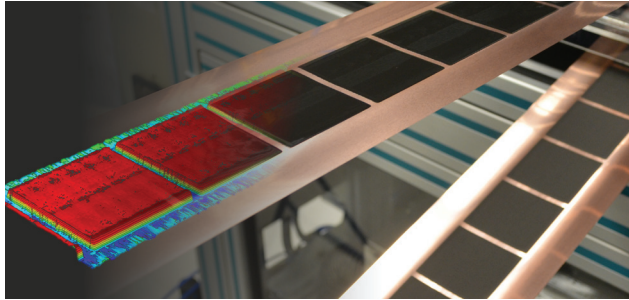




## 13<sup>th</sup> Short Course Coating and Drying of Thin Films

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



## 6<sup>th</sup> Thin Film Technology Forum Advances in Processing of Functional Films, Electrodes for Battery, Fuel Cell and Electrolyzer Applications

2-day forum on May 12-13, where renowned scientists will present and discuss recent research results and new trends in industry and academia



May 09-13, 2022

Virtual Venue

Organization: Prof. Dr.-Ing. Dr. h. c. Wilhelm Schabel  
Dr.-Ing. Philip Scharfer  
with 35 experts from industry and academia

Organized by Gesellschaft für Chemische Technik  
und Biotechnologie e.V.



## Program Short Course and Forum

44 contributions from 35 speakers (22 invited external)

### Schedule 09.05.2022 – Short Course Monday

- 08:00 *Registration and virtual check-in*
- 08:15 *Technology check / tutorial for virtual area*  
Philipp Quarz M. Sc. / Jonas Mohacs M. Sc. (KIT)
- 08:30 *Welcome and introduction*  
Prof. Dr.-Ing. W. Schabel / Dr.-Ing. P. Scharfer (KIT)
- 09:20 *Coating and printing fluids characterization*  
Prof. Gilbert Gugler (iPrint, CH)
- 10:30 *Coffee break*
- 10:50 *Rheology of coating fluids*  
Prof. Dr. Norbert Willenbacher (KIT)
- 12:00 *Introduction to premetered coating methods*  
Dr. Peter Schweizer (Schweizer Coating Consulting, CH)
- 13:00 *Lunch break*
- 14:00 *Industrial perspectives on curtain & slot die coating*  
Dipl.-Ing. Harald Döll (TSE, CH)
- 14:30 *Fluid flow in coating tools*  
Prof. Dr. Dr. h. c. mult. Franz Durst (FMP)
- 15:30 *Coffee break*
- 15:50 *Special issues on curtain and slot coating*  
Dr. Peter Schweizer (Schweizer Coating Consulting, CH)

### Schedule 10.05.2022 – Short Course Tuesday

- 08:30 *Coating and extended coating window*  
Sandro Spiegel M. Sc. / Alexander Hoffmann M. Sc. (KIT)
- 09:00 *Knife and blade coating*  
Prof. Dr. Hadj Benkreira (University of Bradford, UK)
- 09:50 *Coffee break*
- 10:10 *Gravure and roll coating*  
Prof. Dr. Hadj Benkreira (University of Bradford, UK)
- 10:55 *Fundamentals of film drying technology I*  
Prof. Dr.-Ing. Wilhelm Schabel (KIT)
- 12:00 *Fundamentals of film drying technology II*  
Prof. Dr.-Ing. Wilhelm Schabel (KIT)
- 13:00 *Lunch break*
- 14:00 *About film drying phenomena and drying studies*  
Prof. Dr.-Ing. Wilhelm Schabel (KIT)
- 15:15 *Coffee break*
- 15:35 *Drying of multicomponent mixtures*  
Dr.-Ing. Philip Scharfer (KIT)
- 16:00 *Drying of particulate coatings and crack formation*  
Prof. Dr. Alex Routh (Cambridge, UK)

### Schedule 11.05.2022 – Short Course Wednesday

- 08:30 *Sorption equilibrium in polymeric and porous films*  
Thilo Heckmann M. Sc. / Nadine Zimmerer M. Sc. (KIT)
- 09:00 *Simulation and design of industrial thin film dryers*  
Dr.-Ing. Philip Scharfer (KIT)
- 10:30 *Coffee break*
- 10:50 *Homogeneous drying with comb nozzles*  
Dipl.-Ing. Philipp Cavadini (CN Drying Technology UG)
- 11:15 *Coating, drying and web handling apps*  
Prof. Dr. Steven Abbott (TCNF, UK)
- 13:00 *Lunch break*
- 14:00 *Live streaming of experimental workshop at the TFT coating and printing laboratory*  
- Rheology & wetting  
- Pilot-scale coating trials  
- Heat and mass transfer coefficients  
- Experimental drying curves

