SVC™
SOCIETY of VACUUM COATERS

TechCon 2024 Chicago

Chicago Hilton
Chicago, Illinois, USA

May 4 – May 9, 2024

Call for Papers

Deadlines for Abstracts:

October 6, 2023
(Guaranteed placement in requested session)

February 9, 2024
(Guaranteed conference participation)

Now Accepting Abstracts for the 2024 Technical Conference

Technical Program: May 6 – 9

- Technical Sessions
- Interactive Networking Forums
  + Technology Forum Breakfasts

Education Program: May 4 – May 9

- Problem-Solving Tutorial Courses

Featuring Sessions on:

- Atomic Layer Processing (ALP)
- Coatings for Energy Conversion and Related Applications
- Coatings and Processes for Biomedical Applications
- Digital Transformation of Industrial Deposition Processes
- Emerging and Translational Technologies and Applications
- High-Powered Electron Beam Technology
- High-Power Impulse Magnetron Sputtering – HIPIMS
- Large Area Coatings
- Optical Coatings
- Plasma Processing & Diagnostics
- Process Monitoring, Control and Automation
- Protective, Tribological and Decorative Coatings
- Technical Poster Session
- Thin Film Sensors
- Thin Film Contributions to the Hydrogen Economy
- Exhibitor Innovator Showcase
- WebTech Roll-to-Roll Coatings for High-End Applications

For more information, contact the SVC at +1-505-897-7743
or CLICK HERE to submit an abstract

www.svc.org

2024 SVC TechCon Call for Papers

Message from the Program Director

The 2024 SVC TechCon will be back home in bustling, downtown Chicago, Illinois! We are thrilled to return to one of our favorite destinations after our 2020 TechCon was abruptly cancelled at the last minute due to the outbreak of Covid-19. We eagerly await reconnecting with the great city of Chicago and the incredible companies and academic institutions that make the city an economic powerhouse.

The technical program will encompass a broad range of relevant issues covering thin film technology and surface engineering. The program will address applications, challenges, and technology development from a contemporary focus. The 2024 TechCon offers an industry-leading technical exhibition, abundant networking opportunities, along with an extensive educational program and in-depth technological expertise. The 2024 TechCon is a great opportunity to present your latest research results, coating processes, and equipment applications in the field.

We invite you to share your latest R&D and application successes with the SVC community. The TechCon offers a broad range of presentation options – oral, posters, or vendor innovation formats – which can accommodate the full spectrum of academic research and industrial product innovations. This is complemented by our publication options – PowerPoint presentation (static or narrated/pre-recorded) or manuscript in the conference proceedings, or peer-reviewed journal submission. The SVC Student/Young Professional Travel Sponsorship Program provides financial support for a limited number of qualified applicants to encourage student and young member participation.

We encourage you to contribute a paper, taking advantage of the opportunity for renewing or making new connections that only the SVC can offer! Our academic researchers, industrial innovators, technical practitioners, and application experts await your news and look forward to talking with you in Chicago. With the addition of our freshly established Digital Transformation of Industrial Deposition Processes, Process Monitoring, Control and Automation, Thin Film Sensors, and Thin Film Contributions to the Hydrogen Economy sessions, the SVC TechCon enhances its position as the worldwide forum for thin film technologies and surface engineering. Come and be a part of SVC 2.0 in 2024. See you in Chicago!

SVC™ Society of Vacuum Coaters

Our Vision: *To provide a dynamic forum for transitioning and commercializing thin film and surface engineering innovation to industry.*

Our Mission: *To promote technical excellence by providing a global forum for networking, educating, and informing the stakeholders, the technical community, and the industrial eco-system on all aspects of industrial vacuum coating, surface engineering and related technologies.*

Publication Options:

There are two publication options and one video presentation option for work presented during the 2024 Technical Program

WITHOUT PEER REVIEW

Submission Deadline: August 4, 2024

Publication in PowerPoint OR Manuscript format in Society of Vacuum Coaters Annual Technical Conference Proceedings (ISSN 0737-5921)

PEER REVIEWED

Submission Window Open May 1 – July 15, 2024

Publication in a special edition of Elsevier's Surface and Coatings Technology Journal (ISSN: 0257-8972)

VIDEO PRESENTATIONS

Submission window open
May 1 – September 15, 2024

Narrated mp4 or PowerPoint video to be posted to the SVC's dedicated YouTube Channel

SVC and SVC Foundation Travel Support for Students and Young Professionals

Young professionals and students are our future. The SVC and the SVC Foundation recognize that capturing the imagination and the interest of young technicians, engineers, and scientists are essential activites that will perpetuate the technologies and the companies that comprise the SVC. Student education scholarships and sponsorships supporting travel and conference participation are offered annually through programs that encompass a global reach to qualified and deserving individuals.

SVC Student/Young Professional Travel Sponsorship Program

The SVC Travel Sponsorship Program provides travel support and complimentary conference registration to selected full-time students and young professionals (under the age of 35 working in industry) to make an oral technical presentation at the SVC Annual Technical Conference. A limited number of sponsorships will be awarded to the best applicants. Applicants from industry, academic, research, and technical institutions from the United States and around the world are encouraged to apply. The Travel Sponsorship Committee evaluates applications and makes selections based on the quality and relevance of the applicant's project to the interests and mission of the SVC. It will also consider the quality of the application itself (completeness, quality, etc.), potential impact of the oral presentation, its relevance to the specific session, as well as the need for funding.

Requirements for Participation:

The applicant must have a sponsor. The sponsor can be a faculty member or supervisor at the student's institution/place of employment or another academic, technical, or research institution. The sponsor must indicate that he or she understands the nature of the conference and what SVC technical programs are about. The applicant must commit to providing a manuscript based on the content of the oral presentation at the TechCon or the PowerPoint presentation delivered at the TechCon for subsequent publication by the SVC before any financial support is provided.

During the selection process, preference will be given to those applicants who have not already received sponsorship from SVC. The successful candidates should also preferably come from different institutions.

SVC Travel Sponsorship Program Abstract and Application Deadline: October 6, 2023

The SVC Foundation provides scholarships and/or stipends for travel expenses to attend the annual SVC technical conference. Scholarships are open to well-qualitified students planning to enter fields related to vacuum coatings as well as techicians already working in the field practicing the craft. The Society of Vacuum Coaters (SVC), the SVCF's founder, and AIMCAL, an organization committed to advancing vacuum roll-coating technology, and their members, provides support for the Foundation to pursue these goals. Since its inception in 2002, the SVCF has awarded more than 175 scholarships and travel awards totalling over $490,000 to students from more than 28 countries.

Please visit www.svcfoundation.org for more information

College Scholarship application deadline: October 15, 2023

Industry Scholarship application deadline: January 15, 2024

Student Travel Sponsorship application deadline: October 6, 2023

For more information, contact the SVC at +1-505-897-7743 or CLICK HERE to submit an abstract | 2024 TechCon

Call for Papers

Abstract Submission Deadline
Guaranteed Session Placement: October 6, 2023

The SVC welcomes contributions in the following areas. Each area is organized by a Technical Advisory Committee (TAC) or Session Organizing Committee.

Atomic Layer Processing (ALP)

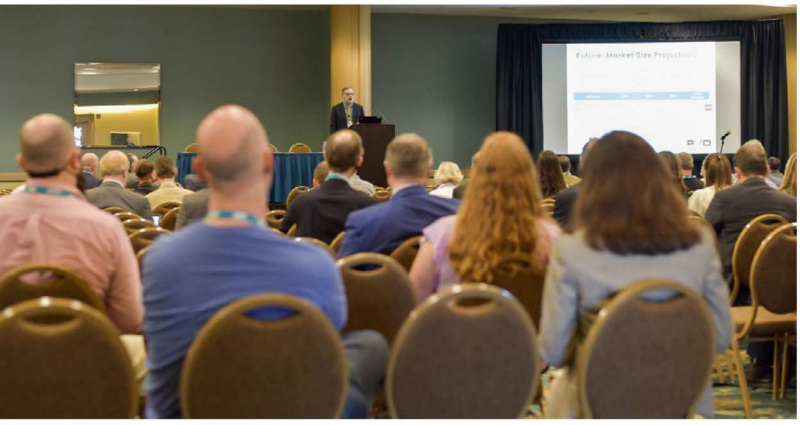
Over the last few years, atomic layer processes (ALPs), such as atomic layer deposition (ALD), atomic layer etching (ALE), molecular layer deposition (MLD), and atomic layer epitaxy (ALEp) have increased in importance, enabling many new products and applications. With excellent uniformity, nanoscale precision, and high versatility, ALPs have applications in sensing, optical coatings, energy storage, and microelectronics. Recent advances in low temperature processing makes ALP methods attractive to the processing polymers, biomaterials, and other applications with low thermal budgets.

We are soliciting oral and poster contributions to ALP sessions in areas including both established ALD technologies and creative new ALP developments. Advanced ALP technologies which successfully cross over from early stage feasibility studying into commercially viable industrial solutions are of particular interest.

