SVC™ Society of Vacuum Coaters

TechCon 2025 Nashville

Gaylord Opryland Hotel
Nashville, Tennessee, USA

May 17 – May 22, 2025

Extended Call for Papers

Featuring Select Keynote and Invited Speakers & Preview of the 2025 In-Person Tutorial Program

Technical Program: May 19 – May 22, 2025

- Technical Sessions
- Interactive Networking Forums
  + Technology Forum Breakfasts

Education Program: May 17 – May 22, 2025

- Problem-Solving Tutorial Courses

Featuring Sessions on:

- Atomic Layer Processing (ALP)
- Coatings and Processes for Biomedical Applications
- Coatings for Energy Conversion and Related Processes
- Digital Transformation through Artificial Intelligence, Machine Learning, Simulation, and Data Science in the Thin Film Industry
- Emerging and Translational Technologies and Applications
- Electron Beam Processes
- High Power Impulse Magnetron Sputtering (HIPIMS)
- Large Area Coatings
- Optical Coatings
- Organic and Perovskite Electronics
- Plasma Processing and Diagnostics
- Process Monitoring, Control, and Automation
- Protective, Tribological and Decorative Coatings
- Quantum Computing
- Selective Atomic Scale Processes
- Thin Film Sensors
- Thin Film Contributions for the Hydrogen Economy
- Two-Dimensional (2D) Materials and Heterostructures – Applications, Large-Scale Growth and Advanced Characterization
- WebTech Roll-to-Roll Technologies and Innovation

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

www.svc.org

The SVC Awards Committee Invites Your Nominations

The SVC Awards Committee is responsible for selecting the recipients of our awards: the **Nathaniel H. Sugerman Award** for distinguished achievement, and the **Fellow-Mentor Award** for significant contributions to the SVC or the vacuum coating industry. We request that nominations be sent to Chris Muratore, University of Dayton, Awards Committee Chair, cmuratore1@udayton.edu, by December 15, 2024. The criteria for the awards and a list of past award recipients can be found on the ***SVC website***.

Nominations should give a brief, thoughtful statement about the individual in light of the criteria for the proposed award. The Sugerman and Mentor Awards can be based on a broad range of possible contributions to the SVC and/or the vacuum coatings industry. Please consider candidates whose contributions are significant but perhaps not as apparent based on more formal mechanisms, i.e., scientific publications.

We encourage you to submit nominations for the 2025 awards now!

Fellow-Mentor Awardees are eligible for the Sugerman Award. Employees and contractors of the SVC and current members of the Awards committee are not eligible.

Awards Committee Members:

Chris Muratore, University of Dayton, *Awards Committee Chair* | cmuratore1@udayton.edu
Ladislav Bardos, Uppsala University, Sweden, *Immediate Past Chair* | ladislav.bardos@angstrom.uu.se
Clark Bright, Bright Thin Film Solutions (3M retired), *Past Chair* | brightcrew@aol.com
Traci Langevin, Soleras Advanced Coating | Traci.Langevin@soleras.com
Gary Vergason, Vergason Technology, Inc. | gvergason@vergason.com
Jolanta Sapieha, Polytechnique Montréal, Canada| jsapieha@polymtl.ca

SVC Society of Vacuum Coaters

TechCon 2025 Nashville

Technical Program
May 19 – May 22
Education Program
May 17 – May 22
Technology Exhibit
May 20 – May 21

68th Annual SVC Technical Conference • May 17 – May 22, 2025

Gaylord Opryland Hotel, Nashville, Tennessee, USA

Technical Program May 19 – May 22

Featuring the very latest industrial and technical advances in Thin Films, Coatings, and Surface Engineering

Plus! Interactive Networking Forums, Discussion Groups and Social Events
Free Conference Admission on May 20th and May 21st

Education Program May 17 – May 22

Problem solving tutorials taught by the world's leading experts in vacuum technology, thin film science, and surface engineering

Technology Exhibition May 20 –21

Over 125 exhibiting companies dedicated to vacuum coating technologies
Plus! Free Exhibition Admission, Exhibit Hall Presentations, and Social Networking Events

Thin Films, Coatings and Surface Engineering

The 2025 SVC TechCon in Nashville, Tennessee focuses on the essential role that Thin Films, Coatings, and Surface Engineering play in the products and services that drive our daily lives and the impact that Artificial Intelligence has had in our field. The SVC represents the latest technologies, manufacturing methodologies, and business insights, supporting a global group of stakeholders. Highlighted by prominent Keynote presentations and Invited speakers, the TechCon offers an engaging podium for contributed talks & posters as well as roundtable discussions and other interactive features addressing the following themes:

- **(2D) Materials and Heterostructures – Applications, Large-Scale Growth, & Advanced Characterization** ***New***
- Atomic Layer Processing
- Coatings and Processes for Biomedical Applications
- Coatings for Energy Conversion and Related Processes
- **Quantum Computing** ***New***
- Digital Transformation through Artificial Intelligence, Machine Learning, Simulation, and Data Science in the Thin Film Industry
- Emerging and Translational Technologies and Applications
- Electron Beam Processes
- High-Powered Impulse Magnetron Sputtering (HiPIMS)
- Large-Area Coatings
- Optical Coatings
- **Organic and Perovskite Electronics** ***New***
- Plasma Processing and Diagnostics
- Process Monitoring, Control, and Automation
- Protective, Tribological and Decorative Coatings
- **Selective Atomic Scale Processes** ***New***
- **Thin Film Contributions for the Hydrogen Economy** ***New***
- Thin Film Sensors
- WebTech Roll-to-Roll Technologies and Innovation
- Exhibitor Innovator Showcase

The SVC TechCon provides the forum where researchers, technologists, innovators, business leaders, decision makers, and newcomers to the field can connect, exchange ideas and gain knowledge. An industry-leading Exhibition, Technical Program, and Education Program complement each other for exceptional attendee value. The Nashville venue is an industry favorite, offering both professional networking as well as recreational value in a relaxed atmosphere. See you in Nashville!

CLICK HERE to submit an abstract to TechCon 2025

P.O. Box 10628, Albuquerque, NM 87184 • Telephone: +1 (505) 897-7743 • Fax: +1 (866) 577-2407 | www.svc.org

Message from the Program Director

The 2025 SVC TechCon will take place in the heartland of the U.S. in Nashville, Tennessee! The venue is conveniently close to many stakeholders of our community, and features a fantastic combination of a first-class meeting venue and an attractive tourist destination. The all-in-one Gaylord venue contains the hotel, conference rooms, tutorial classrooms and the industry's largest technical exhibit in close proximity to provide you with the best experience for learning, networking, creating new connections, and mingling with new and long-time members of our community.

The technical program offers a comprehensive and updated selection of sessions that covers critical technical and business aspects of thin film technology and surface engineering. The program will address applications, challenges, and technology development from a contemporary focus that has been updated with latest topics such as the influence of artificial intelligence on our industry as well as several new application arenas. The 2025 TechCon offers an industry-leading technical exhibition, abundant networking opportunities, along with an extensive educational program and in-depth technological expertise. The 2025 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 achievements with the SVC community. The TechCon offers a range of presentation options – oral, poster, or exhibitor innovation formats – which facilitate the full spectrum of academic research and industrial product innovations. This is complemented by our wide range of publication options – PowerPoint presentations (static or narrated/pre-recorded) or a manuscript in the conference proceedings, or peer-reviewed submissions to a high-impact scientific journal. The SVC Student / Young Professional Travel Sponsorship Program provides financial support for a limited number of qualified applications to encourage student and young member participation.

We encourage you to contribute a talk or poster, 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 Nashville. With the addition of our brand-new sessions covering two-dimensional materials, organic electronics, quantum computing, and supply chain issues, the SVC TechCon confirms its position as the worldwide forum for thin film technologies and surface engineering. In 2025, the magic will happen in Nashville, and we very much look forward to having you join us there!

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 2025 Technical Program

WITHOUT PEER REVIEW

Submission Deadline:
September 12, 2025
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 – September 12, 2025
Publication in a special edition of Elsevier's Surface and Coatings Technology Journal (ISSN: 0257-8972)

VIDEO PRESENTATIONS

Submission window open
May 1 – September 12, 2025
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 4, 2024

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

Academic Scholarship application deadline: October 18, 2024

Industry Scholarship application deadline: January 10, 2025

Student Travel Sponsorship application deadline: October 4, 2024

Equilibrium Versus Non-Equilibrium Heating to Control the Microstructure of Coatings and Thin Films

André Anders[1,2]
[1]*Leibniz Institute of Surface Engineering (IOM), Leipzig, Germany*
[2]*Leipzig University, Leipzig, Germany*

Properties of coatings and thin films are primarily determined by their chemical composition and microstructure. In the simplest case, one uses substrate heating to affect the density (porosity) and crystallinity (i.e. amorphous vs. crystalline phases, possibly with a preferred orientation or texture). The involvement of plasmas and/or ion beams opens the possibility for non-equilibrium or atomic-scale heating, which can be very beneficial from several points of view, including, but not limited to, a reduction of the requirements on conventional substrate heating and cooling, the possibility to use temperature-sensitive substrates, the formation of otherwise unattainably phases, and the combination of deposition and etching effects. The key to non-equilibrium heating is specifically the kinetic ion energy, which can be controlled by the difference between surface potential and plasma potential, i.e., using suitable substrate and/or plasma biasing. When the kinetic ion energy exceeds the displacement energy, film growth can occur under the surface (very shallow ion implantation or "subplantation"), which is utilized, for example, in the deposition of diamond-like carbon. Biasing is often pulsed, which in combination with pulsed plasmas can be used for phased or species-selective control of ion energies, allowing us to synthesize non-equilibrium phases with new and interesting materials properties. In this talk, I will present in a systematic manner the concepts of non-equilibrium heating, the contributions of kinetic and potential energies of particles arriving at the surface of the growing film, and practical approaches to utilize the concepts for materials design in thin films and coatings.