### Schedule 12.05.2022 – Short Course & Forum Thursday

- 09:00 *Welcome and introduction to TFT Forum*  
Prof. Dr.-Ing. W. Schabel / Dr.-Ing. P. Scharfer (KIT)
- 09:25 *Welcome and introduction to KIT*  
Prof. Dr. Andrea Robitzki (KIT)  
Head of KIT Division 1  
(Biology, Chemistry, and Process Engineering)
- 09:35 *Slot coating for battery electrodes: early attempts to understand slurry coating flows*  
Prof. Dr. Jaewook Nam (Seoul National University, KOR)
- 10:05 *Simulation approaches in mixing of battery slurries*  
Prof. Dr.-Ing. habil. Hermann Nirschl (KIT)
- 10:35 *Advances in processing and recycling of battery cells*  
Prof. Dr.-Ing. Arno Kwade (TU Braunschweig)
- 11:05 *Coffee break*
- 11:30 *Industrial production of lithium-ion battery cells*  
Dr.-Ing. Martin Gallenkemper (Volkswagen AG)
- 12:00 *Advances and challenges in future battery recycling processes*  
Prof. Dr.-Ing. Urs Peuker (TU Bergakademie Freiberg)
- 12:30 *Solution-processed functional films in chem. industry*  
Prof. Dr.-Ing. Frank Kleine Jäger (BASF SE)
- 13:00 *Lunch break*
- 14:00 *Formation of crack networks in coatings*  
Prof. Dr. Ludovic Pauchard (Univ. Paris, FR)
- 14:40 *Colloidal redistribution during drying*  
Prof. Dr. Alex Routh (Cambridge, UK)

- 15:10** *Marangoni-induced flow fields and defects during film drying*  
Prof. Dr.-Ing. W. Schabel / Dipl.-Ing. M. Tönsmann (KIT)
- 15:40** *Coffee break*
- 16:00** *Drying of polymer composite coatings*  
Victor Gracia M. Eng. (KIT)
- 16:25** *Principles, applications and current research on PEM fuel cells and electrolyzers*  
Dipl.-Ing. Bernd Oberschachtsiek (ZBT)
- 16:55** *Catalyst coated membranes for fuel cell applications*  
Philipp Quarz M. Sc. (KIT)
- 17:15** *Advances in coating and drying of catalyst coated membranes for PEM electrolyzer applications*  
Nadine Zimmerer M. Sc. (KIT)

### Schedule 13.05.2022 – Short Course & Forum Friday

- 09:00** *A research factory for battery cell production – recent advances*  
Prof. Dr. Jens Tübke (Fraunhofer ICT, KIT)
- 09:30** *AgiloBat: Flexible production of battery cells*  
Prof. Dr.-Ing. Jürgen Fleischer (KIT)
- 10:00** *About thermal transport properties and behavior of Li-ion battery cells*  
Prof. Dr.-Ing. Thomas Wetzel (KIT)
- 10:30** *Coffee break*
- 10:50** *Actual challenges of industrial intermittent battery coatings*  
Dipl.-Ing. Ralf Diehm (RapidEdge Technology GmbH)
- 11:10** *Simultaneous double-sided coating of LiB electrodes*  
Sandro Spiegel M. Sc. (KIT)
- 11:25** *Development of an agile dryer concept for optimized drying of battery electrodes*  
Jonas Mohacsi M. Sc. (KIT)
- 11:40** *Coffee break*
- 11:55** *Advances in drying of battery electrodes*  
Kevin Ly M. Sc. (KIT)
- 12:10** *Processing of structure-optimized lithium- and sodium-ion battery electrodes*  
Julian Klemens M. Sc. (KIT)
- 12:25** *Radiation-based drying of battery electrodes*  
Andreas Altvater M. Sc. (KIT)
- 12:40** *Towards an improved recycling and recovery of electrolyte solvents from shredded battery cells*  
Lukas Lödige M. Sc. (KIT)
- 12:55** *About electrode post-drying and moisture mangement in LiB electrodes processing*  
Thilo Heckmann M. Sc. (KIT)
- 13:10** *TFT Forum closing session*