Session Topics will include:

- Innovations in methods for upscaling ALPs towards high-volume industrial applications
- New business concepts or market perspectives that accelerate transfer of ALPs from the lab to commercial viability.
- Current commercial products using ALPs
- Precursor synthesis
- Fundamental aspects of ALP
- Process development
- Plasma enhanced processes
- Challenges and applications of ALPs
- Novel concepts for ALP process control, characterization, and monitoring

TAC Co-Chairs:
Lenka Zajíčková, *Central European Institute of Technology & Masaryk University,* lenkaz@physics.muni.cz
Jacob Bertrand, *Maxima Sciences LLC,* jacob@max-sci.com
Assistant TAC Chairs:
Staci Moulton, *Forge Nano, Inc.,* smoulton@forgenano.com
Craig Outten, *Universal Display Corp.,* coutten@verizon.net



Coatings and Processes for Biomedical Applications

Coatings and surface treatments are important and used in many biomedically related areas. Recent advances in knowledge related to biological systems have motivated the development and characterization of coatings with the purpose of improving osseointegration, interfacing with the nervous system, extending implanted device lifetimes, and improving biocompatibility to highlight a few. The applications also extend beyond implantable devices. For example, energy harvesting for health monitoring wearable devices requires biocompatibility and flexibility. Applications for coatings in healthcare are already broad and continue to expand.

To disseminate advances and address technical issues in this broad and growing area, The Coatings and Processes for Biomedical Applications Technical Advisory Committee (TAC) welcomes papers reporting on biomedical coatings and surface modifications, characterization of these materials and their performance, as well as advances leading to new applications in the biomedical area. The following list is intended as a guide to topics appropriate for this session but other biomedically relevant papers are also encouraged:

- Orthopaedic and osseointegration applications
- Cardiac rhythm management
- Neurostimulation
- Cardiovascular intervention
- Bio-corrosion
- Flexible electronics
- Biosensors, bioelectronics, and biochips
- Antimicrobial applications

TAC Co-Chairs:
Hana Baránková, *Uppsala University,* hana.barankova@angstrom.uu.se
Jeff Hettinger, *Rowan University,* hettinger@rowan.edu
Gregory Taylor, *Lawrence Livermore National Laboratory,* taylor275@llnl.gov

Coatings for Energy Conversion and Related Processes

The Coatings for Energy Conversion and Related Processes Technical Advisory Committee (TAC) welcomes papers in the following areas:
Solar and Ambient Light Energy Conversion:

- Thin-film and thin wafer photovoltaics
- Organic flexible photovoltaics (OPV)
- Semi-transparent photovoltaics
- Coatings for improved performance

Energy Harvesting:

- RF Harvesting
- Piezoelectrics
- Kinetic harvesting through body movement

Energy Storage:

- Thin flexible batteries

The 5th Annual SVC Foundation Casino Night on Monday Evening, May 6, 2024
To benefit the SVC Foundation and Student Sponsorship Program!

- Conformal batteries
- Coatings for improved stability
- Graphene and carbon nanotubes
- Protective coatings

Efficient Functional Coatings:

- Radiative cooling
- Hydrophobic and hydrophilic
- Self-cleaning catalytic coatings

Business Topics:

- Market assessment
- Advanced manufacturing processes
- Integration of functional coatings into wearable products

Other traditional subjects of the Coatings for Energy Conversion and Related Processes TAC will be considered including:

- Smart windows
- Selective radiators
- Fuel cells
- Large-scale energy conversion and storage

TAC Chair:
Volker Sittinger, *Fraunhofer Institute for Surface Engineering and Thin Films IST, Germany,* volker.sittinger@ist.fraunhofer.de
Assistant TAC Chairs:
Roel Bosch, *IHI Hauzer Techno Coating B.V.,* RBosch@hauzer.nl
Claes G. Granqvist, *Uppsala University,* claes-goran.granqvist@angstrom.uu.se
David Sanchez, *Materion Advanced Chemicals,* david.sanchez@materion.com
Ric Shimshock, *MLD Technologies, LLC,* ricshimshock4mld@aol.com
Stefan Saager, *Fraunhofer-FEP*, stefan.saager@fep.fraunhofer.de

Digital Transformation of Industrial Deposition Processes

Industrial deposition processes are subject to strong competitive pressure, as better productivity is always demanded with a higher precision and increasing complexity of coating products. This increased complexity requires optimized coating processes, model-based process control and a view of the complete process chain. Therefore, a digital transformation, which will be one of the key drivers in the future for industrial deposition processes, is needed. The digital transformation includes the systematic collection of data which is generated in the different processes and the representation of the (coating) processes by means of real-time capable, digital twin.
Already nowadays, the simulation, which can be part of digital twin, is a well-established tool for predicting and optimizing deposition processes. It is possible to use physical and/or chemical models to predict the behavior of the process.
Another approach of predicting processes is the use of generated data and utilize the artificial intelligence. Therefore, the data acquisition, storage, and accessibility of the data plays an important role. Artificial intelligence is already deployed for example in image recognition, predictive maintenance, and process control.
This session will cover all topics in which digitalization plays an important role. It will bring the experts for simulation and artificial intelligence together and offers a perfect floor to discuss the benefits of the digital transformation of industrial deposition processes from point of view of different technology fields.

Session Organizers:
Holger Gerdes, *Fraunhofer-IST,* holger.gerdes@ist.fraunhofer.de
Andreas Pflug, *Fraunhofer-IST,* andreas.pflug@ist.fraunhofer.de

Emerging and Translational Technologies and Applications

This session welcomes presentations related to Deposition and Surface Engineering Technologies and Applications that do not readily align with the classic Session topics of the SVC TechCon program.

Modern market needs and application requirements continuously trigger innovation in the production and development of Thin Films and coatings. There are two trajectories that historically advance the field: (a) Adjacent markets and applications expand by taking advantage of innovation in traditional technologies, and on the other side (b) established markets and applications benefit from technical innovation in fields that previously were restricted to exterior "heritage" domains.

This session seeks to highlight new applications and markets that are enabled by advances in Thin Film and coating Deposition, Interface engineering, and Surface processing. Contributed presentations may emphasize applications & markets, describe the role of enabling or cross-over technologies, as well as business topics such as market opportunity overviews, or new business and engineering concepts.

Market- and business-focused talks should generally relate to technology innovation within the SVC domain, and technology-focused talks should relate to a new market or application arena that SVC stakeholders should pay attention to.

TAC Chair:
Chris Stoessel, *Eastman Chemical Company,* stoessel@attglobal.net
Assistant TAC Chairs:
Manuela Junghähnel, *Fraunhofer-IZM,* manuela.junghaehnel@assid.izm.fraunhofer.de
Jacob Bertrand, *Maxima Sciences LLC,* jacob@max-sci.com
Clark Bright, *Bright Thin Film Solutions (3M retired),* brightcrewllc@gmail.com
Frank Papa, *GP Plasma,* frank@gpplasma.com
Maryam Olsson, *RISE,* maryam.olsson@ri.se
Stephan Barth, *Fraunhofer-FEP,* stephan.barth@fep.fraunhofer.de

Call for Papers

Abstract Submission Deadline
Guaranteed Session Placement: October 6, 2023

High-Powered Electron Beam Technology

The High-Powered Electron Beam Technology Technical Advisory Committee (TAC) is a spin-off from the International Conference on High-Powered Electron Beam Technology, originally founded by Dr. Robert Bakish in 1983. Today, high-powered electron beam technology is well established for coating, melting and welding. The focus of the TAC is the development of new coatings and coating processes utilizing high-powered electron beam technology as well as new ebeam guns, power supplies and beam guidance systems for improved materials properties. Of particular interest are improvements to equipment that enable new applications such as additive manufacturing of turbine engine components and medical implants.

The TAC supports the technical and technological exchange of knowledge to promote high-powered electron beam technology for industrial applications and is looking for papers on the topics listed below:

- Advances in high-rate PVD by electron beam evaporation for thermal barrier coatings.
- Electron beam processes for the production of novel materials
- Additive manufacturing with electron beam
- New applications for PVD by electron beam evaporation for photovoltaics, concentrated solar, energy production (fuel cells), energy storage (batteries) and high efficiency lighting,
- Modelling of electron beam sources, processes, and systems
- New components in electron beam technology (guns, power supplies, vacuum systems, plasma assist)
- Emerging technologies (electron generation, beam guidance, etc.)
- Related and new applications for high-power electron beams

TAC Chair:
Mark Pellman, MarkAPellman@outlook.com
Assistant TAC Chairs:
Goesta Mattausch, *Fraunhofer-FEP,* goesta.mattausch@fep.fraunhofer.de
Matthias Neumann, *VON ARDENNE GmbH,* neumann.matthias@vonardenne.biz
Stefan Saager, *Fraunhofer-FEP,* Stefan.Saager@fep.fraunhofer.de

High Power Impulse Magnetron Sputtering – HIPIMS

High Power Impulse Magnetron Sputtering (HIPIMS) has moved from lab scale to industry. Today, a significant number of industrial-scale HIPIMS processes exist as well as some commercial processes and products. Both fundamental understanding and application-oriented development are essential for exploiting the full potential of this technology.

The latest results from fundamental research, new and advanced approaches for simulation and modeling, and the combination of applied research from lab scale to industrial size cathodes and machines are the focus of this TAC. The session aims to provide a forum linking scientists, technologists, and industrialists to discuss all aspects of the HIPIMS technology.