Dr. André Anders has a joint appointment as the Scientific Director and CEO (Vorstand) of the Leibniz Institute of Surface Engineering, Leipzig, Germany, and Professor of Applied Physics at Leipzig University. From 1992 to 2017 he worked at Lawrence Berkeley National Laboratory in Berkeley, CA, USA, and from 1987 to 1991 at the Academy of Science in East Berlin, Germany. He studied physics in Wroclaw, Poland, Berlin, (East) Germany, and Moscow (Russia, then Soviet Union), to obtain his PhD degree from Humboldt University in Berlin in 1987. André is a specialist in applied plasma physics and materials sciences, especially on thin film deposition by plasma-based methods. He has authored 3 books and more than 350 peer-reviewed journal papers (over 23,000 citations). For ten years (2014-2024) he was the Editor-in-Chief of Journal of Applied Physics, published by AIP Publishing, Melville, NY. His work was recognized by several awards, including the 2016 Nathaniel Sugerman Memorial Award of the SVC, and election to Fellow of APS, AVS, IEEE, and InstPhys (UK).

Materials Science-Based Guidelines to Develop Robust Hard Coatings

Paul H. Mayrhofer
Technische Universität Wien, Vienna, Austria

For mechanically dominated load profiles, nitrides are preferred as the base material for structural and functional hard coatings, while oxide-based materials offer better protection against high-temperature corrosion (such as oxidation). Thus, when mechanical and thermal loads are combined, the nitrides used should also have excellent stability against temperature and oxidation. How to develop such nitride materials that can withstand both high mechanical and thermal loads is the focus of this review article. This is done primarily with the help of experimental and theoretical investigations of the Ti–Al–N system. On the basis of transition metal nitride coatings, we discuss important material development guidelines for improved strength, fracture toughness as well as thermal stability and oxidation resistance. Using various superlattice coatings, we further discuss how such nanolamellar microstructures can improve both the strength and fracture toughness of hard coating materials. In addition, other concepts for improving fracture toughness are discussed, with a focus on those that can increase both fracture toughness and hardness. The individual concepts allow to design materials to meet the ever-growing demand for coatings with a wide range of excellent properties and outstanding property combinations.

Dr. Paul Mayrhofer is a University Professor of Materials Science at the Institute of Materials Science and Technology, and chairs the Materials Science Division at TU Wien, Vienna, since 2012. He earned his Ph.D. in 2001 and Habilitation in 2005 in Materials Science at the University of Leoben. His post-doctoral work and Erwin-Schrödinger Fellowship took him to the University of Illinois, RWTH Aachen, and Linköping University. Paul pioneered age hardening in hard ceramic thin films based on ternary nitrides and borides and has a deep interest in phase transitions. His research focuses on developing and characterizing vapor-phase deposited nanostructured protective and functional materials through a combination of computational and experimental approaches. He has received numerous prestigious awards, including the START Prize from the Austrian Science Fund in 2007, the Christian Doppler Laboratory in 2011, appointed Fellow of the American Vacuum Society (AVS) in 2018, the Bill Sproul Award and Honorary Lecture from AVS in 2023, and the Dr.- Wolfgang-Houska-Preis in 2024. Paul is an elected member of the Austrian Academy of Sciences and served/serves the community in numerous appointed and elected positions including: Advanced Surface and Engineering Division (ASED) of AVS Long Range Planning Committee Chair; ICMCTF Symposium, Program, and General Chair; ASED Symposium Chair; ASED Chair; President of the Austrian Vacuum Society; Councilor to IUVSTA; Board of the Austrian Science Fund; Scientific Advisory Board of the Theodor Körner Fonds; Dean of Academic Affairs at TU Wien.

Speakers for the 2025 TechCon

Crystals Generated in a Microgravity Environment

Kenneth Savin
Redwire, Indianapolis, IN

Redwire's heritage efforts have included manufacturing prototypes and science enablers for individuals doing work in orbit and can find their foundation in work performed on Space Shuttle missions starting over 30 years ago. A recent focus for us has been the systems that facilitate the development of pharmaceutical crystals.

In general, both small and large molecule drugs, are often best formulated as crystals. The crystalline state is more easily handled, isolated and is relatively stable but can suffer from polymorphism and size coefficients of variation that are too large. A potential solution to these problems was impressed upon us by the result found in the microgravity enabled crystal growing experiment of the monoclonal antibody, Pembrolizumab marketed by Merck as the product, Keytruda. Creating new forms and potentially improving the existing forms of drugs in microgravity with greater crystalline uniformity and less variation in size allows for new polymorphs could lead to faster development times, less waste in the process of making the drugs, and possibly lead to new modes of delivery.

We will present results demonstrating the difference in crystals formed terrestrially vs those generated on the International Space Station Platform and describe the use of those crystals for future terrestrial production of pharmaceuticals.

After receiving his PhD from the University of Utah in synthetic organic chemistry, **Dr. Kenneth Savin** did a post doc at the Memorial Sloan Kettering Cancer Center before going on to work for Eli Lilly and Co. as a senior research scientist. During his 20-year career in the pharmaceutical industry, Ken led discovery chemistry research teams, discovery operations, radiochemistry, drug disposition, chemistry development and product teams as well as being an adjunct faculty member at Butler University.

During the last four years of Ken's industrial career, he led an effort that resulted in five separate flight experiments flown on the International Space Station. After retiring from Lilly, he joined the team at The Center for the Advancement of Science In Space (the operators of the International Space Station US National Lab) working in both Business Development, as a science lead and ultimately as the Sr. Director of In Space Production Applications. During his time at CASIS Ken worked with a team at NASA to develop the In Space Production and Applications program that is run out of NASA as an effort to develop products in space that will benefit life on the Earth. Ken joined the Redwire team in early 2022 to be the Chief Scientific Officer at Redwire. His focus at Redwire has been on the commercialization of work performed in the labs at Redwire and in developing partnerships that will lead to better products and easier access to the value that space based products can have to humanity.

Machine Learning for Atomic Layer Deposition: Accelerating Optimization and Predicting Scale Up of Thin Film Growth Processes

Angel Yanguas-Gil
Argonne National Laboratory, Lemont, IL

Fast process optimization is critical to help reduce the cost of development and adoption of novel thin film-based technologies. Examples include energy technologies, where low cost manufacturing is key to ensure commercial viability, and microelectronics, where longer processing times, with substrates sometimes spending weeks in a fab before reaching a specific step, higher complexity, and ever stringent requirements compound the cost of innovation at the leading technology nodes. Current approaches to transfer technologies from lab to manufacturing often require extensive tool time and characterization or, when assisted by simulations, accurate models carefully tuned to each specific process.

In this presentation I will explore how machine learning can be leveraged to help accelerate the optimization of atomic layer deposition. In particular, I will highlight two different approaches: the first one explores the use of surrogate models to connect experimental metrology data with optimal processing conditions. We have explored two different cases: optimizing a process within a reactor and optimizing process transfer to a different reactor. In both cases, we show that, for thermal ALD processes, the information contained in thickness profiles in undersaturated conditions is enough to help predict optimal dose times both within and across different reactors. We also extended this methodology to the case of plasma-assisted deposition processes. The second approach relies on the use of in-situ characterization techniques to design self-driving deposition tools that can automatically search and identify optimal process conditions. For this approach, we developed a two step process where algorithms are tested first using simulations and digital twins of the reactors before being experimentally deployed. This methodology can lead to x100 faster process optimization compared to standard growth-vent-characterize optimization cycles.

Dr. Angel Yanguas-Gil is Principal Materials Scientist at Argonne National Laboratory, where his research focuses on the fundamentals of thin film growth and semiconductor processing, neuromorphic computing, and AI. He is particularly interested in chemistry-based techniques such as atomic layer deposition. With a background in theoretical physics, Angel obtained his PhD at the University of Seville, Spain in 2006. Before joining Argonne in 2009, he was a postdoctoral researcher at Ruhr Universitaet in Germany and at the University of Illinois at Urbana-Champaign. Angel currently serves in the program committees of the Electronic Materials Conference and the International Conference on Atomic Layer Deposition and is part of Argonne's Microelectronics Institute and a board member of the Argonne Quantum Institute. He was also the 2022 chair of the AVS Thin Film Division and a member of the program committee of the International Conference on Neuromorphic Systems. Beyond his research interests, he is an advocate of open source software and its application to materials, chemistry, and manufacturing.

Colloquium @ TechCon 2025 Nashville

SVC Society of Vacuum Coaters

The modern SVC era has been the most intense period of innovation, member engagement, event management, and technology focus in the SVC's sixty-seven year history. The SVC is completely focused on our stakeholders, developing an inclusive culture of listening, adopting, refining, and improving approaches that enhance the unique networking and problem solving culture that sets the SVC apart from all other professional organizations. In the spirit of this culture, we are proud to announce, "Colloquium at the TechCon"; a series of focused, technical conversations that address critical industrial needs. This meeting format was first introduced at the 2022 TechCon in Long Beach and based on the extremely positive feedback, we are bringing it back yet again in 2025!

Each topical workshop will be anchored by a technical presentation or series of presentations that will frame a follow-on roundtable discussion. Subject matter experts will be acting as moderators to facilitate discussions and promote interaction and networking between the attendees. As part tutorial, part problem solving, and part networking, the "Colloquium at the TechCon" represents the vanguard of the SVC's efforts to enhance and redefine the technical conference experience. These workshops will be open to all of our conference attendees and exhibitors.

The time and location of all **Colloquium @ TechCon** will be posted in the Final Program; stay tuned!