### Registration fees Short Course and TFT Forum

	Early Bird (until 09.04.22)	later
<b>Short Course &amp; TFT Forum*</b>		
General	€ 1700.–	€ 1850.–
GVT discount	€ 1650.–	€ 1800.–

### Registration and Contact

Registration Short Course and TFT Forum\*  
[gvt-hochschulkurse@gvt.org](mailto:gvt-hochschulkurse@gvt.org)  
Nicola Größ / Patrice Mengler: +4969-7564-202

Technical support/questions: [jonas.mohacsi@kit.edu](mailto:jonas.mohacsi@kit.edu)

Note: The Short Course registration includes the registration to TFT Forum!

Registration online open via: <https://gvt.org/Hochschulkurse.html>

\*The TFT Forum can be participated individually. Please contact [margit.morvay@kit.edu](mailto:margit.morvay@kit.edu) for further details and registration to TFT Forum only.

### Payment

According to §4 Nr. 22a UStG the registration fee is purchase tax free. Registration fees include a Short Course file as .pdf with documentation of lectures and workshop. A participation certificate will be distributed.

### Venue

Short Course and TFT Forum take place online and move to a virtual venue. The virtual venue provides opportunities for networking, live discussions as well as valuable breakout sessions. After registration, all "login details" of the virtual venue provider CME24 for the Short Course and the TFT Forum will be provided via email.

### Who has been attending last Short Course

Participants from Germany and **more than 12 EU countries, the US, China, Korea, Taiwan, Japan and others (80 % from industry / average value of the last 12 years)**

### Further information and registration

<https://gvt.org/Hochschulkurse.html>  
<http://www.thin-film-technology.de>



### Feedback about the last Short Courses

Steven Abbot in his blog about the Short Course:  
<http://www.stevenabbott.co.uk/blog/?date=22May2015>

- "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"

### Feedback 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"
- "Good coverage of application of topics covered in course"
- "Interesting material analysis; nice discussions"

### Feedback TFT Forum

- "Broad topics --> nice"
- "Good to see more application topics after the short-course"
- "Good content"
- "Very good selection of topics; all very good speakers"

### Feedback Coating International





## 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 (virtually) by TFT staff members (see photos below).

The [6<sup>th</sup> Thin Film Technology Forum](#) will take place on the last two days, where renowned scientists will present and discuss new trends in industry and academia with a focus on [advances in processing of functional films, electrodes for battery, fuel cell and electrolyzer applications](#).

**The Short Course and the TFT Forum provide a platform for scientific and technical exchange with advanced learning.**



**Prof. Dr.-Ing. Dr. h. c. Wilhelm Schabel (KIT)** is a process engineer graduated with a doctor thesis about Film Drying, which was honored with the CARL-FREUDENBERG-Award in 2005. Prof. Schabel is an expert in Thin Film Drying and Thin Film Processing with more than 150 listed publications and more than 3000 citations in these fields. His academic contributions were honored with the ARNOLD-EUCKEN Award in Germany and the L.E. SCRIVEN Young Investigator Award in the US. 2007 and 2008 he worked in industry at LONZA High Tech Films in Basel and in 2009, he was appointed to a first Professorship in Thin Film Technology in Germany, initiated by KIT and funded by BASF, BAYER and ROCHE. In 2015, he refused a professorship offer to a German Excellence University/TU Dresden. Since 2018, Schabel is Vice President of the European Coating Society. In 2021, he was granted as an EDWARDS Fellow and visited University Cambridge as a Guest Professor. The research of the TFT group has been honored so far with 34 research awards for best posters, best talks, best innovations, best doctoral works and scientific contributions worldwide.



**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. Dr. Scharfer is former Vice President Europe of the ISCST and organized ECS 2009 in Karlsruhe and ECS 2019 in Heidelberg as Chairman together with Prof. Schabel.



**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 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. In 1997, Dr. Schweizer co-edited the book entitled Liquid Film Coating, in 2006, he received the John Talmadge Award from International Society of Coating Science and Technology, and since 2018 he is the President of the European Coating Society.



**Prof. Dr. Norbert Willenbacher (KIT)** is head of the Institute of Mechanical Process Engineering and Mechanics at 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 vice-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.