Papers are solicited, but not limited to, from the following areas:

- Fundamental research on plasma, discharge, and coatings
- Simulation and modeling of HIPIMS
- New plasma sources and process modifications
- Recent development in pulse generation and process and plasma diagnostics
- Application oriented results: tribological, optical, medical, etc.
- New coatings and products

TAC Chair:
Arutiun P. Ehiasarian, *Sheffield Hallam University,* a.ehiasarian@shu.ac.uk
Assistant TAC Chairs:
Ju-Liang He, *Feng Chia University*, jlhe@fcu.edu.tw
Jolanta Klemberg-Sapieha, *Polytechnique Montréal,* jsapieha@polymtl.ca
Ian Haehnlein, *Starfire Industries*, ihaehnlein@starfireindustries.com
Ivan Shchelkanov, *Starfire Industries*, ishchelkanov@starfireindustries.com
Brian Jurczyk, *Starfire Industries*, bjurczyk@starfireindustries.com
Ivan Fernandez, *Nano4Energy*, ivan.fernandez@nano4energy.eu
Frank Papa, *GP Plasma,* frank@gpplasma.com
Ralf Bandorf, *Fraunhofer-IST,* ralf.bandorf@ist.fraunhofer.de

Large Area Coatings

It has been understood for many years that the key factor in driving down the cost of thin film processes is strongly related to the substrate width or total area being processed per batch or per substrate. This has enabled tremendous cost reduction in the manufacturing of Flat Panel Displays, Solar Cells, and Roll-to-Roll polymers. For example, Architectural Glass coaters are now operating with substrates that are 3m x 6m in size.

However, this does not imply that scalability is without its own unique challenges. To operate at a high throughput, the process must be capable of depositing or etching at high rates. Additionally, the uniformity and film properties must be controlled over a large area as they are in a lab scale environment. This is true across all types of etching or for coatings whether they are used for optics, barriers, protection, or transparent conductors to name a few.

Along with the technical challenges, there are complex decisions that need to be made regarding Capital Expenditures (CapEx) versus

2024 SVC TechCon Exhibit Administrator: Jacque Matanis, jacque.matanis@svc.org, +1-505-897-7743
2024 SVC TechCon Exhibit Committee Co-Chairs:
Jason Hrebik, Kurt J. Lesker Company, jasonh@lesker.com
Steve Simons, Manitou Systems Inc., ssimons@manitousys.com

Call for Papers

Abstract Submission Deadline
Guaranteed Session Placement: October 6, 2023

Cost of Ownership (CoO). The facility requirements, substrate handling, and product yield are also key considerations.

The Large Area Coating Session is focused on the challenges related to scalability of thin film vacuum science. The talks may cover the limitations, challenges, or successes of moving from lab scale or pilot production up to high volume manufacturing (HVM).

TAC Chair:
Ken Nauman, *SCI / Bühler*, knauman@sputteringcomponents.com
Assistant TAC Chairs:
Marcus Frank, *Bühler Group,* marcus.frank@buhlergroup.com
Brent Boyce, *Guardian Industries Corp.,* bboyce@guardian.com
Aneliia Wäckerlin, *Glas Trösch*, a.waeckerlin@glastroesch.ch
Kyle Schuberg, *Gentex,* kyle.schuberg@gentex.com

Optical Coatings

Exciting developments in optical coatings are stimulated by the latest trends in optics, optoelectronics, photonics, optical data processing, mobile devices, displays, biomedical, sensors, energy and photovoltaics, architectural, aerospace, astronomical, and other technologies. The Optical Coatings sessions will bring together these different aspects for technical interchange in the field of optical interference coatings.

To build a well-rounded Optical Coatings session, abstracts are solicited to cover topics including coating design, development of practical manufacturing techniques, characterization methods, and a wide range of applications. Specific areas may include:

- Application of Optical Coatings for mobile electronics (e.g., fingerprint sensors, cameras, displays, touch-screens, etc.).
- Performance enhancement through optical coatings (e.g., improved efficiency for solar cells).
- Optical coatings for wearable technology, including AR/VR
- Coatings on sapphire, polymers or other special substrate materials.
- Applications in non-traditional wavelengths, from EUV to IR (e.g., IR thermal imaging).
- Complex 3-D optical devices.
- Coatings for LIDAR/driverless vehicles.
- Optical coatings for biomedical applications.
- Optical coatings for energy control and solar power.
- Optical coatings for laser applications, including femto-second lasers.
- Optical coatings for display, aerospace, and integrated photonic device applications.
- Novel optical coating materials, including metamaterials and metasurfaces.
- New fabrication processes for optical coatings.
- Novel optical interference design software and design techniques.
- Production issues common to the industry – including lessons learned or serendipitous discoveries that came from problems or disasters.
- Metrology of optical films (new instrumentation and software developments, inline or in-situ approaches, etc.).
- Real-time process monitoring and control with optical coating processes.
- Industrial scale-up.

TAC Co-Chairs:
Jay Anzellotti, *IDEX Health & Science*, janzellotti@idexcorp.com
Vivek Gupta, *Meta/Facebook,* guptavivek23@fb.com
Nadja Felde, *Fraunhofer Institute for Applied Optics and Precision Engineering IOF,* nadja.felde@iof.fraunhofer.de

Plasma Processing & Diagnostics

Plasma has the unique capability of providing a diverse and complex environment that has proven to be well-suited for a wide variety of industrial applications including anisotropic dry etching, surface chemical modification, magnetron sputter-deposition and plasma enhanced chemical vapor deposition (PECVD) of thin films and coatings. Nevertheless, the potential of plasma processing on an industrial scale can only be realized when basic material processing studies are accompanied by the understanding of plasma physics, plasma chemistry and the underlying mechanisms at the plasma-surface interface, developed through both modeling and experimental efforts. More recently, the plasma processing community is exploring exciting new opportunities involving atmospheric pressure discharges, micro-plasmas and pulsed discharges, plasma interactions with liquids, plasma-enhanced catalysis at surfaces and plasma processing of nanomaterials. These new developments along with the never-ending quest for improvement in long standing applications are the basis for an active plasma processing community engaged in the research of reactive plasma environments and exploration of new possibilities and applications.

Accordingly, the session chairs welcome papers of a fundamental and applied nature in the following topics:

- Plasma-enhanced physical or chemical vapor deposition and plasma-surface modification techniques.
- Novel and emerging plasma processing methods such as the processing of nanoparticles and nanomaterials, plasma catalysis and the treatment of non-traditional materials including liquids.

Back by Popular Demand: FREE Technical Conference Admission for May 7th & 8th
Two-day free passes will be heavily promoted to drive in foot traffic to the SVC Exhibition from local industry and adjacent expositions.

- Development of plasma sources and related technologies (ex. power electronics) to enable both conventional and novel plasma processing techniques including those operating at or near atmospheric pressure.
- Diagnostics (optical, electrical, particle, or systemic) applied to understand the plasma environment and plasma interactions with materials, along with techniques to improve diagnostics capabilities.
- Modeling of gas-phase phenomena in plasmas, plasma-surface interactions, and plasma processing systems.

TAC Co-Chairs:
Adam Obrusnik, *PlasmaSolve*, obrusnik@plasmasolve.com
Oleg Zabeida, *Polytechnique Montreal*, oleg.zabeida@polymtl.ca
Assistant TAC Chairs:
Lenka Zajíčková, *Central European Institute of Technology & Masaryk University,* lenkaz@physics.muni.cz
Craig Outten, *Universal Display Corp.,* coutten@verizon.net

Process Monitoring, Control, and Automation

The fourth industrial revolution is steering manufacturing towards full automation. Producers seek robust thin-film deposition process monitoring and control solutions. They hold the key to the success of any attempt to achieve the necessary level of critical industrial process automation. The bonuses of any such successful automation include higher production rates, lower waste of materials & energy, lower operating costs, and increased overall efficiency.

Reliable monitoring and control solutions are far from readily available, and intense development efforts are underway in industry and academia across the globe. It is intensely hot around the topics related to the development and industrial application of (1) embedded sensors & actuators, (2) cyber-physical monitoring and control systems and (3) holistic process control methods and systems.

This session/TAC brings together experts, technologists, and solution providers from the thin film/surface engineering community to discuss challenges, developments, and solutions that pave the way toward enabling the autonomous operation of coating plants.

Contributions that highlight particular challenges or constraints and talks that detail cutting edge control methods and their physical and digital embodiments are particularly well suited to this session.

Session Organizer:
Martynas Audronis, *Nova Fabrica Ltd.*, martynas@novafabrica.biz
Session Co-Chairs:
Joseph Brindley, *Gencoa Ltd., joseph.brindley@gencoa.com*
Gun Hwan Lee, *Korea Institute of Materials Science,* ghlee@kims.re.kr
Edmund Schüngel, *Evatec AG,* edmund.schuengel@evatecnet.com

Protective, Tribological and Decorative Coatings

The Protective, Tribological and Decorative Coatings Technical Advisory Committee (TAC) encourages speakers to submit presentations dealing with design, research, development, applications, and production in the field of vacuum coatings and surface engineering processes, materials characterization and equipment for applications to protect components, tools, as well as decorative parts.

The use of such coatings is typically driven by performance requirements, reduction of life-cycle cost, environmental consideration, and durable cosmetic and aesthetic designs. These end-user motivations lead to dedicated coating and technology developments, vacuum coating equipment concepts, new testing procedures and methods, and production quality standards. Therefore, successful coating solutions in the marketplace require strong cooperation between market specialists, universities, suppliers, manufactures, and end-users.

The TAC invites speakers to present on the subjects of new emerging technologies. Developing and scaling up from laboratory to high volume production at high production yields is also of high interest of the participants in this session.

Today's global landscape is changing rapidly and will drive developments that include new coatings on new applications. Environmental pressure on CO_2 emissions and electroplating as well as fast moving communication technologies are well known examples of such change. Electrification of transportation and moving away from the combustion engine are daily news.