Thursday, May 22, 2025 | *Sponsored by the SVC's HIPIMS Technical Advisory Committee*

HIPIMS – Facts and Fiction

Moderator: **Herbert Gabriel** *(PVT)*

Herbert Gabriel
PVT

Event Description: High Power Impulse Magnetron Sputtering (HIPIMS) was discovered 25 years ago and has become a disruptive technology within the vacuum coating field. Although HIPIMS has become a mainstay in the semiconductor and in several other industries, there are still many misconceptions regarding its benefits and limitations. The purpose of this colloquium is to pragmatically separate fact from fiction. As a disruptive technology the promise is tempered by perception and expectation. Our panel will address the following areas to concretely bring to light the potential and reality of HIPIMS.

1) Deposition rate
2) Ion energy/selection and plasma density
3) Productivity
4) Scalability challenges
5) Applications

We will dedicate 25 minutes to each area led by a short presentation followed by a roundtable question and answer period. At the end of the session, we'll ask for further questions and comments.

Panelists:

- Ion energy/selection and plasma density
  – **Arutiun Ehiasarian**
  Sheffield Hallam University
- Deposition rate of HIPIMS processes
  – **Ralf Bandorf** *Fraunhofer IST*
- Productivity of HIPIMS processes
  – **Frank Papa** *GP Plasma*
- Scalability of HIPIMS processes
  – **Daniel Loch** *Trumpf Huettinger*
- Industrial applications and products available today
  – **Ivan Shchelkanov** *Starfire Industries*

Arutiun Ehiasarian

Ralf Bandorf

Frank Papa

Daniel Loch

Ivan Shchelkanov

Colloquium 2.2

A Large Success Factor of Vacuum Coating: The Right Cleaning!

Moderator: **Dr.-Ing. Martin Engels** (*Ionbond Group*)

Martin Engels
Ionbond Group

Event Description: Pre-cleaning is a highly critical and important step before PVD (Physical Vapor Deposition) processes in order to ensure that the substrate surface is free of contaminants, oxides, and organic materials that could significantly reduce the adhesion of the deposited thin film to the substrate. Adhesion of coatings is a crucial aspect in order to obtain reproducible production quality, especially for mass production of coated parts, like automotive or decorative components.

For PVD mass production, the pre-cleaning is generally performed with either aqueous or solvent cleaning lines, which can be designed as so-called multi-tank systems or monoline chambers. Furthermore, hybrid systems which combine these approaches are available for end users as well. Generally, the chosen design, technology and chemistries in a cleaning line highly depend on the products to be washed and coated. For example, automotive components like piston pins are normally oiled and the oil needs to be removed, whereas the parts must be protected against corrosion between washing and coating. In addition, cleaned surface finishes of decorative parts need full attention on rinsing and drying to avoid any visual contamination like water stains. To meet these requirements, a high level of experience and understanding of cleaning machine designs, cleaning chemicals, and the related processes is needed to provide the best solution to coating operations.

In order to give the TechCon participants a deeper insight into this very important factor of vacuum coating related processes, we have gathered a team of experts, who will cover the different cleaning technologies as well as chemicals which are used to reach effective and efficient cleaning solutions:

Panelists:

Ken Allen *Novatec S.r.l. (Executive Director North America)*
35 years experience in ultrasonic cleaning; primary expertise in developing precision cleaning processes in Aerospace, Textile, Medical, PVD/CVD Coating, and general metal finishing applications.

Ken Allen

Dr. Henry Ederle *Borer Chemie AG (International Sales Manager Industry)*
18 years experience in sales and consulting for industrial cleaning tasks, especially also for cleaning of metals prior to PVD applications.

Henry Ederle

M.Sc. Stefan Lukowski *SAFECHEM Europe GmbH (European Sales Manager)*
15+ years of industry experience in advising companies across diverse sectors, including the safe and sustainable use of solvent cleaning, but also aqueous based cleaning in demanding applications.

Stefan Lukowski

Joe McChesney *KYZEN CORPORATION (Global Products Line Manager – Solvents)*
40+ years of experience in solvent and aqueous cleaning processes, from conceptual design through field operation. as presented hundreds of papers over the years and holds several patents on solvent applications.

Joe McChesney

Dipl.-Ing. Karl Trautz *HEMO GmbH (Project Engineering and Sales)*
25+ years experience in the field of industrial cleaning technology; focus on special applications, challenging industries and unexplored regional markets worldwide; unique cleaning processes such as Hybrid and Beyond.

Karl Trautz

Call for Papers

Abstract Submission Deadline
Guaranteed Conference Participation: February 14, 2025

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 make 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

INVITED SPEAKER:

Spatial Atomic Layer Deposition: A New Revolution in Ultra-Fast Production of Conformal and High-Quality Thin-Film Coatings

John Rönn, Sauli Virtanen, Philipp Maydannik, Sami Sneck
Beneq Oy, Espoo, Finland

Since its invention 50 years ago, atomic layer deposition (ALD) has shown tremendous performance in depositing thin film structures for various applications in physical, chemical, biological, and medical sciences. Due to the unique layer-by-layer growth mechanism of ALD, thin films with exceptional uniformity, conformality and quality can be deposited not only on planar substrates, but also on the most complicated surfaces. Despite its superior advantages, traditional ALD, or temporal ALD, suffers from relatively low deposition rates (~20-50 nm/h), which has greatly limited ALD's application in many systems where thin films with thicknesses of several hundreds or even microns are required. Such examples are often found in optical coatings that are widely used in our everyday lives in the form of self-driving cars, augmented reality glasses or mobile phones, to name a few.

In this work, we present a new-generation ALD technology that revolutionizes the production of conformal thin-film coatings: the spatial ALD. In spatial ALD, the substrate is rotated across successive process zones to achieve ultra-fast and high-precision thin film deposition. We present our latest results, which include ultra-fast production of SiO_2, Ta_2O_5 TiO_2, HfO_2 and Al_2O_3 with deposition rates reaching up to 2 µm/h. In addition, we show that the deposition of these films can be controlled in such a way that no coating induced stress is obtained on the substrate, ultimately allowing extremely thick layer configurations to be deposited. Finally, we show that these films exhibit low optical losses which make them very advantageous especially in novel optical applications where conformal, thick, and low-loss coatings are highly desirable.

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 used in many existing and emerging biomedically relevant areas. Recent advances in knowledge related to biological systems have motivated the development and characterization of coatings and surface treatments with the purpose of improving osseointegration, interfacing with the nervous system, extending implanted device lifetimes, improving biocompatibility, and lowering costs 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:

- Orthopedic and osseointegration applications
- Cardiac rhythm management
- Neurostimulation

The 6th Annual SVC Foundation Casino Night on Monday Evening, May 19, 2025
To benefit the SVC Foundation and Student Sponsorship Program!

- Cardiovascular intervention
- Bio-corrosion
- Flexible electronics
- Biosensors, bioelectronics, and biochips
- Antimicrobial applications

INVITED SPEAKER:

Hierarchical Surface Restructuring: The Technology of the Future for Sustainable, High Performing and Multifunctional Neural Interfacing Electrodes and Microelectrode Arrays

Shahram Amini
Pulse Technologies Inc., Quakertown, PA

Recent advancements in implantable neural interfacing devices have led to significant breakthroughs in neurostimulation and cardiac rhythm management, enabling precise neural stimulation and signal recording for the treatment of various neurological and cardiac disorders. To enhance the specificity, functionality, and overall performance of these devices, electrodes and microelectrode arrays—the core components of most emerging devices—must be further miniaturized and demonstrate exceptional electrochemical performance with neural tissue. Since the selective and targeted stimulation of small populations of neurons near implantable electrodes is crucial for their success, the trajectory for further refinement of neural interfacing devices largely depends on increasing electrode miniaturization, which enables higher spatial resolution, precision, and reliability. However, challenges remain in optimizing electrode performance, commercial viability, manufacturability, and sustainability. In this presentation, several key areas of innovation will be explored. First, the miniaturization and electrochemical enhancement of femtosecond-laser hierarchically restructured electrodes, which demonstrate unprecedented improvements in performance, will be discussed. Second, the development of multifunctional, high-performing antibacterial electrodes designed to combat post-implantation infections while maintaining superior electrochemical properties will be highlighted. Advancements in ultra-thin, flexible electrodes for invasive nervous system applications will also be presented, with a focus on their enhanced electrochemical properties and mechanical stability. Finally, a sustainable alternative to platinum group metal electrodes will be presented, showcasing how titanium-based electrodes, restructured using a novel reactive hierarchical surface restructuring platform, achieve superior electrochemical performance and provide a low-cost, sustainable solution for long-term neurostimulation and cardiac rhythm management devices.

TAC Co-Chairs:

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Coatings for Energy Conversion and Related Processes

This session provides a comprehensive forum for experts and researchers to discuss the latest developments and technologies in the field of energy conversion coatings. These talks cover a wide area of applications, however with a core focus on energy conversion, storage, and management. This session brings industry, research, and academics together in order to facilitate the transfer of technology and share new and upcoming ideas and technologies for the improvement of sustainable living.

The Technical Advisory Committee (TAC) welcomes papers in the following areas:

Solar and Ambient Light Energy Conversion:

- Thin-film and thin wafer as well as perovskite silicon tandem photovoltaics for space and terrestrial applications
- 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
- Flow batteries
- Powder surface treatment (PVD, CVD, ALD) for Li-ion batteries or Na-batteries, or solid-state batteries (or other types)
- Super capacitors
- Coatings for improved stability, graphene and carbon nanotubes
- Protective coatings for the prevention of e. g. hydrogen embrittlement

Efficient Functional Coatings:

- Radiative cooling
- Hydrophobic and hydrophilic
- Self-cleaning catalytic coatings
- Development of coatings for reduction of precious metal
- Anticorrosive coatings

Other traditional subjects:

- Smart windows
- Selective radiators
- Fuel cells and electrolyzers (low temperature, high temperature, advanced types)
- Large-scale energy conversion and storage

Call for Papers

Abstract Submission Deadline
Guaranteed Conference Participation: February 14, 2025

INVITED SPEAKERS:

Thin-Film Technology Innovations for Silicon Heterojunction Solar Cell

Kaining Ding, **Karsten Bittkau, Alexander Eberst, Andreas Lambertz, Uwe Rau**
Forschungszentrum Jülich GmbH, Jülich, Germany

Silicon heterojunction (SHJ) solar technology has emerged as a frontrunner in the pursuit of efficient and cost-effective photovoltaic solutions. The years 2023/2024 have witnessed significant strides in this domain, marked by the continuous integration of advanced concepts into mass production. This contribution aims to provide a comprehensive overview of the advancements in SHJ technology through thin-film innovations.

