. From 1998 on, he worked at Ilford Imaging Switzerland GmbH. Leading the Technology Center of Wifag-Polytype Technologies AG since 2014 he was 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 multilayer curtain coating technology, starting from the preparation of coating fluids, characterization, processing, to the multilayer curtain coating and drying.



Dr. Peter M. Schweizer (Fribourg, CH) received his PhD in Mechanical Engineering from the Swiss Federal Institute of Technology in 1979, and he did post-doctoral research in coating flows at the University of Minnesota with Prof. Scriven 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 ILFORD in Fribourg, Switzerland. From 1997 – 2000, Dr. Schweizer was Managing Director of TSE Troller Schweizer Engineering in 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 Fluid Mechanics of Coating Flows in 1980 under the supervision of Professor WL Wilkinson (CBE, FRS). Following five years of EPSRC post-doctoral re-search, 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 Symposia steering committee.



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 and shareholder he has been to this day.



Dipl.-Ing. Wolfram Szczepaniak (Kroenert) studied mechanical engineering in Hamburg. After 8 years development and design of crosscutters for paper sheets, he started to work for Kroenert in 1998 as the leader of the design department. His field of work was at that time the design and development of all different coating machines and application systems. Furthermore he developed new coating method processes together with customers. Since 2017 he is the Head of Technology at Kroenert GmbH & Co KG.



Dr. Alex Routh (Cambridge University, UK) received his PhD from Princeton University. Since 2006 he has been a lecturer in Chemical Engineering at the University of Cambridge. His position is a joint appointment with the BP Institute for Multi-Phase Flow; a multi-disciplinary research institute, within the University, spanning the physical sciences. Within the film drying topic, Dr. Routh has been active for the past 15 years and has published extensively in the specifics of film cracking and the flows within thin films. Dr. Routh has published 75 articles and a textbook called fundamentals of latex film formations: Processes and Properties (Springer 2010).



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-Tests" and graduated as Dr.-Ing. (with award) at the faculty of mechanical engineering 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, in Europe and in Asia.

Additional speakers at the 2nd TFT Forum on June 1-2



Ir. Ike de Vries (HOLST CENTRE, NL) studied Chemistry at the Wageningen University, Netherlands. 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 in Eindhoven, The Netherlands. He utilizes his experience to develop new (R2R) processes which

enable large scale production of organic light emitting diodes (OLEDs) and photovoltaic (PV). He is a board member of the European Coating Symposium (ECS) and the International Coating Science and Technology Symposium (ISCST).



Prof. Dr. Paul Blom (MPI Polymer Research) received his Ph. D. Degree in 1992 from the Technical University Eindhoven on picosecond charge carrier dynamics in GaAs. At Philips Research Laboratories he was engaged in the electro-optical properties of polymer light-emitting diodes. From 2000 he held a professorship at the University of Groningen in the field of electrical and optical properties of organic semiconducting devices. In September 2008 he became Scientific Director of the Holst Centre in Eindhoven, followed in 2012 by an appointment as director at the MPI for polymer research in the field of molecular electronics.



Dr. Ulrich W. Paetzold (KIT) received his diploma in physics (2009) and PhD in physics (2013) from the RWTH Aachen University. He conducted his PhD thesis at Forschungszentrum Jülich and continued as a Post-Doc expanding his research interest to novel nanopatterning methods, nanophotonic light management concepts, and scanning optical near-field microscopy. In 2014, Dr. Paetzold moved to imec (Leuven, Belgium) and started researching new materials and processes for solution-processed perovskite thin-film solar cells. Since June 2016, Dr. Paetzold leads a Helmholtz Young Investigator Group at the KIT, focussing on light management, nanophotonics for energy as well as new materials and processes for inexpensive and stable perovskite optoelectronic devices.



Dr. Armin Modlinger (Litarion) graduated in Chemistry at the University of Bayreuth in 2000, followed by a doctoral degree in 2004 at the TU Munich. After a Postdoctoral fellowship at the University of Bristol he started his career 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 Litarion GmbH with responsibility for the process chain of electrode and separator production for large format lithium ion cells. Since 2017 he is responsible for Product and Process Development at Litarion GmbH.



Dr. Stefan Guldin (University College London, UK) is a University Lecturer and heads the Adaptive and Responsive Nanomaterials Group at University College London. Prior to his appointment in 2014 he was a postdoctoral fellow of the German Academy of Sciences (Leopoldina) at the École Polytechnique Fédérale de Lausanne, Switzerland. He obtained a PhD in 2012 from the University of Cambridge for his work on "Inorganic nanoarchitectures by organic self-assembly", mainly elucidating the structure-function relationship in self-organised materials. Previously, he studied applied physics with an emphasis on soft matter at the TU Karlsruhe and TU Munich. His research interests include the self-assembly of soft & hybrid matter, adaptive and responsive materials architectures as well as light-matter interactions.



Dr. Stephan Zöllner (tesa SE) studied chemistry at the University of Hamburg. After receiving his doctoral degree in 1990 he did postdoctoral research at the IBM Almaden Research Center. In 1992 he started his career in the chemical industry at the Beiersdorf AG, developing polymers for adhesives. Since 2000, he is responsible for acrylic adhesives at the tesa SE. Major areas of expertise include polymerization technologies, pressure sensitive adhesives in general, acrylate based pressure sensitive adhesives in particular, radiation cured adhesives and processing of adhesives.



Dr. Guy Newcombe (Archipelago Tech., Cambridge UK) is CEO at Archipelago Technology (www.archipelagotech.com), a Cambridge-based company focused on developing precision droplet creation and deposition systems. Guy studied physics at the Cavendish Laboratory, Cambridge, UK before embarking on a career in the world of inkjet and microfluidics. In the course of the past 30 years Guy has created technology in piezo, electrostatic and continuous inkjet. At Archipelago Technology, he is driving the development and applications of the Powerdrop print platform.



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 on 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.



Dr. Andreas Huth (VWVW-Forschungsgesellschaft) finished his diploma in Mechanical Engineering and Business Administration at Technical University of Braunschweig in 2003. From 2004-2007 he participated in the PhD program at Volkswagen Group Research and received his PhD in Physical Chemistry at the Leibniz University of Hannover in the research group of Prof. Caro in 2007. From 2007-

2009, he was scientific member in the research group for high temperature fuel cells at Volkswagen Group Research. Since 2010, Dr. Huth is Participant in the Joint Venture of Volkswagen and Varta Microbattery (VWVW), with responsibility for prototyping and upscaling of recipes, coatings and manufacturing processes for single cell formats in hard case and pouch cell housings.

A total of 25 speakers, including 19 external and following PhD students of the TFT group at KIT:



Dipl.-Ing. Anna-Lena Riegel 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. Sebastian Raupp completed his studies in Chemical Process Engineering at KIT in 2012, majoring in Technical Thermodynamics and Thermal Process Engineering. He was a scholarship holder of the foundation of the German Economy while studying at KIT and at the Royal Institute of Technology (KTH) in Stockholm. At graduation, he was awarded with the Hans Rumpf and Emil Kirschbaum

prize for his excellent achievements in his studies. Since 2013 he is working as research assistant at the KIT/TFT. In his PhD he works on solution processing of organic electronics including fundamental research on diffusion and drying processes in thin multilayer films. Mr. Raupp is expected to finish his PhD in summer 2017.

Workshop speakers and instructors



Ralf Diehm (since 2014)



T. Fritzensmeier (since 2015)



Jochen Eser (since 2015)



Max Tönsmann (since 2015)



Lisa Merklein (since 2016)



Jana Kumberg (since 2016)