Topics of interest for this session include, but are not limited to:

- Applications:
  - Hydrogen economy related components
  - Coatings for high-performance engines, including hydrogen and e-fuels combustion
  - PVD and CVD coatings for cutting, forming and molding tools
  - Coatings for the reduction of friction and exhaust gas emissions
  - Low- and high-temperature coatings for aerospace applications
  - Decorative components and large area pre-fab sheets
  - Corrosion protective coatings (e.g. Zn:Al) on large-area surfaces
  - Electroplating replacements by vacuum deposited coatings

Call for Papers

Abstract Submission Deadline
Guaranteed Session Placement: October 6, 2023

- Development:
  - Super-lubricity coatings
  - Corrosion protection
  - New colors
  - Hydrogen embrittlement barriers
  - Testing and evaluation of coating performance
  - Scale-up of vacuum coating processes for industrial demands
  - Failure analysis of coatings
  - Assessment, control and management of residual mechanical stress
  - Duplex coatings and thin-on-thick systems
  - Modelling approaches to performance analysis and prediction
- Production Related:
  - Reliability and life of coated parts and systems
  - Upscaling from laboratory to production
  - Scrap rates from percentages to ppm levels
  - Integration of Industry 4.0 in vacuum coating plants

TAC Chair:
Ton Hurkmans, *IHI Ionbond Group,* Ton.Hurkmans@ionbond.com
Assistant TAC Chair:
Jolanta Klemberg-Sapieha, *Polytechnique Montreal,* jsapieha@polymtl.ca

Thin Film Sensors

The evolution of sensors in today's world has been driven by numerous technological advances and an explosion of new demand/applications. It is evident that as we continue to grow as a society, there are limitless ways to advance our capabilities as it pertains to health, labor, safety, transportation and economic prosperity. Sensors are becoming extremely common in our everyday lives and can be found in such items as clothing, machinery, photovoltaics, analysis of light, pressure, gas, temperature, speed, and a wide variety of health monitoring equipment. Sensor technology is frequently based on thin film technologies; principally physical vapor deposition (e.g., magnetron sputtering and thermal evaporation), and even when they incorporate additive manufacturing (such as printing and device attach) or micro-electromechanical systems (MEMS), the interfaces and multi-layer material sets of the resulting sensor structures require expert knowledge of surface and thin films engineering. The competencies found in the thin film and surface engineering community can provide solutions to advance the overall capability and efficiency of these devices. This advancement will not only accelerate the adoption of existing applications, but also enables new sensor applications and modalities.

Topics of interest to this session will include:

- Advanced photonic sensing materials design and fabrications,
- Nano plasmonic materials for environmental sensing applications,
- Sensing modalities enabled by microfluidics and selective surface functionalities, and
- Flexible sensing materials and devices for wearable health monitoring applications.

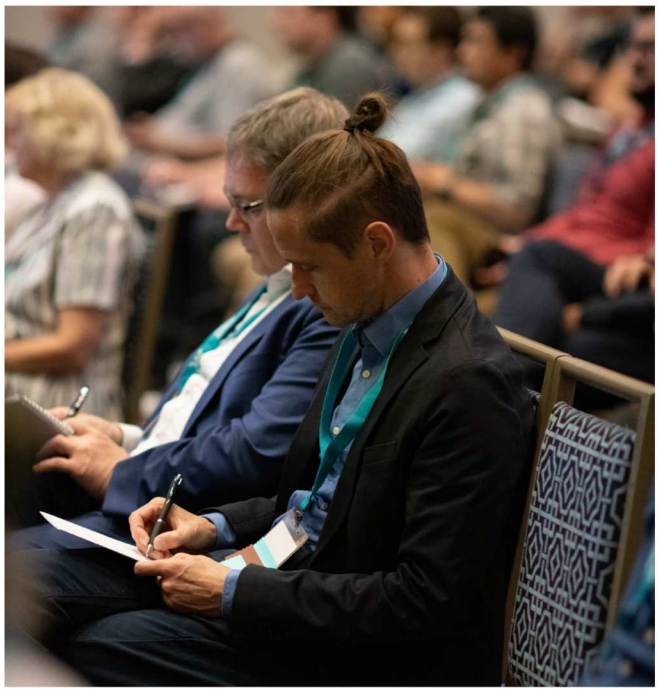
This session /TAC seeks to connect thin film and surface engineering technologies to the myriad applications driven by the connectivity opportunities of the Internet of Things (IoT). Contributions that focus on novel solutions, techniques, and manufacturing challenges are of particular interest.

TAC Co-Chairs:
Jason Hrebik, *Kurt J. Lesker Company,* jasonh@lesker.com
Maciej Lisiak, *Futek,* mlisiak@futek.com
Binbin Weng, *University of Oklahoma,* binbinweng@ou.edu

Thin Film Contributions for the Hydrogen Economy

We are pleased to announce a dedicated session at the 2024 SVC TechCon focused on the role of Physical Vapor Deposition (PVD) and related thin film & surface engineering technologies in the emerging hydrogen economy. This session aims to bring together experts, researchers, and industry professionals from around the world to share their knowledge and insights on the application of PVD thin film coating techniques in advancing the use of hydrogen as a clean energy source.

Participants will have the opportunity to present their research findings, case studies, and innovative approaches in utilizing PVD thin film coating technology for various aspects of the hydrogen economy. The topics of interest include but are not limited to: PVD coatings for hydrogen storage materials, PVD methods for fuel cell catalyst preparation, thin film coating-based hydrogen production and purification techniques, and advancements in thin film coating processes for the manufacturing of hydrogen-related devices and components. Specific industrial implementation of solutions are of critical importance to the SVC's international stakeholder base.



Back by Popular Demand: FREE Technical Conference Admission for May 7th & 8th
Two-day free passes will be heavily promoted to drive in foot traffic to the SVC Exhibition from local industry and adjacent expositions.

Call for Papers

Abstract Submission Deadline
Guaranteed Session Placement: October 6, 2023

The SVC TechCon provides a unique platform for scientists, engineers, and industry leaders to collaborate, exchange ideas, and explore the potential of thin film coating technology in shaping the future of the hydrogen economy. We encourage interested individuals and organizations to submit their abstracts showcasing their contributions to this rapidly evolving field. Together, let us uncover the transformative capabilities of thin film coating technology and pave the way for a sustainable and efficient hydrogen-powered future.

Exhibitor Innovator Showcase

This unique session allows our exhibitors and other vendors to introduce their company's newest products and services to the SVC community. This is an ideal way to share your company's message, new products and encourage booth traffic at the TechCon.

Session Organizers:
Jason Hrebik, *Kurt J. Lesker Company,* jasonh@lesker.com
Frank Zimone, *Society of Vacuum Coaters,* frank.zimone@svc.org

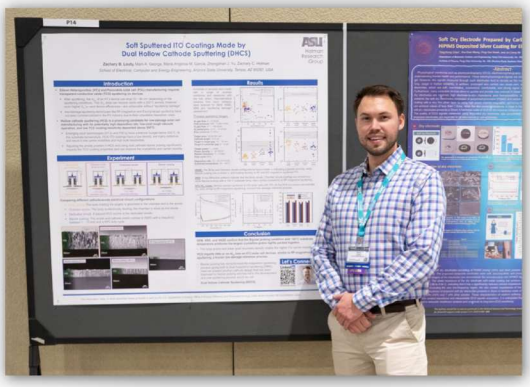
WebTech Roll-to-Roll Coatings for High-End Applications

WebTech is the forum for flexible web and roll-to-roll (R2R) processing at the SVC. It is the podium to present new achievements in processing of flexible substrates such as polymer, textile, or glass. The session scope encompasses manufacturing techniques, products, applications, market developments, and economical aspects of this versatile high-volume manufacturing method.

The WebTech TechCon session typically features presentations on materials, deposition processes, manufacturing techniques, use cases/application examples, market analysis, and economical perspectives in all areas related to R2R processing. Some pertinent topic focus areas are:

- Novel substrate materials and technologies
- Novel deposition sources and layer technologies
- Inline process diagnostics & control (particularly for non-transparent coatings)
- Modeling and simulation of R2R processes
- Aspects of progressing R2R coatings from concept demonstration to commercial scale
- Coatings under harsh conditions
- Interfacing with non-vacuum / atmospheric pre- and post-processing, including cleaning
- Low-cost / high-performance barrier coatings
- R2R processing for electronics, semiconductor and energy conversion applications

TAC Chair:
Chris Stoessel, *Eastman Chemical Company,* stoessel@attglobal.net
Assistant TAC Chairs:
Scott Jones, *3M,* sjjones@mmm.com
Neil Morrison, *Applied Materials,* neil_morrison@amat.com
Liz Josephson, *Intelli-Vation,* ljosephson@intelli-vation.com
Andy Jack, *Emerson & Renwick,* a.jack@eandr.com
Hazel Assender, *University of Oxford (Begbroke),* hazel.assender@materials.ox.ac.uk
Simon Cheung, *Emerson & Renwick,* s.cheung@eandr.com
Robert Malay, *VDI,* rmalay@vdi-llc.com



Technical Poster Session

Poster Presentations serve as an important component of the Technical Porgram by providing a format for extended discussions of the results in a casual environment.
The Program Committee encourages poster presentations on all topics covered in the Call for Papers. A $200 cash award for the Best Poster will be offered. **Submit an abstract for your presentation in the Poster Session before February 9, 2024.**

2024 SVC TechCon Exhibit Administrator: Jacque Matanis, jacque.matanis@svc.org, +1-505-897-7743
2024 SVC TechCon Exhibit Committee Co-Chairs:
Jason Hrebik, Kurt J. Lesker Company, jasonh@lesker.com
Steve Simons, Manitou Systems Inc., ssimons@manitousys.com

Conference Calendar

Start planning now for your trip to Chicago, IL, USA

May 4	May 5	May 6	May 7	May 8	May 9

Education Program

31 Tutorial Courses

TechCon Registration Counter Hours:

Saturday, May 4	7:00 a.m. – 10:00 a.m.
Sunday, May 5	7:00 a.m. – 10:00 a.m. and 4:00 p.m. – 7:00 p.m.
Monday, May 6	7:00 a.m. – 6:00 p.m.
Tuesday, May 7	7:00 a.m. – 5:30 p.m.
Wednesday, May 8	7:00 a.m. – 5:00 p.m.
Thursday, May 9	7:00 a.m. – 12:00 p.m.