The most intuitive approach to overcome parasitic absorption in SHJ solar cell front layers is to work on the transparency of these layers especially in UV and blue wavelength range. The transparency of the transparent conductive oxide can be tuned in a small range by the choice of alloying material, oxygen content, doping concentration, and film thickness. The addition of oxygen or carbon into the silicon films giving rise to silicon alloys with larger optical bandgap has been tested intensively. Intrinsic amorphous silicon oxide or carbide were meant to substitute the intrinsic amorphous silicon passivation layer. Doped amorphous or nano-crystalline silicon oxide or carbide were investigate as alternative to doped amorphous or nano-crystalline silicon, respectively. Until now, the most successful development is the front side doped nano-crystalline silicon oxide which gave rise to absolute efficiency improvement of >0.4% in production average and hence an industry standard now. Its success lies in the self-assembled formation of a 3-dimensional crystalline silicon network embedded in an amorphous silicon oxide matrix. Another more radical approach is to merge the doped layer and the passivation layer into one functional layer with a lower total thickness.

Smart Windows Using Thermochromic VO_2 Coatings for Autonomous Adaptation of Solar Heat Gain for Optimized Energy Efficiency in Buildings

Daniel Mann
TNO, Geleen, The Netherlands

Crystalline vanadium dioxide is a naturally occurring smart material that reacts on a number of different stimuli with a structural phase transition (STP) that changes the optical, electrical and physical properties of the material. This phase and property change can be used in smart applications, such as thermochromic glass coatings for smart windows. Here a thermal and optical stimulus is used to switch the solar infrared transmission of a coated glass plate between a transparent and a blocking state. Integrated into a window this enables the autonomous adaptation of its solar heat gain based on a building's energy and comfort needs. This significantly reduces the energy demand of a building on heating and cooling simultaneously and increases comfort levels for occupants. Furthermore, smart windows using thermochromic VO_2 coatings can reduce the CO_2 emissions of buildings and add to the transition towards a climate neutral built environment.

In the past years, we have developed a process to synthesize doped thermochromic VO_2 nanoparticles at high purity, crystallinity and precise size and shape. We integrated this functional smart material into a coating on glass, resulting in thermochromic smart window coatings with optimized optical properties, combining high visible transmission >60% with high solar modulation >20%. Here we present the importance of the functional materials characteristics on the smart properties. Various parameters, such as crystallinity, size and compatibility between functional nanoparticles and coating matrix, are crucial to optimize functional performance. To influence the STP towards application oriented requirements, we used precise meatal ion doping to reduce the phase transition temperature from 68°C for regular VO_2 to application oriented region between 20 – 30°C. The technology has been scaled up to 1 m^2 sized glass plates using an industrial roller coater and the coated glass plates have been integrated into insulating glass units. We further investigated the combination of the smart window coating with industrial low emissivity coatings, adding insulating properties to the adaptive solar heat gain properties of the smart window coating. Synergistic and parasitic effects of both coatings have been investigated to find the correct balance between both effects. Full sized window demonstrators have been installed in test buildings, monitoring the thermochromic effect dependent on the glass and outdoor temperature, as well as the solar irradiance. Using the gained insight into the smart window behavior in a real life setup, the thermochromic properties and phase transition temperature could be further optimized. Finally, we present the energy and CO_2 emission savings potential of the new smart window via building energy simulations. Here we show that in a regular Dutch household energy savings of approximately 9% in comparison to existing highly energy efficient windows can be achieved and that the Dutch built environment may save up to 5.8 Mt in CO_2 emissions per year using widespread implementation of the new smart window. Overarching, we present the development of a new smart product, from conceptualization to lab scale optimization, scale up, system integration, real life testing and impact analysis.

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Digital Transformation through Artificial Intelligence, Machine Learning, Simulation, and Data Science in the Thin Film Industry

This session covers all topics in which novel digital technologies play an important role. These include, without limitation, physics and chemistry simulations, advanced data science techniques, and approaches that rely on subsets of artificial intelligence, such as machine learning. It brings together experts in simulation and artificial intelligence and provides an ideal platform to discuss the benefits of the digital transformation of industrial deposition processes from the perspective of various technology fields. The session welcomes perspectives from academic experts as well as stakeholders from the entire vacuum coating supply chain — OEMs, coating centers,

providers of coater components and monitoring tools, and providers of digital services and simulation software.

The motivation behind this session is the fact that industrial deposition processes are under strong competitive pressure, as better productivity is always demanded with higher precision and increasing complexity of coating products. This increased complexity requires optimized coating processes, model-based process control, and a comprehensive view and understanding of the entire 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 generated in different processes and the representation of the coating processes through real-time capable digital twins.

Even today, simulation and digital twin models are well-established tools for predicting and optimizing deposition processes. It is possible to use physical and/or chemical models to predict the behavior of the process with very little a priori knowledge.

Another approach to predicting processes is the use of generated data and components of artificial intelligence, such as machine learning, deep learning, or grey-box models. In this context, data acquisition, storage, and accessibility become increasingly important. Artificial intelligence is already deployed in areas such as image recognition, predictive maintenance, and process control.

INVITED SPEAKER:

Physics-Informed Data-Driven Approaches to Plasma Processing Technologies

Satoshi Hamaguchi
Osaka University, Osaka, Japan

The process developments for thin-film coating, surface modification, and semiconductor manufacturing have become so complex that there is much room for improvement in their efficiency with data-driven approaches. A trial-and-error approach by experienced engineers based on the knowledge of existing processes and materials can be replaced with a more systematic approach based on synthetic knowledge inferred by machine learning (ML). Currently, a large amount of data on specific processing tools is typically collected and used for process optimization and control for those tools. However, if such data are associated with the underlying physics mechanisms, they may be used to optimize different process tools and, possibly, to develop new processes. Computer models of processing tools with physics-based process models, i.e., digital twins of processing tools, allow such physics-informed data-driven approaches to solving complex problems of process development and control. One of the main obstacles to developing such digital twins is the lack or shortage of fundamental physics parameters such as reaction rate constants. A data-driven approach assisted by artificial intelligence (AI)/ML techniques may also be able to infer such physics parameters. In this presentation, starting with a brief overview of the current status of data-driven plasma science, the author will discuss several subcomponents of a digital twin of a plasma processing tool. As in typical plasma systems, a plasma process tool model involves multi-scale physics and may be divided into a macroscopic bulk plasma model and microscopic or even nano-scale surface reaction models. Each model also consists of several subcomponent models, and at the most fundamental level, gas-phase and surface chemical reactions are governed by quantum mechanics. Using some examples, the author will discuss how "surrogate models" of the digital twin's subcomponents, constructed with experimental data augmented with first-principle numerical simulation data, may allow reliable real-time simulation of a process tool or inference of new process conditions.

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Adam Obrusnik, *PlasmaSolve s.r.o.,* obrusnik@plasmasolve.com

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 and 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.

INVITED SPEAKER:

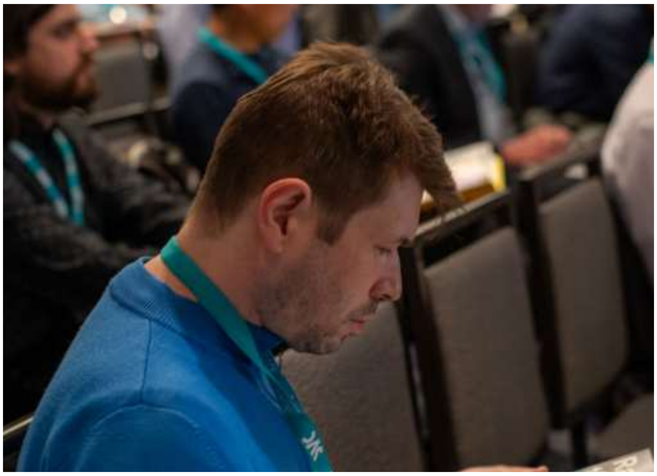
Flash Lamp Annealing – A New Approach to Surface Engineering Challenges

Jörg Neidhardt[1], **Thomas Preußner**[1], **Marcel Neubert**[2]

[1]Fraunhofer Institute for Organic Electronics, Electron Beam and Plasma Technologies, Dresden, Germany
[2]ROVAK GmbH, Grumbach, Germany

Even though flash lamp annealing is not a new technology, commercially viable applications within the realm of coatings, thins films and surface engineering are still largely unexplored. Instead, static annealing procedures and/or deposition at elevated temperatures are frequently employed to adjust materials and/or surface properties for given applications. However, the applicable temperatures are often limited by substrate materials as well as unwanted side effects, such as diffusion, and/or economic considerations. Therefore, rapid (<50 ms) thermal annealing processes are an alternative technology enabling thermal treatment of functional layers and coatings. The limited penetration depth of the imposed heat can even allow the thermal treatment on temperature sensitive substrates. By superimposing periodic flashes and moving the substrate perpendicular to the lamp axis, large areas can be continuously and homogeneously annealed. Recent developments transferred this technology from lab-scale to a pilot scale level and even beyond providing a reproducible and effective large area treatment in air, controlled atmosphere or even in-line with vacuum processes. In comparison to conventional furnace processing, a superior energy efficiency is demonstrated at a comparatively small machine footprint at high throughput.