**Prof. 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. Since 2020 he is one of the director of iPrint institute and competence center. 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. Since 2017, he is heading his own company called Gugler Coatech Consulting.



**Prof. Dr. Hadj Benkreira (Univ. of Bradford, UK)** (CEng, FICHEM, FHEA) 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 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 International Society of Coating Science and Technology (ISCST) of which he was the Vice President in 2006-8 and the European Coating Society (ECS) steering committee. He has published widely on coating science and technology and is the editor of the Special Issues of the ISCST conferences and a member of the editorial board of the journal Coatings.



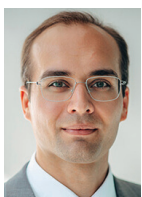
**Dipl.-Ing. Harald Döll (TSE Troller AG, CH)** successfully graduated from the Technical University in Darmstadt in Mechanical Engineering in 1989. After some year in web-guiding systems Harald Doell joined TSE Troller AG in 1997. In the beginning, he was the head of the engineering team; since 2008, 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.



**Prof. Dr. 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 project 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 three shareholders of the company.



**Prof. 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 with 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 specifics of film cracking and the flows within thin films.



**Dipl.-Ing. Philipp Cavadini (CN Drying Technology GmbH)** 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 acts as program lead with focus on advanced cooling technologies in the department of "Aero-Thermal and Tools" at Siemens Energy. In secondary employment, he is working on the spin-off creation "CN Drying Technology GmbH", developing highly homogeneous comb nozzle dryers for lab application.



**Prof. Dr. Steven Abbott (TCNF, UK)** has 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. At Autotype he also worked with U Leeds colleagues on the theory of screen printing, transforming an ill-defined art into a science.

### Additional speakers at the 6<sup>th</sup> TFT Forum on May 12-13



**Prof. Dr. Jeawook Nam (Seoul National Uni.)** is currently working as an associate professor in Chemical and Biological Engineering (CBE) at Seoul National University (SNU). His research area is related to the numerical and experimental study of transport phenomena, rheology, and microstructure analysis. As an engineer, he also focuses on fundamental aspects of liquid coating processes. He received the L.E. Scriven Young Investigator award 2016 from the International Society of Coating Science and Technology (ISCST), the Distinguished Young Rheologist award 2018 from TA instrument, and Sinyang Outstanding Young Professor Award 2020 from the College of Engineering, SNU. He recently served as the director of Energy & Environmental materials Process integration research Center (EPIC), supported by the Ministry of Science and ICT of South Korea, focusing on a roll-to-roll liquid coating process for rechargeable batteries.



**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 laden 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 technologies.



**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+Schweddes 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.-Ing. Martin Gallenkemper (Volkswagen AG)** graduated as a chemical engineer in 1999 at the Technical University Clausthal. In 2005, he received his PhD from RWTH Aachen after working as a research associate at the Institute of Process Engineering. Afterwards, he worked 16 years as a process engineer at Kodak company in Osterode in the production focusing on coating preparation, coating and drying. In 2021, he joined Volkswagen Center of Excellence for Battery Cells in Salzgitter as a planner and process developer responsible for the coating and drying process.



**Prof. Dr.-Ing. Urs Peuker (TU Bergakademie Freiberg)** graduated in Chemical Engineering in 1997, and received his doctor's degree (Ph.D.) from the Karlsruhe University (TH) in 2002. End of 2002, he joined the Institute of Chemical Process Engineering at the TU Clausthal as a junior professor. Since 2008, he is the professor and executive director of the Institute of Mechanical Process Engineering and Mineral Processing (MVTAT), TU Bergakademie Freiberg. Prof. Peuker is active in various national and international societies. The focus of the research is on mechanical separation processes, functional particles and particle interaction as well as mineral processing and recycling.



**Prof. Dr.-Ing. Frank Kleine Jäger (BASF SE)** is currently Vice President 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. Ludovic Pauchard (University Paris-Saclay, France)** completed his PhD in Laboratoire de Physique Statistique (Ecole Normale Supérieure, Paris) in 1997. He has been a researcher in CNRS (French National Centre for Scientific Research) at the University Paris-South since 1999 and was promoted to Director of Research in 2015. His scientific interests are at the frontier of Soft Condensed Matter and Physics-Mechanics, including drying complex liquids (colloids, polymers), morphogenesis, and mechanical instabilities in out-of-equilibrium systems. He has been active in studying the stability of coatings in varying environmental conditions, as well as the formation of cracks (including craquelures in paintings).