Exhibit

Exhibit Open Hours
1 p.m. – 6:00 p.m. Tuesday
10 a.m. – 4 p.m. Wednesday

Conference Registration Open

Chicago Hilton Hotel

NEW for 2024!

All paid conference registrations will include one free SVC in-person tutorial at the TechCon and a 30% discount on additional courses.

Attendee Registration

(through 4-1-24/after 4-1-24)

- ❑ Full Conference ..... $905.00/$1005.00
- ❑ Media Personnel $0.00
- ❑ Student Conference ..... $400.00/$500.00
- ❑ Young Members Group Conference ..... $400.00/$500.00
- ❑ Exhibit Visitor Only ..... FREE

SVC Membership is included with all paid conference registrations.
If not attending the conference, renew your membership for 2024 or join SVC on-line

Exhibitor Registration

(through 4-1-24/after 4-1-24)

- ❑ Exhibitor Booth Personnel and Manufacturer's Representative $0.00
- ❑ Exhibitor with Full Conference Registration ..... $905.00/$1005.00

Special Events at the TechCon

- ❑ SVC Foundation 5K Run (Tuesday Morning) includes a T-shirt. $35.00
- ❑ Awards Ceremony and Welcome Reception (Tuesday Evening) ..... No Fee
- ❑ SVC Foundation Casino Night Fundraiser (Monday Evening) ..... 1 Ticket Included with Full Conference Registration (additional tickets $75.00)
- ❑ Farewell Social (Thursday Evening) ..... No Fee

** Pricing contingent on making hotel accommodations at the Chicago Hilton Hotel*

Back by Popular Demand: FREE Technical Conference Admission for May 7th & 8th

Two-day free passes will be heavily promoted to drive in foot traffic to the SVC Exhibition from local industry and adjacent expositions.

Networking Opportunities at the 2024 TechCon

Make Connections

The TechCon is packed with networking events designed to connect vacuum coating and surface engineering professionals with the global SVC community. Each technical and social networking event provides a different forum for invaluable face-to-face interactions and the opportunity to collaborate with technical experts.

Technology Forum Breakfasts

Vacuum coating technology spans multiple applications and processes. Join a discussion group focused on a topic that's important to you. Enjoy the conversation over breakfast before the start of the technical program Monday, Tuesday and Thursday.

To all of our SVC Stakeholders:

The **Technology Forum Breakfasts** have emerged as one of the most significant networking events at the TechCon. These breakfasts, held from 7:00 a.m. to 8:30 a.m. during the TechCon are "loosely" organized around a specific topic where we provide a moderator, a continental breakfast, plenty of seating, and an opportunity for free form discussion to take place. In the TFB's; problems are solved, new ideas are vetted, relationships are made and rekindled; all in the spirit of camaraderie that has made the SVC the most unique technical conference in our field. This year we are expanding the program even further and will offer more than 20 meetings during the TechCon Please be sure to check the daily schedule (the TFB's are offered on Monday, Tuesday, and Thursday of the TechCon) to find those topics that interest you! And remember, we are always looking for new topics as well as moderators to get the discussion going in the mornings. Good luck and have fun!

– Frank Zimone, Executive Director

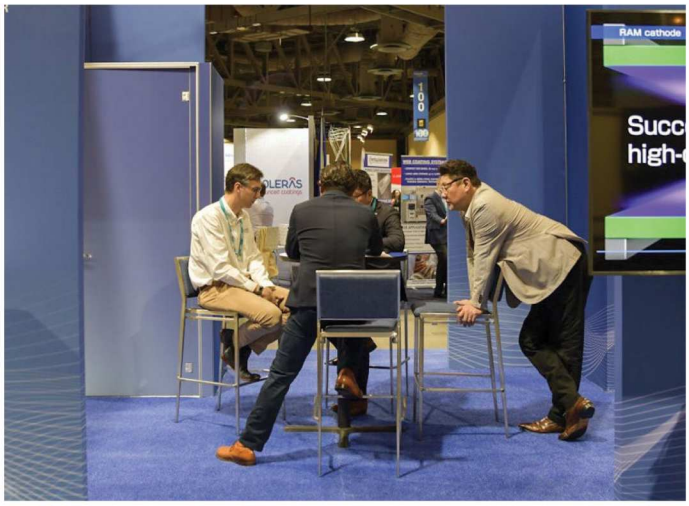


Exhibit Networking

Enjoy more opportunities than ever to visit the Exhibit Hall on May 7 – 8, 2024.

- Welcome Reception (held in Exhibit Hall)
- Poster Session ■ Beer Blast

Additional Networking:

- Technical Program Keynote Presentations
- Exhibitor Innovator Showcase
- Roundtable Discussions

SVC Foundation Networking Events

CASINO NIGHT

Come and join us for an evening of fun and networking, all to help a great cause at the Fifth Annual SVC Foundation Casino Night on Monday, May 6, 2024. *Additional Casino Night tickets can be purchased on-line during TechCon registration or at the TechCon. This is a wonderful opportunity to entertain friends and customers who may not be registered for the conference.*

RUN FOR A CAUSE!

Register for the Annual 5K Fun Run and support the scholarship efforts of the SVC Foundation. Bib pickup is tentatively scheduled for 5:30 AM on Tuesday, May 7, 2024.

2024 SVC TechCon Exhibit Administrator: Jacque Matanis, jacque.matanis@svc.org, +1-505-897-7743

2024 SVC TechCon Exhibit Committee Co-Chairs:

Jason Hrebik, Kurt J. Lesker Company, jasonh@lesker.com

Steve Simons, Manitou Systems Inc., ssimons@manitousys.com

Networking Opportunities at the 2024 TechCon

2024 SVC Awards Ceremony and Welcome Reception

Date: **Tuesday, May 7, 2024**

Everyone is invited to attend

The **Awards Ceremony** will introduce and recognize the Nathaniel Sugerman Memorial Award recipient, SVC Mentor Award recipients, and Sponsored Student awardees.

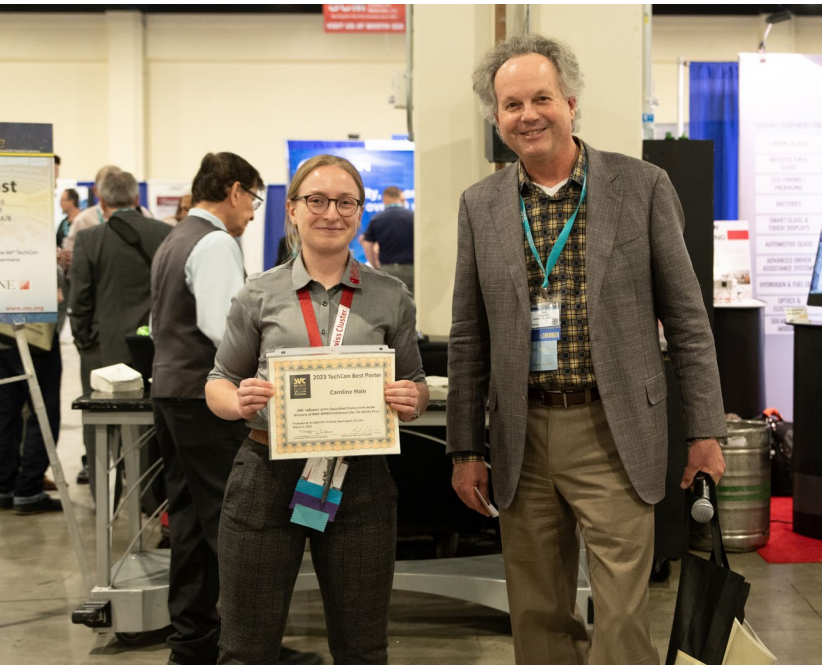
The **Welcome Reception** is a popular networking event at the TechCon. It offers a relaxed venue to meet friends and colleagues and provides the opportunity to make new connections before the start of the Technical Program.

2024 SVC TechCon Farewell Social

Date: **Thursday, May 9, 2024**

Everyone is invited to attend

The **Farewell Social** will be the last networking event of the TechCon and will commemorate what promises to be the most successful TechCon yet! Come join us as we celebrate our Young Members and all the new connections that were made after a densely packed four day program.



Back by Popular Demand: FREE Technical Conference Admission for May 7th & 8th

Two-day free passes will be heavily promoted to drive in foot traffic to the SVC Exhibition from local industry and adjacent expositions.

FROM THE EDUCATION DIRECTOR

Those of us in the research world will sometimes designate Friday afternoon as a "no rules" time in the laboratory. Unlike the rest of the week, this is the time when we stop following the established path and try something risky. I know. Most folks wouldn't think much of our definition of risky, but I think you know what I mean. Anyway, the payoff can be one of those eureka! moments or a dud. Importantly, you never learn nothing.

So what does this have to do with our education program? Well, most of the time we follow an established path. That is, we offer popular courses and charge a fee that is competitive with other societies. We repeat this recipe every year with much success. In fact, we have one of the largest and most well-utilized education programs in the business.