This talk introduces the principles of flash lamp annealing as well as the available equipment options for (large area) thin film and surface treatment for up to pilot-level. These will be related to selected applications and use cases explored at Fraunhofer FEP over the last decade. Examples are crystallization of large area TCO coatings in combination with inline FLA on rigid and ultra-thin bendable glass, treatment of Ag-based lowE multilayer stacks, formation of antimicrobial as well as plasmonic nanoparticles, surface activation of TiOx thin films as well as toughening of plain glass surfaces. Furthermore, the FLA process itself is in the focus of research and commercial validation. Therefore, topics like long-term stability, scalability and energy efficiency will also be addressed.



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Electron Beam Processes

The 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-power electron beam technology is well established for coating, melting and welding. The EB TAC focuses on the development of new coatings and coating processes using electron beam technology, as well as new e-beam components such as power supplies and beam control systems to enhance material properties. Of particular interest are equipment improvements 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 electron beam technology especially for industrial applications and is looking for papers on the topics listed below:

- Advances in high-rate PVD by electron beam evaporation (EB-PVD) such as for thermal barrier coatings.
- Electron beam processes for the production of novel materials
- Additive manufacturing with electron beam
- Thermal processes (welding, hardening, refining, drilling)
- Non-thermal processes (curing, sterilization, crosslinking, gas conversion)
- New applications for PVD by electron beam evaporation for photovoltaics, concentrated solar, energy production (fuel cells), energy storage (batteries) and high efficiency lighting,

- Modeling 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 of electron beam processes

INVITED SPEAKER:

Innovative Approach to Low-Temperature Deposition of Ceramic TBC Coatings Using Hollow Cathode Plasma in the EB-PVD Process

Andrzej Nowotnik, Grzegorz Maciaszek, Damian Nabel, Krzysztof Cioch
Rzeszow University of Technology,
Rzeszow, Poland

In response to the growing demands of the aerospace industry, especially in the context of post-pandemic recovery, there is an urgent need to implement advanced technologies that combine energy efficiency with high-performance gas turbines. One of the critical components in this process is the development of advanced thermal barrier coatings (TBC) on superalloys.

This presentation will discuss the results of research on a new methodology for depositing ceramic coatings from yttrium-stabilized zirconia (YSZ) on newly developed PDC bond coats, which require lower deposition temperatures compared to traditional aluminide or MeCrAlY bond coats. The innovation of the proposed solution lies in the use of hollow cathode (HC) plasma in the EB-PVD process, which enables the formation of columnar ceramic coatings at temperatures up to 200°C lower than standard, while still meeting the requirements for TBC applications.

The presentation will cover both the theoretical and practical aspects of this process, including the technical challenges associated with integrating HC plasma, electron beam interactions, and magnetic field shielding. Results from 4D-Beam simulations, along with initial morphological analyses of coatings deposited at lower temperatures, will demonstrate the effectiveness of this new approach, opening up new possibilities for the advancement of thermal barrier coatings in the aerospace industry.

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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

INVITED SPEAKER:

Reactive Sputtering of High Entropy Alloy Nitride, Carbide, and Oxide Thin Films by HiPIMS: Effect of Reactive Gas Flow Rates

Jyh-Wei Lee[1,2,3,4], Bih-Show Lou[2,5]
[1]Ming Chi University of Technology, New Taipei, Taiwan
[2]Chang Gung University, Taoyuan, Taiwan
[3]National Tsing Hua University, Hsinchu, Taiwan
[4]National Taiwan University of Science and Technology, Taipei, Taiwan
[5]New Taipei Municipal TuCheng Hospital, Chang Gung Memorial, Taiwan

The pioneering work on bulk high entropy alloys (HEAs) by Prof. Yeh and coworkers in 2004 has opened a new field of material research due to their unique properties, such as high strength, good ductility, excellent wear resistance, good thermal stability, decent corrosion resistance, and anti-radiation ability of HEAs. Meanwhile, the HEA thin films deposited by the magnetron sputtering technique have been widely studied because of their better corrosion resistance, oxidation resistance, mechanical properties, and wear resistance than the traditional alloy substrates. In this study, the TiZrNbTaFeN HEA nitride, AlCrNbSiTiC HEA carbide, and VNbMoTaWO HEA oxide thin films were fabricated by reactive high power impulse magnetron sputtering (HiPIMS) technique, respectively. The relationships between the nitrogen, acetylene, and oxygen gas flow ratios, respectively, and the chemical compositions of TiZrNbTaFeN nitride, AlCrNbSiTiC carbide, and VNbMoTaWO oxide thin films were studied to understand the multicomponent target poisoning effect. Effects of acetylene and oxygen gas flow ratios on the intensities of optical emission spectrometry signals of high entropy alloy elements (AlCrNbSiTi and VNbMoTaW), carbon, and oxygen species were explored. Meanwhile, the influence of nitrogen, acetylene, and oxygen gas flow ratios on the phase structures, microstructures, and mechanical and electrochemical properties of TiZrNbTaFeN nitride, AlCrNbSiTiC carbide, and VNbMoTaWO oxide thin films were further explored. The phase structures of TiZrNbTaFeN films changed from amorphous to FCC when the nitrogen gas flow ratio and the nitrogen content were higher than 10% and 32%, respectively. The hardness of TiZrNbTaFeN thin films was enhanced from 9.8 GPa to 36.2 GPa by adding 32 % N due to the formation of metal-nitride phases and solid solution strengthening effect by various elements. The oxygen concentrations of VNbMoTaWO films increased from 73.6 to 77.5% as the oxygen gas flow ratio increased from 33% to 50%. The electrochemical activity of the VNbMoTaWO films increased with increasing oxygen contents. The vanadium redox flow battery (VRFB) equipped with the VNbMoTaWO modified graphite electrode exhibited a superior energy efficiency of 80.50 % at a current density of 100 mA cm^{-2}, outperforming the VRFB with the unmodified graphite electrode by 9.49%. For the AlCrNbSiTiC carbide films, the hardness increased from 16.5 to 18.2 GPa and then decreased to 11.6 GPa as the acetylene gas flow rate increased, and carbon content increased from 42.6 to 55.7 and then 78.4%. The corrosion resistance of AlCrNbSiTiC film against the 0.5 M sulfuric acid increased with increasing carbon content. We can conclude that by properly controlling chemical compositions and reactive gas flow ratios, we can produce functional high entropy alloy thin films with good performance and specific properties, which can be further applied in various environments.

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Large Area Coatings

A key factor in driving down the cost of production is highly correlated to the throughput or scale of production. In thin film processes the substrate width or total area being processed per batch or per substrate is the key metric. Scaling up to High Volume Manufacturing (HVM) has enabled tremendous cost reduction in the production of Architectural Glass, 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 or larger.

Scalability comes with unique challenges. To operate a plant at HVM scales, the process must be stable over long operation time and reproducible, capable of depositing or etching materials homogeneously over large areas and at high rates. Film properties (such as stoichiometry, stress, or conductivity) must be precisely controlled to achieve performance as in a lab scale environment. This is true across all types of coatings whether they are used for optics, barriers, scratch resistance, or transparent conductors to name a few. Furthermore, complex decisions involve inversely proportional factors of Capital Expenditures (CapEx) versus Cost of Ownership (CoO). Further factors include facility constraints and requirements and product yield.

The Large Area Coating Session is the forum where scholars and industry experts present the scalability of thin film vacuum science. The talks may cover the limitations, challenges, failures, and success of moving from lab scale or pilot production up to High Volume Manufacturing. Session topics will cover:

- Scale-up and process Transfer: challenges and good practices,
- Understanding process and nanoscale: Physics and chemistry of thin films and their interfaces, analytical equipment in-/ex-situ, in-/off-line,
- Coating of 3D substrates: enabling technologies,
- Functional coatings at temperature sensitive plastic substrates or thin glass: hard coating, barrier properties, adhesion, and stress management,
- Architectural, Automotive, Aerospace, and Display thin film materials, processes, equipment for heat reflecting, hydrophobic/hydrophilic, de-icing, and anti-static functions,
- New Large Area Trends and Solutions: coatings for semiconductor industry at glass, patterned or integrated structures for bird friendly glass, mobile signal transmission, sound insulation,
- "Low-carbon footprint coatings" and required technologies for inside/outside of vacuum, and
- Automation of coating processes, as well as assisting tools: physical vs statistical models, ML, AI.

INVITED SPEAKER:

Trends in Large Area Coating for Glazing Applications

Paul C. Mogensen
Saint-Gobain Glass France, Courbevoie, France

Every year, worldwide, hundreds of millions of square meters of float glass is coated with thin films of inorganic materials to add functions to glass used in a wide range of building and automotive applications.

Most of this glass is coated by a physical vapor deposition process called magnetron sputtering, which allows the deposition of high homogeneity, nm scale thin films on large substrates of tens of square meters in an industrial process.

This technology has developed in parallel with an increasing complexity of products and an increasing focus on the energy performance of glazing, with a move from single pane to double and triple glazing and the development of a wide range of high-performance low emissivity and solar control coatings.

This presentation will provide an overview of large area glass coating, focusing on sputtering based process and technology. The major technical challenges associated with this technology will be presented and the development of the technology reviewed from the point of view of a glass manufacturer.

Some of the approaches where we can use digital tools and data and analysis to enable the rapid and effective optimization of the production of coated glass products will be presented.