**Prof. Dr. Jens Tübke (Fraunhofer ICT, KIT)** is the institute director of the Fraunhofer Research Factory Battery Cell FFB in Münster and head of the department "Applied Electrochemistry" at the Fraunhofer Institute for Chemical Technology ICT in Pfinztal. In 2015, Jens Tübke was appointed to a professorship in "Materials and Processes for Electrochemical Storage" at the KIT. He studied chemistry with the specialization of technical and macromolecular chemistry at the Martin-Luther-University Halle Wittenberg and finished his PhD in 1997 with the topic "Structure-Properties-Relationships of Polymeric Gel Electrolytes for Lithium-Ion Batteries". From 1997-2000 followed an overseas stay at Kyoto University (Japan) in the working group Prof. Zempachi Ogumi and the Toyota Corp. with the aim of developing electrolyte and electrode materials for lithium-ion polymer batteries for hybrid and electric vehicles. Since 2000, he has been working with Fraunhofer Gesellschaft.





**Dipl.-Ing. Bernd Oberschachtsiek (Zentrum für BrennstoffzellenTechnik GmbH, ZBT)** received his diploma in mechanical engineering from the University Duisburg-Essen in 2000. From 2000 to 2007 he worked at University Duisburg-Essen as scientific assistant at the Chair of Energy Technology in the field of hydrogen production from various hydrocarbons as well as the purification of hydrogen rich gases for fuel cell applications. In 2007, he took up his position at ZBT and established the Department Hydrogen & Batteries. His areas of work include the hydrogen production by electrolysis, hydrogen storage in metal hydrides, and the development of electrodes and cells for Lithium-Ion- and Lithium-Sulfur-Batteries. Since 2020 he is head of the department Electrolysis and Batteries.



**Prof. Dr.-Ing. Jürgen Fleischer (KIT)** obtained his doctorate at the Institute of Production Science (wbk) in 1989. From 1992 on, he held several leading positions in industry before being appointed professor and head of the wbk at today's Karlsruhe Institute of Technology (KIT) in 2003. Furthermore, he is a visiting professor at Tongji University in Shanghai since 2012. Prof. Fleischer is active in various national and international societies. Since 2020, Professor Fleischer has been the spokesman for the Battery Competence Cluster of the German Federal Ministry of Education and Research. His current scientific research focuses on intelligent components, automated manufacturing systems for lightweight structures, and the production of components for electromobility.



**Prof. Dr.-Ing. Thomas Wetzel (KIT)** graduated in Electrical Engineering in 1996 from the University of Hannover and received his Dr.-Ing. in 2000. Before joining KIT in 2009, Prof. Wetzel held several scientific and management positions in leading German semiconductor and automotive industry companies. He is Professor for Heat and Mass Transfer at the Institute of Thermal Process Engineering and Dean of the Faculty of Chemical and Process Engineering at KIT. His current research fields are single- and multi-phase heat transfer in energy technology applications, the thermal behavior, design and management of Li-ion batteries as well as the use of liquid metals for high temperature process technology and heat storage.



**Dipl.-Ing. Ralf Diehm (RapidEdge Technology GmbH, rhc+ consulting GmbH)** graduated in Process Engineering at KIT in 2014. From 2014 until 2020 he worked at the KIT/TFT group, focusing on stability and mechanism of slot-die coating and of intermittent coating. In 2015, he was awarded the first prize of the KIT "Neuland" award for his innovations in high speed intermittent slot-die coating. After his work at KIT, he co-founded RapidEdge Technology GmbH, which develops and produces special equipment for efficient battery production lines. In 2021, he was co-founder of rhc+ consulting GmbH, a consulting company specializing in technical consulting and project management for battery cell production, where he serves as head of electrode production.

## A total of 35 speakers, including 22 external and following PhD students of the TFT group at KIT:



**Victor Gracia M. Eng. (KIT)** completed his studies in Chemical Engineering at the University of Mexico in 2014, with minors in organic synthesis, applied mathematics and process design. In 2016 he got his Masters degree in Process Engineering with the thesis titled "Analysis of mass exchangers". Since 2017, he has been working as a research assistant at the KIT/TFT group, focusing in suspensions mass transport and drying of particle coatings, establishing simulation models to predict particle distribution in dry films.