This year's TechCon in Washington DC was a great example. We offered 31 courses, which drew 322 attendees. While the average course attendance was a little over 10, several of our courses drew about 20 or more. Those include some of our historically popular course such as, Troubleshooting for Thin Film Deposition Processes taught by Mike Miller; Sputter Deposition for Industrial Applications, taught by David Glocker; Diamond Like Carbon Coatings - From Basics to Industrial Realization, taught by George Savva and Lars Haubold; and Application of Reactive Sputtering, taught by Ralf Bandorf and Holger Gerdes.

However, we get a little restless with this recipe. To spice things up we like to try offering new courses. For example, we offered three new courses at the TechCon including, Thin Film Deposition Optimization taught by Ron Willey; Nanoscale Heat Transfer in Thin Films and Interfaces taught by Patrick Hopkins; and Practical Elements of Leak Detection taught by Jean-Pierre Deluca. All three had very good attendance. In fact, Ron Willey's course was one of highest attended courses. The other experiment we tried this year was to offer a complimentary tutorial to each full conference registrant. It turned out to be a big success with nearly half of all tutorial seats occupied by someone taking us up on our offer.

The techCon is not the only place we like to try new things. This fall, we are offering a webinar event that targets our stakeholders in Europe. **EdCon Europa 2023** will be a 4 day event (October 9-12, 2023) that includes courses taught by both European and North American instructors. The daily schedule begins at 8:30 Central European Time (CET). While the tutorials will be virtual, they will be moderated and interactive to provide ample opportunity for dialogue with the instructors. Specifics for each of the tutorials we are offering along with dates/times are found elsewhere in this issue of the SVC Bulletin. We are expecting an exciting event.

Of course, we are always interested in hearing what you like and what you want. So, if you have any questions, please ask and if you have any ideas – spicy or not – reach out and let us know.

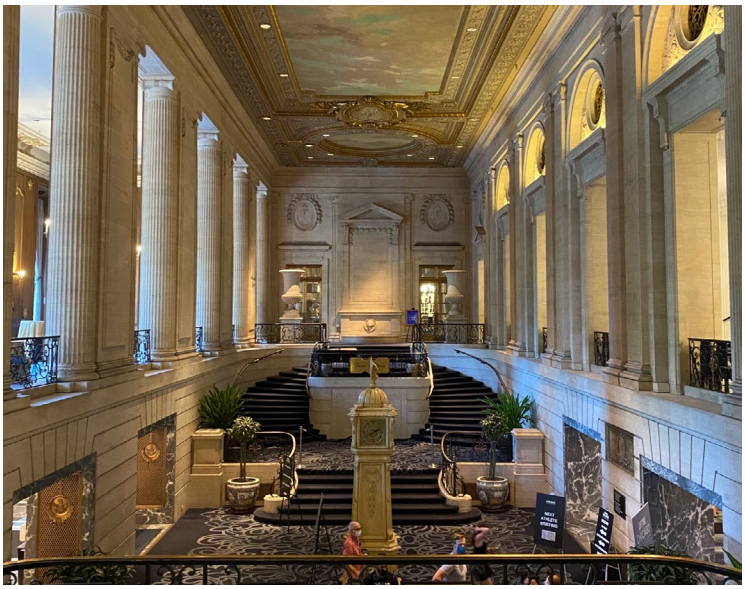
— Scott Walton, SVC Director of Education
scott.walton@svc.org

About Our Venue

Chicago Hilton Hotel, Chicago, Illinois

The 2024 TechCon will be held at the Chicago Hilton Hotel in downtown Chicago, Illinois. Chicago shares the unique balance of having one of the world's most cosmopolitan cities coupled with the beautiful lakeside parks and beaches of Lake Michigan on the doorstep of the Great Lakes. Bursting with character and beauty, Chicago shines with its historic architecture, vibrant dining, stunning lake views, and endless entertainment.

The Windy City also offers renowned museums, theater, and entertainment options as well as parks, public beaches, and sports teams to cheer on. You can stroll along Navy Pier's boardwalk and experience cultural exhibits, live performances, fireworks, and lake cruises. Or, take a ride on the iconic Centennial Ferris Wheel to enjoy 360-degree views of the city and Lake Michigan. If you love the view from the top, try dining on the 95th floor of the John Hancock's Signature Room, walking on The Skydeck Ledge of Willis tower, or relaxing at a rooftop bar. Shopping and dining enthusiasts can take advantage of the great shops along Michigan Avenue and in the Gold Coast neighborhood, with everything from eclectic boutiques to luxury shops and Michelin Star dining options.



With so many year-round options, Chicago has it all to keep you coming back for more.

- $249.00 USD/night – Chicago Hilton Hotel, 720 S. Michigan Avenue, Chicago, IL 60605, 312-922-4400

Back by Popular Demand: FREE Technical Conference Admission for May 7th & 8th

Two-day free passes will be heavily promoted to drive in foot traffic to the SVC Exhibition from local industry and adjacent expositions.

EdCon Europa 2023

SVC Society of Vacuum Coaters

The SVC is a non-profit, international, professional organization primarily devoted to coating and surface finishing using vacuum processes. Our organization consists of industry, academia and members from national research laboratories; our industrial membership includes coating companies, materials suppliers, process designers, and equipment manufacturers. Our stakeholders apply coatings and treatments to a wide variety of consumer and industrial products in all business sectors and is global in perspective. These technologies are critically important to an ever-growing number of companies and applications.

The SVC's education program is renowned as the broadest set of seminars that address thin film deposition and surface engineering technology. The SVC is delighted to provide a program tailored to the needs of our European colleagues, taught by international subject matter experts. We are pleased to offer a week-long series of seminars that are offered virtually. Class sizes are limited, and the virtual format allows for direct interaction between the attendee and the instructor. The tutorials are a mixture of ½ day and full day tutorials. Full day tutorials are taught over a two day time period. The schedule is designed for the convenience of our European stakeholders and all course times listed are Central European Time (CET). A full set of downloadable course notes are provided for each tutorial. The pricing structure of the tutorial program has been designed to offer the most value to prospective students. Half-day tutorials are $150 USD/each, full-day tutorials are $250 USD/each and a "masterclass program" where all tutorials can be taken is priced at $500 USD. Come join us for a truly informative and valuable experience!

www.svc.org

Monday – Thursday
October 9-12, 2023

Morning sessions 08:30–12:00 (CET); Afternoon sessions 13:00–16:30 CET.
Tutorials will either be ½ day events or full day events spread out over 2 sessions.

Monday, October 9, 2023


Diederik Depla

AM: Diederik Depla (*Reactive Magnetron Sputter Deposition*);
½ day tutorial


Tom Christensen

PM: Tom Christensen (*Characterization of Thick Films, Thin Films, and Surfaces*);
full day tutorial, session 1 of 2

Tuesday , October 10, 2023


Chris Muratore

AM: Chris Muratore (*Introduction to Two Dimensional Materials*);
½ day tutorial


Tom Christensen

PM: Tom Christensen (*Characterization of Thick Films, Thin Films, and Surfaces*);
full day tutorial, session 2 of 2

Wednesday, October 11, 2023


Andreas Pflug

AM: Andreas Pflug (*Modelling*);
½ day tutorial


Mike Miller

PM: Mike Miller (*Troubleshooting for Thin Film Deposition Processes*);
full day tutorial, session 1 of 2

Thursday, October 12, 2023


Peter Awakowicz

AM: Peter Awakowicz (*Layer Deposition by Sputtering Process*);
½ day tutorial


Mike Miller

PM: Mike Miller (*Troubleshooting for Thin Film Deposition Processes*);
full day tutorial, session 2 of 2

CLICK to Register for the 2023 EdCon Europa 2023

Reactive Magnetron Sputter Deposition

Diederik Depla, *Professor, Ghent University, Ghent, Belgium*

Course Objectives:

- Understand the fundamental processes driving (reactive) magnetron sputtering
- Develop strategies for dedicated experiments to unravel the complexity of reactive magnetron sputtering
- To get a good overview of the current literature and modelling techniques.

Course Description: Reactive magnetron sputter deposition is a mature technique often used in laboratories and at industrial level to grow compound thin films. The growth of these films is defined by the deposition conditions, and therefore a good knowledge of the deposition process is essential to tune the growth and as such the film properties.

After a short introduction on the physics of sputtering, the magnetron discharge and the transport of sputtered atoms through the gas phase, the course starts with a few definitions regarding reactive sputtering to show that the processes driving this technique are general applicable. This introduction assists the attendee to the next step: the description of the most common experiment during reactive magnetron sputtering, the hysteresis experiment. The simplicity of this experiment fools initially the scientist because it hides a complex interplay between different processes that define the actual outcome of the experiment. During the course, the details of this experiment are analyzed, and modelling is used to guide the attendee. In this way, the attendee will gain knowledge in a wealth of important process controlling the film growth. A good knowledge of these processes will arm the attendee to analyze and to control the reactive sputtering process.

Who should attend? This course is intended for engineers, scientists, and students interested in reactive sputter deposition and its applications.

Course materials: Lecture notes based on the handbook "Magnetrons, reactive gases and sputtering" will be provided.