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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:

- 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.
- Preconditioning and cleaning issues; refurbishment approaches for optical coatings.
- Coatings on sapphire, polymers or other special substrate materials, Coatings for complex 3-D optical devices.
- Applications in non-traditional wavelengths, from EUV to IR (e.g., IR thermal imaging).
- Optical Coatings for mobile electronics (e.g., fingerprint sensors, cameras, displays, touchscreens, etc.).
- Optical coatings for wearable technology, including AR/VR.
- 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 and integrated photonic device applications.
- Optical coatings for astronomy and aerospace.
- Optical coatings for quantum optics.

INVITED SPEAKERS:

Chromogenic Properties of Molybdenum Trioxide (MoO_3) Thin Films

Pandurang Ashrit
Université de Moncton, Moncton, NB, Canada

Various transition metal oxides (TMO) are very well known for their efficient chromogenic properties, i.e. reversible coloration under the influence of external forces such as electric field (electrochromic), light (photochromic) and heat (thermochromic). Amongst the TMOs, Tungsten trioxide (WO_3) has attracted the attention of researchers worldwide due to its efficient electrochromic properties. Many applications such as smart windows and switchable rare view mirrors based on this material have been in use for quite some time. However, Molybdenum trioxide (WO_3) which shows an equally efficient electrochromic as well as photochromic effect has not been studied to the same extent. In the present work, we have carried out a detailed study of the photochromic and electrochromic properties MoO_3 films prepared under different conditions. The electrochromic effect is studied under a laboratory developed dry lithiation method and the photochromic effect, under UV irradiation. A systematic study of the coloration as a function of the nanostructure, quantity of lithium inserted and the duration of UV irradiation has been carried out. In addition to the optical, structural and electrical characterization, an attempt has been made to correlate the two effects through Hall effect mea-

surements and the determination of the free electron density involved in the two processus. A comparison between the coloration behavior of MoO_3 and WO_3 has been made. The absorption band in WO_3 films spans the higher visible and near infrared region leading to its blue coloration. The coloration of MoO_3 films, on the other hand, is centered in the visible region giving a dark appearance which is advantageous for display applications. The photochromic coloration in MoO_3 films is also found to be more stable making it a potential candidate for memory applications.

Optical Coatings and Plasma Processes for Quantum Computing Hardware

Ulrike Schulz[1], **Astrid Bingel**[1], **Anne Gaertner**[1], **Nancy Gratzke**[1], **Thomas Fricke-Begemann**[2], **Gregor Matz**[2], **Friedrich Rickelt**[1]
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The generation and manipulation of "qbits" is the basic requirement for building quantum computers. At present, various ways of generating qubits are being pursued in parallel. One of them is Rydberg atoms which can precisely be trapped to carry out controlled long-range and tunable interactions. Quantum computing experiments with Rydberg atoms require an ultra-high vacuum (UHV) surrounding. A limited number of atoms is extracted from a gas cloud and fixed with optical tweezers. For this experimental setup an UHV fused silica cell has been developed. Various laser beams are focused through the cell walls to the center of the cell. In addition, a newly developed objective will be attached to one of the cell windows to manipulate the atomic states. Highly specialized AR-coatings are in development to address the laser wavelengths from the UV to the NIR spectral range and for the incidence angles according to the geometric requirements. The coatings for demanding phase shift specifications, high light incidence angles and for the curved lens surfaces can essentially be improved by using sub-wavelength nanostructured layers with low effective refractive index as the top-layers of multilayer interference coatings. However, organic vapor deposition materials are used together with silica in the manufacturing process of the nanostructured layers. Carbon containing residuals must be removed as completely as possible after overcoating the structures with silica in order to achieve low absorption values in the UV range and high laser stability. Various procedures were successfully tested for this purpose. The coatings were deposited at first on separate fused silica sheet material. Bonding technologies for fused silica had been developed and tested in parallel. Cleanability, outgassing and mechanical resistance of the nanostructured layers was investigated to define a practical handling procedures for manufacturing the cell. The presentation provides an overview of the surface technologies required to manufacture the cell and the objective lens.

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Organic and Perovskite Electronics

Organic and organometal-halide perovskite materials have emerged in recent years as important alternatives to traditional inorganic materials for optoelectronic devices. These novel materials provide huge potential benefits such as reduced-cost processing, compatibility with nonconforming and flexible substrates, and tunable color properties, allowing for a range of interesting applications. Organic light-emitting diodes (OLEDs) have become widespread commercially in displays, with improvements in brightness and contrast ratios, as well as interesting form factors such as thin and flexible devices. Perovskite-based photovoltaic devices are attracting considerable interest as a potentially disruptive energy technology, with power conversion efficiencies similar or in excess of those seen in current panels but with simpler processing requirements.

Like any interesting and fast-growing field of technology, the achievements, and benefits in the field of organic/organometallic electronics and optoelectronics don't come without their own challenges. The inherent properties of these materials make them challenging to deposit using a vapor-phase technology:

- The materials are typically prone to decomposition at relatively lower temperatures which has led to development and use of evaporation sources with complex set of features and temperature control mechanisms.
- Additionally, some of the active films in the device architecture require precise rate control algorithms to achieve the required host-dopant compositions, which in turn also require critical hardware considerations.
- Materials are mostly sensitive to moisture and oxygen, so the protection from these elements during and post-fabrication is critical.

These factors require a deep understanding of material properties, study and treatment of substrates and interfacial properties of layers, considerations of the bottlenecks towards device fabrication, encapsulation techniques and thin-film deposition system solutions, and combined they result in an exciting process in this field of study.

This session invites papers addressing materials and processing challenges related to these technologies involving vacuum and vapor-based techniques such as evaporation, sputtering and ALD. We encourage submissions on practical approach towards fabrication of organic devices and emphasizing on key parameters to consider during the design and building steps. Discussion on challenges and opportunities in scaling up processes for industrial production will be integral to the symposium.

The session will include discussions on research on the following device types:

- Organic & Perovskite Light-Emitting Diodes (OLEDs & PLEDs)
- Organic & Perovskite Photovoltaics (OPV & Perovskite PV)
- Hybrid Inorganic/Perovskite Tandem Photovoltaics
- Organic Thin-Film Transistors (OTFTs & OFETs)
- Organic Memory Devices & Spintronics
- Organic Sensors
- Flexible and Wearable Electronics
- Building-Integrated Photovoltaics (BIPV)

INVITED SPEAKERS:

Vacuum Coating of Metal Halide Perovskite Thin Films for Photovoltaic Applications: Challenges and Opportunities

Zhaoning Song, **Yanfa Yan**
The University of Toledo, Toledo, OH

Metal halide perovskite solar cells have experienced a rapid learning curve in the past decade and have achieved power conversion efficiencies of more than 26%, surpassing those of established thin-film solar cells and approaching the record of crystalline silicon photovoltaics. As this new promising photovoltaic technology progresses toward commercialization, a critical question is how to develop high-throughput, cost-effective, and reliable production methods for depositing high-quality perovskite thin films. Among various approaches, vacuum coating methods have their unique advantages and are most relevant to semiconductor manufacturing. However, there are still significant obstacles that limit the commercial production of halide perovskite thin films using industrial vacuum coating techniques.

This presentation provides a compendious overview of vacuum coating techniques for fabricating efficient and stable perovskite solar cells. It will start with a brief review of the evolution of coating techniques for perovskite solar cells and the status of the field. The growth mechanisms of perovskite thin films through solution- and vacuum-based routes and their pros and cons will be summarized and compared. We will then highlight the challenges pertinent to vacuum coating of perovskite films and review recent advances in addressing these issues. Finally, we will provide insights into the outlook of the industrialization of vacuum coating processes for producing efficient perovskite solar cells in the future.

Engineering Organic and Metal-halide Perovskite Thin Films and Devices via Vapor Processing

Russell J. Holmes
University of Minnesota, Minneapolis, MN

Displays based on organic light-emitting devices (OLEDs) are increasingly ubiquitous for mobile and wearable applications, with increasing growth in augmented/virtual reality and lighting. High performance is enabled in part by processing using high vacuum thermal evaporation (VTE), offering high uniformity and compositional control. However, vapor processing also offers a finer level of property optimization in terms of control over molecular orientation. While the films used in OLEDs are generally amorphous, their electrical and optical performance is still subject to the average molecular orientational in thin film, a parameter that can be manipulated through choice of processing conditions. In parallel, there is increasing interest in applying vapor processing for the fabrication of metal-halide perovskite thin films and devices. Perovskites are among the most promising active materials for the realization of efficient, low-cost, photovoltaic modules. These often hybrid organic-inorganic materials present unique challenges for vapor processing, in-part due to the need to controllable vaporize organo-halide compounds. This talk will center around two primary focus areas. First, we will examine recent efforts to engineer organic semiconductor thin film behavior and OLED performance through choice of processing conditions that tune average molecular orientation. Specific interest is in how preferred molecular orientation impacts thin film birefringence, optical outcoupling efficiency, peak device efficiency, and device degradation. Second, we will discuss the application of vapor transport deposition (VTD) to the processing of hybrid organic-inorganic perovskites, and the impact on subsequent application of these films in photovoltaic cells. This talk will conclude with a discussion of how vapor processing of these materials opens new axes for engineering behavior, and future opportunities for advances in vapor processing of both materials classes.

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Plasma Processing and 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.
- 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.