**Sandro Spiegel M. Sc. (KIT)** completed his studies of Chemical Process Engineering at KIT in 2017 with a focus on Thermal Process Engineering and Mechanical Process Engineering. During his studies, he specialized in intermittent coatings of lithium-ion battery electrodes in his bachelor thesis and concentrated on the mechanical cracking behavior of lithium-ion battery electrodes in his master thesis. Since 2017, he is working as a research assistant at the KIT/TFT group on simultaneous double-sided coatings and edge effects of lithium-ion battery electrodes.



**Andreas Altvater M. Sc. (KIT)** completed his studies of Chemical and Process Engineering at KIT in 2018 with a focus on Thermal Process Engineering and product design. Already during his studies he specialized in the sorption and drying behavior of thin film coatings. In his master thesis in the TFT Group he investigated the drying behavior of functional coatings for energy storage. Since 2018, he is working as a research assistant at KIT/TFT on the processing of battery electrodes to optimize the drying process by different types of drying applications.



**Julian Klemens M. Sc. (KIT)** completed his master's degree in Process Engineering in 2019 at KIT, majoring in Thermal Process Engineering and Chemical Process Engineering. In an internship at BASF SE he gained experience in the processing of various material systems from formulation to coating technologies and drying strategies. During his master thesis at BASF SE he was engaged in the investigation of process parameters on drying behaviour of pastose and ceramic films. Since 2019, he is working as research assistant in the KIT/TFT group, focussing on the processing of lithium ion and post-lithium battery electrodes.



**Thilo Heckmann M. Sc. (KIT)** completed his master's degree in Chemical Process Engineering in 2019 at KIT, majoring in Thermal Process Engineering and Technical Thermodynamics. He conducted his thesis work at the University of Massachusetts, Amherst as part of the Baden-Württemberg exchange program, investigating antibacterial polymer coatings. As of 2019 he is employed as research assistant at the KIT/TFT group. His research focuses on developing physical models to simulate the coating, drying, and post-drying of Li-ion batteries, with emphasis on the post-drying step, addressing the sorption behavior in porous media.



**Philipp Quarz M. Sc. (KIT)** graduated in Chemical Process Engineering at KIT in 2019 with a focus on food process engineering and product design. During his studies he specialized in the rheology of particular suspensions and product-oriented processing. In his master thesis he investigated the diffusion behavior in disperse systems via nuclear magnetic resonance (NMR). Since 2019 he is working as a research assistant at KIT/TFT. In his PhD he focuses on the processing of fuel cell membrane electrode assemblies (MEA), especially on the application and optimization of functional layers.



**Jonas Mohacsi M. Sc. (KIT)** graduated in Mechanical Engineering at KIT in 2019, majoring in Thermodynamics and Energy Technology. After he had completed his bachelor's degree at the University of Stuttgart in Automotive Engineering in 2016, he was able to gain practical experience during an internship at the Porsche AG. In his master's thesis, he dealt with the research of hydrogen investigating aspects of hydrogen safety. Since 2020 he is working as a research assistant in the KIT/TFT group. Predominately, he investigates the drying behavior of lithium-ion battery electrodes with a focus on the development of new drying systems.



**Kevin Ly M. Sc. (KIT)** completed his master's degree in Chemical Process Engineering at the Karlsruhe Institute of Technology (KIT) in 2019, majoring in Thermal Process Engineering and Chemical Process Engineering. In his master's thesis, he investigated the thermal behavior of lithium-ion batteries and developed a method for the validation of a thermal simulation model. Since 2020, he is working as a research assistant in the KIT/TFT group. His research focuses on the investigation of the drying behavior of lithium-ion battery electrodes.



**Nadine Zimmerer M. Sc. (KIT)** completed her master's degree in Process Engineering in 2020 at KIT, specializing in Food Process Engineering and Mechanical Process Engineering. During her studies, she got an insight into food drying technologies in her bachelor thesis and then found her way to drying battery anodes for sodium ion batteries in her master thesis. Since 2021, she is working as a research assistant in the KIT/TFT research group. Her research focuses on the processing of functional layers for fuel cells and electrolyzers.

## Additional speakers and workshop instructors



Alexander Hoffmann (since 2021)



Lukas Lödige (since 2021)



David Burger (since 2022)