Diederik Depla has received his Master Degree in Chemistry in 1991 at Ghent University (Belgium). In 1996 he promoted with a PhD thesis in Solid State Chemistry on spray drying of precursors for superconductors. After a short period as senior scientist in the Department of Solid State Sciences, he became in 1999 assistant professor. As full professor, he is now head of the research group "Dedicated research on advanced films and targets" in the same physics department. Two fundamental research questions has driven his research up till now. The first question is how deposition conditions influence film growth, while the second question probes for the impact of reactive gas addition on the magnetron process. Under his guidance, the research group "Dedicated research on advanced films and targets (DRAFT)" has distinguished itself from the traditional, technological approach, and has set an own course seeking for answers on the two above mentioned fundamental questions, translated in the mission statement of the group : "At DRAFT we want to become the recognized leader in the understanding of thin film growth by reactive magnetron sputtering, and to enjoy research by experiments and simulations". This "target on growth" approach has resulted in several publications in peer reviewed papers. He authored the book "Magnetrons, reactive gases and sputtering". He co-initiated in 2000 the successful RSD conference series. He received the Bill Sproul Award from AVS for "his persistence to unravel the fundamental processes during reactive magnetron sputtering." More details on his research can be found on www.draft.ugent.be.

WOMEN ENCOURAGING ENGAGING EXCELLING

Vision:
To provide a platform for women in the society to support each other and excel in the industry.

Mission: To promote the work, innovation and achievements of women in the SVC Community. We will raise awareness of women in the industry, highlighting women speakers and chairs throughout the conference and encourage, engage and provide mentorship to the female students of the SVC Foundation and the women of the SVC Young Members Group. Contact the SVC Executive Director (frank.zimone@svc.org) if you would like to learn more about how you too can play a role!

SVC Society of Vacuum Coaters

EdCon Europa 2023

www.svc.org

Introduction to Two-Dimensional Materials

Christopher Muratore, *Ohio Research Scholars Endowed Chair Professor in the Chemical and Materials Engineering Department, University of Dayton - Dayton, OH*

Two dimensional (2D) materials are an expanding family of atomically thin materials with unique and unexpected optical and electronic properties that we continue discover each day. These materials are of particular interest because they offer the ultimate in layer-by-layer tailorablity to achieve the desired properties of materials. Moreover, electronic and optical devices produced from 2D materials demonstrate extreme mechanical flexibility, giving rise to new possibilities for technological developments with broad and impactful applications. This class will describe in detail the fundamental properties of this unique class of materials, typical approaches to making and characterizing them, and their applications.

Topical Outline

Properties:

- Fundamentals of physics associated with 2D materials resulting in unique combinations of electronic, optical, and mechanical properties.
- Characteristics of two dimensional material families, including graphene, transition metal dichalcogenides, and group IV monochalcogenides.

Processing:

- Approaches for synthesis of 2D materials including mechanical and chemical exfoliation, chemical vapor deposition, physical vapor deposition, additive manufacturing, as well as the associated challenges of processing low dimensional materials
- Practical discussions on how to get started synthesizing new materials and fabricating 2D devices

Characterization:

- Common chemical and structural characterization approaches for two-dimensional materials including Raman, XPS, TEM
- Novel, in situ characterization techniques
  - Applications
  - Transistors
  - Light sources
  - Photodetectors
  - Molecular sensors

Christopher Muratore is the Ohio Research Scholars Endowed Chair Professor in the Chemical and Materials Engineering Department at the University of Dayton. Prior to joining the University, Professor Muratore spent 10 years as a staff member at the Air Force Research Laboratory and still works closely with multiple flexible electronics groups there. In 2013, he also founded m-nanotech Ltd., a consulting company specializing in thin film materials processing and characterization. Throughout his 20 year research career, Christopher's work has focused on developing an understanding of how to control structure and properties of thin films and surfaces for diverse applications, and their impact on properties and performance. His research group currently focuses on novel large-scale synthesis of materials for flexible, wearable electronic devices. He has 4 patents, published over 80 peer-reviewed articles and has served as guest editor for Surface and Coatings Technology and Thin Solid Films for five years.

SVC Society of Vacuum Coaters

EdCon Europa 2023

www.svc.org

CLICK to Register for the 2023 EdCon Europa 2023

Characterization of Thick Films, Thin Films, and Surfaces

Tom Christensen, *Professor, Department of Physics, University of Colorado at Colorado Springs*

This course is intended for people with a basic background in thin films who need to understand the broad range of techniques available to characterize films. The course is appropriate for technicians, engineers, and managers who perform or specify characterization work as well as students seeking a broad understanding of the field.

This tutorial examines the broad range of techniques available to characterize thin film materials. We examine the range of properties of interest and how thin film properties may differ from bulk properties. Generic differences between counting and spectroscopic techniques are presented. Available "probes" are identified.

The main emphasis of the tutorial is an overview of a wide range of characterization techniques. We examine imaging techniques such as Optical microscopy, Scanning electron microscopy (SEM), Transmission electron microscopy (TEM), and Scanning probe microscopies (STM, AFM …). We also explore techniques, which provide information about structural properties including X-ray diffraction (XRD), Stylus profilometry, Quartz crystal monitors (QCM) and density measurements.

The tutorial examines techniques, which explore chemical properties such as Auger electron spectroscopy (AES), Energy Dispersive Analysis of X-rays (EDAX), X-ray Photoelectron Spectroscopy (XPS, ESCA), Secondary Ion Mass Spectrometry (SIMS), and Rutherford Backscattering (RBS). AES is used as a prototype to examine quantitative analysis of spectroscopic data. Characterization techniques for optical properties such as ellipsometry and optical scattering are also considered. Many of these chemical and optical techniques can also provide information about structural properties.

Techniques for determining electrical and magnetic properties are also discussed. These include resistance / four-point probe, Hall effect, magneto-optical Kerr effect and ferromagnetic resonance. The emphasis here is on materials characterization as opposed to device characterization.

The tutorial concludes with an examination of techniques used to explore mechanical properties such as stress-curvature measurements, friction testing, micro/nano indentation and adhesion tests.

Topical Outline

Overview of wide range of characterization techniques for thin films including:

- Mechanical properties (stress, friction, micro/nano indentation, adhesion…)
- Imaging (microscopies: optical, SEM, TEM, AFM …)
- Structural properties (XRD, profilometry, QCM …)
- Chemical properties (AES, EDAX, XPS, SIMS, …)
- Electrical/magnetic properties (resistance, Hall effect, Kerr effect …)

Course Details:

- Overview of thin film characterization
  - What do we want to know?
  - How could we find this out?
- Available probes
- Counting techniques
- Spectroscopic techniques
  - Why are thin films different from bulk?
- Imaging techniques
  - Optical microscopy
  - Scanning electron microscopy (SEM)
- Electrons in solids

SVC Society of Vacuum Coaters

EdCon Europa 2023

SVC™ Society of Vacuum Coaters

EdCon Europa 2023

Characterization of Thick Films, Thin Films, and Surfaces (cont'd)

- Transmission electron microscopy (TEM)
- Scanning probe microscopies
- Overview: near field effects
- Scanning tunneling microscopy (STM)
- Atomic force microscopy (AFM)
- Structural properties
  - X-ray diffraction (XRD)
  - Stylus profilometry
  - Quartz crystal monitors (QCM)
  - Density
- Chemical / structural properties
  - Auger electron spectroscopy (AES)
- Quantitative data analysis in spectroscopies
- Instrumental sensitivity factors
- Depth profiling by inert gas sputtering
  - Energy Dispersive Analysis of X-rays (EDAX)
  - Wavelength Dispersive X-ray Analysis (WDX, electron microprobe)
  - X-ray Photoelectron Spectroscopy (XPS, ESCA)
- Depth profiling by angle-resolved XPS
  - Secondary Ion Mass Spectrometry (SIMS)
  - Rutherford Backscattering (RBS)
- Optical / structural properties
  - Ellipsometry
- Single wavelength vs. multiple angle vs. spectroscopic
- Ellipsometry models
  - Optical scattering
- Electrical properties
  - Resistance/resistivity
- four point probe
- Van der Pauw
  - Hall effect
- Magnetic properties
  - Magneto-optical Kerr effect
  - Ferromagnetic resonance
- Mechanical properties
  - Stress-curvature measurements
- Tensile vs. compressive stress
  - Friction testing
- Pin on flat
- Pin on disk
  - Micro/nano indentation
  - Adhesion tests

Tom Christensen is a Professor in the Department of Physics at the University of Colorado at Colorado Springs. He received his B.S. in physics from the University of Minnesota in 1979 and his M.S. and Ph.D. degrees in Applied Physics from Cornell University. After several years at Sandia National Laboratories in Albuquerque he joined the University of Colorado faculty in 1989 where he has served as Department Chair, Dean and Provost. He has worked with vacuum technology, thin film technology and surface characterization since 1980 and has taught local AVS or SVC short courses since 1992.

Layer Deposition by Sputtering Process

Prof. Dr. Peter Awakowicz, *Professor for Applied Electrodynamics and Plasma Technology, Ruhr-Universität Bochum, Bochum, Germany*

For many years, sputtering technology has been used to produce thin films for all kinds of applications in almost any industry. The technology ranges from architectural glass coating, hard abrasive resistant tool coating, the generation of semiconductor layers in microelectronics to the coating of plastics for display technology and optical coatings.

The substrate materials that can be used are almost unlimited, like metals, plastics, glasses, semiconductors as is the synthesis of possible materials for the thin films.

The course begins with the operation of coating machines used for this purpose. From the DC magnetron discharge, over medium frequency discharges up to high power pulsed so-called HiPIMS systems. RF systems are also briefly covered.

In the next step, the associated technology and physics are explained to achieve a deeper understanding of the underlying processes. Some examples of deposited films are shown, their structure explained and their industrial use discussed.

Subsequently, the plasma diagnostics of all these low-pressure processes will be adressed and the possibility to profitably apply certain methods also in the industrial environment for process control and quality control of the produced coatings.