INVITED SPEAKERS:

Data-Integrated Modeling for Memristive Device Processing

Jan Trieschmann[1], Rouven Lamprecht[1], Tobias Gergs[1], Christian Stüwe[1], Luca Vialetto[1,2], Sahitya Yarragolla[1,3], Finn Zahari[1], Richard Marquardt[1], Thomas Mussenbrock[3], Hermann Kohlstedt[1]
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Emerging technologies for micro-/nanoelectronics devices, in particular with application in novel neuromorphic computing, heavily rely on plasma processing. Engineering such devices continuously requires a more precise process control. This may be attained with a physical knowledge-based design of related plasma processes, taking into account the properties of the corresponding devices. Modeling and simulation of such surface-facing process plasmas, paired with measurement data of the fabricated devices, may enable physical interpretation and guide the process design. Despite the ever-increasing compute power, however, a consistent simulation at all levels is difficult due to the extremely complex dynamics of multi-component plasmas interacting with bounding surfaces. Hierarchical coupling of the manifold physico-chemical processes may be realized through unbiased data-driven surrogate models. These are derived from high fidelity data obtained from physical models at the lower scales (e.g., atomistic simulations of the surface kinetics). Moreover, data-driven approaches correlating experimental device characteristics with local conditions during processing may open a path in understanding and optimizing the plasma process. Thus, a data-driven link between global process quantities (e.g., pressure, voltage, current) and microscopic quantities (e.g., thin film composition, electrical properties) may be devised. The outlined approach is discussed at the example of thin film memristive devices, processed through reactive sputter deposition. A model framework including plasma simulations, a surface kinetics model, and a data-driven correlation of memristive device properties is described. Therein, individual model components are replaced or augmented by machine learning surrogate models, fostering a correlation and interpretation of the device characteristics with respect to intrinsic plasma parameters. We suggest that such a hybrid physical and data-driven model is a versatile and widely applicable tool in plasma processing.

Plasma Nitriding and PACVD Coating As Complementary Technology for PVD for Big Industrial Applications

T. Mueller[1], A. Gebeshuber[1], Christian Übleis[1], Christoph Lugmair[1], D. Heim[2], C. Forsich[2]
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Plasma nitriding and PACVD (plasma assisted CVD) are well known surface treatment technologies and are industrially established for decades. Main applications can be found in the fields of automotive, aerospace, tools and dies businesses as well as in new sustainable energy solutions like wind power gear boxes.

For increasing efficiency and life time as well as for reducing numbers of premature failures of industrially used components - which is directly affecting the maintenance, reliability, and operating costs of installed / used equipment - a variety of thermal and thermochemical (hardening, carburizing, nitriding, etc.) and coating technologies (PVD, PACVD) are used. Results are designed stress profiles (thermochemical treatment) to adjust fatigue behaviour and coating like DLC, Cr plating,… to design corrosion and wear properties.

However, besides these requirements a further new challenge is the trend to huge dimensions for engineering parts like high power wind turbines especially for offshore wind turbines. The increasing importance of size and therefore uniform coating of big complex shaped gears/bearings and the change in used materials versus temperature sensitive steel grades ("zero distortion") pushed new developments to reduce coating temperature and design large area plasma nitriding/PACVD coating processes and combination of these technologies. Many of these parts are limiting the use of standard heat treatment/coating equipment and demand new and tailormade furnaces, coaters and processes.

Call for Papers

Abstract Submission Deadline
Guaranteed Conference Participation: February 14, 2025

It will be demonstrated on an example in the field of wind power industry how the combination of high surface engineering requirements on wear, friction, distortion, fatigue with reliable and consistent new heat treatment/coating equipment can be realized.

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Process Monitoring, Control, and Automation

The fourth industrial revolution is steering manufacturing towards full automation. Producers seek robust vacuum process monitoring, control, and automation solutions. They hold the key to any attempt to achieve the necessary level of industrial automation. The bonuses of successful automation include higher production rates, lower waste of materials and 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:

- Embedded sensors & actuators,
- Cyber-physical monitoring and control systems,
- Holistic process control methods and systems, and
- Robotic automation.

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 vacuum coating plants. Contributions highlighting particular challenges or constraints and talks detailing cutting-edge control and automation methods and their physical and digital embodiments are particularly well suited to this session.

INVITED SPEAKERS:

AI and In Situ Diagnostics Enabled Autonomous PLD System for Fast Thin Film Material Fabrication

Sumner B. Harris[1], **Arpan Biswas[2], Daniel T. Yimam[1], Ruth Fajardo[3], Feng Bao[3], Christopher Rouleau[1], Alexander Puretzky[1], Kai Xiao[1], Rama Vasudevan[1]**
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Advancing thin film fabrication systems towards autonomous machines that integrate the synthesis process controls with artificial intelligence (AI) and in situ diagnostics promises to enable the exploration of large parameter spaces for thin film optimization at rates beyond what is possible with human operators alone. In this talk, I will discuss the key challenges for enabling AI-driven pulsed laser deposition (PLD) platforms and the solutions we are developing at the Center for Nanophase Materials Sciences (CNMS). I will describe PLD systems with two different approaches for AI-driven PLD: a cluster system approach with robotic, in vacuo sample transfer to characterization stations, and a stand-alone approach with rotary sample exchange and real-time optical diagnostics. I will then discuss the first demonstrated autonomous PLD synthesis experiment, in which we optimized the crystallinity of ultrathin WSe_2 films using in situ Raman spectroscopy as feedback to Gaussian process regression with Bayesian optimization algorithms. This effort demonstrated at least a 10x increase in throughput over tradition PLD workflows and autonomously discovered the growth windows with sparse sampling of the parameter space. Next, I will show that deep learning with intensified-CCD image sequences of the plasma plume generated during PLD can be used for anomaly detection and the prediction of thin film growth kinetics. The predictive capabilities of plume dynamics on the kinetics of film growth or other film properties prior to deposition provides a means for rapid pre-screening of growth conditions for the non-expert, which promises to accelerate materials optimization with PLD. Finally, I will discuss on-line Bayesian state estimation methods for model-based real-time control over synthesis using optical reflectivity.

Critical Subsystem Suppliers: Enabling Technologies for the Next Generation of Advanced Vacuum Processing Equipment

John West
Yole Group, Villeurbanne, France

Vacuum processing equipment represents 45% of all expenditure on wafer fab equipment (WFE) used to manufacture semiconductors. This means that in 2024, out of a total $110Bn semiconductor equipment market, $50Bn was spent on vacuum deposition and etch tools. The suppliers of WFE are well known, and they generally take much of the credit for developing the tools that enable the industry to keep pushing the boundaries of what can be produced.

What is less well-known is that suppliers of the critical subsystems and components used on vacuum-related equipment play a significant role in keeping the industry on track. Many enabling technologies originated from these suppliers, and they have been instrumental in developing higher-performance products and new capabilities.

To put this into perspective, in 2024, suppliers of vacuum-related subsystems and components generated $18Bn in revenues. Approximately $11Bn was for products related to new tool shipments, and a further $7Bn was for replacements in the field. These are big numbers; on average, 10% of these revenues are being plowed back into R&D.

This presentation explores the relationship between suppliers and buyers, how this has evolved, and how suppliers can ensure their continued success in providing the enabling technologies for the next generation of advanced vacuum processing equipment.

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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 of coatings deposited with vacuum processes, the characterization of their properties related to wear, friction, and corrosion, and to assess their protection of the receiving components, such as cutting and forming tools, engine components, 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 co-operation between market specialists, universities, suppliers, manufacturers, 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 to the participants in this session.

Today's global landscape is changing rapidly and will drive many new application developments that will 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 prefabricated sheets
- Corrosion protective coatings (e.g. Zn:Al) on large-area surfaces
- Electroplating replacements by vacuum deposited coatings

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

Call for Papers

Abstract Submission Deadline
Guaranteed Conference Participation: February 14, 2025

INVITED SPEAKERS:

CVD-Diamond Coatings for High Performing Tools and Components

Christian Stein, Markus Höfer, Sarah Baron, Markus Armgardt, Daniel Schulze, Tino Harig, Volker Sittinger
Fraunhofer Institute for Surface Engineering and Thin Films IST, Braunschweig, Germany

Diamond has fascinated mankind for centuries due to its unique appearance and outstanding mechanical, electrical, thermal and chemical properties. For heavy-duty components and high-performance cutting and forming tools, the enormous hardness of up to 10,000 HV, the corresponding high wear resistance and the chemical inertness in contact with many workpiece materials offer desirable advantages for innovative products with a long service life. However, making diamond materials technically feasible for industrial applications at acceptable production costs is a major challenge. A very material- and cost-efficient option is the deposition of comparatively thin diamond coatings with typical thicknesses ranging from a few microns to a few tens of microns by CVD technologies. Hot-filament CVD (HFCVD) is commonly used to economically coat complex tools and large machine components. Fully automated HFCVD systems can coat areas up to 1000 × 500 mm^2. Possible base materials include cemented carbides, ceramics (especially SiC, Si_3N_4, AlN), refractory metals, silicon, quartz and sapphire. For the successful application of diamond coatings, the entire process chain must be considered, starting with component/tool design and material selection, through cleaning, pre-treatment and seeding, to coating design and deposition process. This presentation will give an overview of different types of diamond coatings, such as micro- and nanocrystalline diamond, the associated HFCVD production technology, possible options and given limitations. Particularly for tools, a key aspect is to achieve good diamond quality and adhesion on cemented carbide, which is currently the most commonly used base material. The conventional treatment sequence for the coating of cemented carbide involves the reduction of the binder in the near-surface region by chemical etching, since elements such as Co, Ni and Fe are detrimental to the nucleation and growth of diamond. As an alternative to etching treatments, interlayer systems that act as a barrier to the diffusion of binder elements are discussed. Finally, various industrial applications of diamond coatings for tools in cutting and forming operations as well as for high-end mechanical face seals will be shown and present and future research topics will be presented.