Especially in very large plants, the homogeneity of the coating is an important issue. A newly developed active plasma resonance probe, the so-called Multipole Resonance Probe (MRP), is used to address the problem of homogeneity in addition to process and quality monitoring.

Therefore, this diagnostic method, which is easy to use in an industrial environment, will be discussed in more detail, its operating principle will be explained and its field of application will be pointed out. Advantages of using MRP will be shown with examples from industry as well.

A second easy-to-implement diagnostic is optical spectroscopy (OES). This is also briefly introduced and compared to MRP diagnostics. In everyday production, both methods prove to be complementary and provide optimal information about the current status of the machine and the running process. Furthermore, to a certain extent, they also allow predictions to be made regarding thin film quality, especially if manufacturers build up suitable databases and link them in combination with artificial intelligence (AI).

Topical Outline

- Coating processes in many industries
- Coating machines operating with different electrical waveforms from DC to HiPIMS
- Examples of deposited coating for different applications
- Plasma diagnostics of sputter processes, in particular the multipole resonance probe and optical emission spectroscopy
- The beneficial use of these diagnostics to improve plant operation and layer deposition

Prof. Dr. Peter Awakowicz

1978-80 – Vordiplom Electrical Engineering (RWTH Aachen)
1984 – Diplom (Physics of Electrotechnology), Munich University of Technology (TUM)
1990 – PhD (Physics of Electrotechnology), Munich University of Technology
1992-2003 – Group leader "Plasmatechnology", TUM, Institute of Physics of Electrotechnology
1998 – Habilitation (Plasmatechnology) TUM
2003-present – Full Professor at RUB, Head of AEPT

SVC Society of Vacuum Coaters

EdCon Europa 2023

SVC Society of Vacuum Coaters

EdCon Europa 2023

www.svc.org

Troubleshooting for Thin Film Deposition Processes

Dr. Mike Miller, *Test and Process Engineering Manager at Angstrom Engineering Inc. in Kitchener, Ontario, Canada*

The tutorial is designed for process engineers and technicians, quality control personnel, thin film designers, and maintenance staff.

Vacuum deposited thin films are used for optical coatings, electrically-conductive coatings, semiconductor wafer fabrication, and a wide variety of other uses. They may be deposited on glass, plastic, semiconductors, and other materials. Usually, a vacuum deposition process produces durable, adherant films of good quality. But what do you do when things go wrong? Not all films can be deposited on all substrate materials. Sometimes films peel off or crack. Other times they are cloudy, absorbing, scattering, or have other unacceptable properties.

This tutorial will teach you about techniques and tools that can be used to identify the source of the problems, correct the process, and get back into production. It will also help in learning how to develop new processes and products.

Topical Outline

- Mechanical, electrical, and optical properties of thin films
- Process parameters that affect film properties
- Gauge and instrument calibration
- Properties of substrate surfaces
- Measurement of film stress
- Detection of contamination
- Introduction to surface analysis techniques (Auger, ESCA, SIMS, FTIR)
- Substrate preparation and cleaning

Course Details:

Vacuum deposited thin films are used for optical coatings, electrically-conductive coatings, semiconductor wafer fabrication, and a wide variety of other uses. They may be deposited on glass, plastic, semiconductors, and other materials. Usually, a vacuum deposition process produces durable, adherent films of good quality. But what do you do when things go wrong? Not all films can be deposited on all substrate materials. Sometimes films peel off or crack. Other times they are cloudy, absorbing, scattering, or have other unacceptable properties.

This survey tutorial will teach you about techniques and tools that can be used identify the source of the problems, correct the process, and get back into production. It will also help in learning how to develop new processes and products. Many types of deposition processes will be discussed, although the focus is not on in-depth comparison of deposition processes. Techniques and tools are described for making a variety of measurements for quantifying the properties of thin films, both at the "cheap-and-quick" level and for precision analysis. By drawing on methods used in a variety of industries, examples are given that can introduce new approaches to solving problems. The tutorial is designed for process engineers and technicians, quality control personnel, thin film designers, and maintenance staff. Some of the topics to be covered:

- Mechanical, electrical, and optical properties of thin films
  - adhesion, abrasion, humidity, salt spray, hardness, bending
  - scratch and indenter tests
  - transmission, reflection, conductivity
  - index of refraction, absorption, scatter, haze
- Process parameters that affect film properties
  - temperature, rate, pressure, angle
  - effects of water vapor
  - stoichiometry control
- Gauge and instrument calibration
  - pressure (thermocouple, ion, capacitance manometer gauges)
  - mass flow (thermal, laminar flow, displacement types)
  - helium leak checking

Troubleshooting for Thin Film Deposition Processes (cont'd)

- Properties of substrate surfaces
  - smoothness, chemistry
  - results of polishing processes
- Measurement of film thickness and stress
  - use of thin optical flats for stress
  - thickness measurement devices
- Detection of contamination
  - UV light
  - water sheeting
  - residual gas analyzers, partial pressure measurements
  - contaminant "fingerprinting" using RGAs
- Introduction to surface analysis techniques
  - Auger, ESCA, SIMS, FTIR
  - RGA, GC/MS
  - Use of outside services and labs
  - Value vs. costs for capital equipment
- Substrate preparation and cleaning
  - use of solvents and detergents
  - ultrasonic cleaning
  - contact angle measurements for detecting contaminants
  - glow discharge cleaning in vacuum
- Statistical Process Control (SPC)
  - Use of SPC
  - Run charts
  - Design of Experiments (DOE)
- Problem solving within organizational structures
  - Getting support
  - Finding resources
  - Identifying risks
  - Communicating clearly

Dr. Mike Miller is Test and Process Engineering Manager at Angstrom Engineering Inc. in Kitchener, Ontario. He received his BSc in Chemistry from the University of Windsor in 2009 and his PhD in Chemistry from the University of Windsor in 2012. After graduation, Miller founded Substrata Thin Film Solutions, Inc. and began teaching Undergraduate Chemistry in 2014.

SVC Student/Young Professional Travel Sponsorship Program

The SVC Student Sponsorship Program provides travel support and complimentary conference registration to selected full-time students to make an oral technical presentation at the SVC Annual Technical Conference. A limited number of sponsorships will be awarded to the best applicants. Applicants from academic, research, and technical institutions from the United States and around the world are encouraged to apply. The Student Sponsorship Committee evaluates applications from students and makes selections based on the quality and relevance of the student's project to the interests and mission of the SVC. It will also consider the quality of the application itself (completeness, quality, etc.), potential quality of the oral presentation, its relevance to the specific session, as well as the need for funding.

Requirements for Participation:

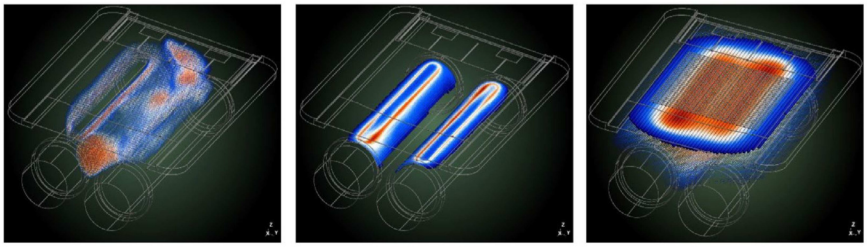
The student applicant must have a sponsor. The sponsor can be a faculty member at the student's institution or another academic, technical, or research institution. The sponsor must indicate that he or she understands the nature of the conference and what SVC technical programs are about. The student must commit to providing a manuscript based on the content of the oral presentation at the TechCon for subsequent publication by the SVC before any fiancial support is provided.

Please visit the SVC website for more details on the 2024 Program.

Deposition Process Simulation

Dr. Andreas Pflug, *Group Manager Simulation & Digital Services | Optical Systems and Applications, Fraunhofer Institute for Surface Engineering and Thin Films IST, Braunschweig, Germany*

This lecture is on the use of kinetic simulation methods for simulation of low-pressure and plasma deposition processes describe low-pressure gas flows and plasma processes. The benefit of rarefied gas flow simulation is illustrated on various practical examples such as flow conductance determination for vacuum components, evaporation and magnetron sputtering. The examples further illustrate the transition between molecular and continuous flow as well as the role of non-local effects occurring at very low pressure.



In a second part, processes involving chemical reactions between gas and reactor walls are discussed. Illustrated examples include a model of hot wire CVD deposition as well as an animated hysteresis loop in a model for reactive magnetron sputtering.

In the field of plasma simulation, the role of the magnetic confinement in magnetron sputtering is shown together with dynamic plasma features in magnetron sputtering such as rotating spokes, that can be observed in simulation and experiments. Another topic will be the impact of pulse sputtering on the plasma potential and ion energy distribution function at the substrate.

The final part of the lecture shows how to combine deposition reactor modelling with atomistic film growth simulation and with fast algorithms for deposition modelling on moving 3D substrates. Such multiscale approach allows to predict deposition homogeneity as well as intrinsic film properties. For certain process conditions it enables to set up real-time capable digital twins, that can be used for iterative optimization or within real-time monitoring applications.

Dr. Andreas Pflug is Head of Group Simulation and Digital Services at Fraunhofer IST (Braunschweig, DE). His focus is on simulation and modeling of plasma processes, components, and coating systems. Andreas has developed a PIC-MC code for plasma and process modeling. This code is licensed to renowned companies in the coating business and is well established in industry. His contributions and leadership have been pivotal in advancing the fundamental understanding of vacuum processes. Furthermore, these simulations can speed up development and improvement processes in large scale industrial processes.