The Astonishing Diversity in the World of 2D Materials – Lessons Learned from MXenes and Transition Metal Carbo-Chalcogenides for Solid Lubrication

C. Gachot
Technische Universität Wien, Vienna, Austria

Tribology, the science of friction and wear, is gaining more public attention as an efficient, reliable, and sustainable operation of machine elements is becoming increasingly important. This is relevant for almost all industrial sectors since machines and mechanical systems with moving parts in relative motion are vital for most systems. According to Holmberg and Erdemir, 23% of the world's energy consumption originates from tribological contacts. Lubricants are commonly introduced between the rubbing surfaces, thus minimizing friction and wear. The most common lubricants are petroleum-based mineral oils in liquid form. However, diminishing oil resources, the need for ever-lower frictional losses, and higher demands on the lubricants in terms of resistance against extreme conditions such as high temperatures or low environmental pressures push liquid lubricants to their limits. It is expected that new lubricant technologies will contribute greatly to a reduction of friction and wear such as the use of new 2D materials coatings in particular MXenes, Transition Metal Carbo Chalcogenides (TMCCs), or Black Phosphorous (BP). In this talk, examples of new 2D materials coatings will be given and discussed in light of energy savings and sustainability and their potential impact on aerospace applications.

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Quantum Computing

Quantum computing promises to harness the power of quantum mechanics to solve problems unfathomable for classical computers to resolve. Quantum computing, once a theoretical dream, is now experiencing an unprecedented surge of progress. Driven by intense research efforts, substantial investments, and collaboration across academia and industry, quantum computing technology is rapidly approaching reality with a promise to revolutionize fields ranging from materials science and drug discovery to finance and artificial intelligence. The SVC symposium aims to explore the current state and prospects of this transformative technology.

The symposium invites researchers, academics, and industry leaders to explore the cutting edge of quantum computing and share their insights on its remarkable emergence. We seek submissions on a range of topics, including:

Quantum Hardware and Software:

- Progress and challenges in superconducting qubits, trapped ion, topological, and other platforms.
- Novel device architectures and fabrication techniques.
- Algorithmic breakthroughs development frameworks and their practical applications.
- Error correction and fault-tolerance techniques.
- Benchmarking and performance analysis.

Scalability Challenges:

- Bridging the gap between quantum and classical systems.
- Architectures for large-scale quantum computing.

Applications:

- Emerging applications in materials science, drug discovery, and encryption.
- Quantum-enhanced machine learning and artificial intelligence.
- Financial modeling and risk analysis.

Impact:

- The ethical implications and impact of quantum computing on society.
- Educational initiatives and talent development for the quantum workforce.
- Commercialization and industry trends in quantum technology.

INVITED SPEAKERS:

Understanding and Surpassing Materials Challenges in Superconducting Quantum Devices

Adam Schwartzberg, Shaul Aloni, Sinéad Griffin, Yashwanth Balaji, Mythili Surendran
Lawrence Berkeley National Laboratory, Berkeley, CA

Superconducting quantum devices rely on radio frequency resonant cavities, often at the single photon level. Preserving coherence, for tangible applications, requires the fabrication of cavities with quality factors that are as high as possible. Similar to optical cavities, fabrication quality plays an important role. However, the addition of quantum device elements (e.g. Josephson Junctions) and additional loss channels present at the operational frequency (two level systems) add complex interactions that play an enormous role in achieving the required performance. To a great extent, these challenges are related to specific materials questions that are currently poorly understood for devices of this type. Research into this area is difficult due to the diversity of expertise and instrumentation needed. Materials growth, fabrication, milli-Kelvin cryogenics, and radio frequency electronics and measurement are the basic building blocks needed to understand the operational effects of materials and device fabrication choices. To this end, we at the Molecular Foundry have been building a holistic toolset for answering these questions. In this talk I will present progress on our work developing these facilities starting with our previous work to understand materials interfaces in quantum devices as a motivation, followed by the development and implementation of a new robotically controlled cluster deposition and analysis tool, and finally our progress in building our own cryogenic characterization suite. The cluster deposition tool contains four deposition stations (e-beam evaporation, reactive sputtering, and oxide and nitride atomic layer deposition), a multi-sample load-lock and glovebox, and an analytical chamber for in-vacuo characterization (XPS, FTIR, and ellipsometry) which allow us to grow a wide range of materials with clean interfaces and the ability to understand the nature of those interfaces. We combine these new growth capabilities with advanced materials characterization and nanofabrication expertise to explore the many facets of this open question. Additionally, I will discuss AI/ML techniques which we are developing to be implemented autonomously with the cluster tool and will provide new pathways for solving complex materials challenges.

High Quality Superconducting Resonators from a Magnetically-Contaminated Sputter System

Maciej W. Olszewski[1], Jadrien T. Paustian[2], Tathagata Banerjee[1], Haoran Lu[1], Aleksandra Biedron[1], Jorge L. Ramirez[4,5], Zhaslan Baraissov[1], David Muller[1], Ivan V. Pechenezhskiy[2], Daniel Ralph[1,6], Gregory D. Fuchs[1], Corey Rae H. McRae[4,5], Britton Plourde[7], Valla Fatemi[1]

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Magnetic impurities are known to rapidly degrade superconductivity. For this reason, physical vapor deposition chambers that have been used previously for magnetic materials have generally been avoided for making high-quality superconducting resonator devices. In this talk, we show by example that such chambers can in fact still be used following some simple steps to minimize contamination. With niobium films sputtered in a chamber that has been and continues to be used for magnetic materials, we demonstrate compact, 3-µm gap, co-planar waveguide resonators with low-power internal quality factors surpassing one million. We additionally tested three methods of preparing silicon substrates prior to deposition, including anneal steps in the chamber at 700° C, finding comparable quality factors. We are using this chamber to test various novel materials for superconducting resonators and Josephson junctions.

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Selective Atomic Scale Processes

Selective processes with atomic and molecular resolution have been attracting considerable attention during the last few years due to their capability to reach sub-10 nm resolution in semiconductor fabrication and a great potential for 3D-patterning.

After the breakthrough of atomic layer deposition (ALD) of dielectrics about a decade ago and revival of interest towards atomic layer etching (ALE), the research efforts to a large extend shifted to area-selective (AS) ALD and material- topographically-selective ALE. The combination of atomically selective ALD and ALE processes not only provide high flexibility in 2D patterning in high-resolution semiconductor technology, but also allow formation of structures in 3D. Both AS-ALD and selective ALE are based on self-limiting process steps that allow extreme control of deposition or etching in a layer-by-layer fashion.

Sequential Infiltration Synthesis (SIS), alternatively called also Vapor Phase Infiltration (VPI) complements the above-mentioned layer-by-layer technologies by its ability to form 3D nanostructures by a bulk diffusion and selective chemical reactions of precursor with functional groups in polymers or block co-polymers (BCP). Highly selective reactions of precursors with e.g. carbonyl groups (C=O) in the polymer bulk allows integration of inorganic materials into the organic matrix, resulting in a hybrid material. A self-organized BCP film after the SIS will form 3D nanostructures.

The common feature of all those methods is the use of self-limiting reactions that can provide atomic-scale resolution in both vertical and horizontal directions: this property can also be complemented by selectivity in etching or deposition. Selectivity in deposition or etching may solve some of the processing challenges in the technology of nano-devices, e.g. alignment of nanometer-sized features. The high degree of control makes the selective atomic scale processes very attractive for future nano-fabrication methods.

We are soliciting both poster and oral contributions to the Selective Atomic Processes session to include the following topics:

- Fundamental mechanisms of selective atomic processes in 2D (layer-by-layer) and 3D (bulk)
- Applications of selective atomic processes
- Selective atomic processes in micro- and nanoelectronics
- Characterization of selective atomic processes
- Industrial applications and scale-ups
- Other relevant topics

Area Selective Atomic Layer Deposition for Future Microelectronics

Stacey F. Bent
Stanford University, Stanford, CA

Area selective atomic layer deposition (AS-ALD) continues to gain attention as an important method to achieve nanoscale features at the sub-10 nm length scale, especially toward future microelectronics. Tuning the surface chemistry of a substrate can be used to either inhibit or enhance ALD nucleation, leading to selective deposition. A key strategy for AS-ALD is the use of inhibitors, ranging from long-chain self-assembled monolayers to small molecule inhibitors, which can alter the native surface reactivity to block nucleation. This inhibition approach enables good selectivity in AS-ALD of thin films on a variety of substrate materials, including dielectrics and metals. Also critical is the role of the ALD precursor in influencing selectivity. This talk will draw from multiple AS-ALD systems to consider what features of inhibitors and ALD precursor affect selectivity in AS-ALD, and how to design for optimal selectivity. We show that precursor size can have a significant influence on the ability of inhibitors to prevent ALD nucleation. We will also share examples that highlight the influence of other effects beyond molecular size. Finally, we will look to what is next, including recent developments and a discussion of emerging challenges and opportunities for AS-ALD.

TAC Chair:
Ivan Maximov, *Lund University,* ivan.maximov@ftf.lth.se

Call for Papers

Abstract Submission Deadline
Guaranteed Conference Participation: February 14, 2025

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 enable 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.

INVITED SPEAKER:

Development of Highly Sensitive Short-Wavelength Infrared Avalanche Photodiodes

Seunghyun (Jacob) Lee
University of Texas at Arlington, Arlington, TX

The increasing demands in the imaging and sensing industries require sophisticated systems capable of precise data acquisition. infrared (IR) optoelectronic devices are at the core of these advancements. My research significantly advances the field of IR optoelectronics through an integrated design approach, combining advanced epitaxial growth, heterostructure design, and bandgap engineering techniques. This presentation will specifically focus on the development of IR avalanche photodiodes (APDs), which are essential for the receiver part of optoelectronic systems. These devices provide internal gain and high-speed operation, enhancing the performance of photonic systems in diverse environments. The device architectures for APDs that I will discuss have been tailored for eye-safe LiDAR and greenhouse gas sensing applications. This talk will discuss the technological innovations in APD development that enhance their performance beyond the current state-of-the-art APD technologies.

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

This session is 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 is of critical importance to the SVC's international stakeholder base.

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.

TAC Co-Chairs:

Ralf Bandorf, *Fraunhofer-IST,* ralf.bandorf@ist.fraunhofer.de
Herbert Gabriel, *PVT Plasma und Vakuum Technik GmbH,* h.gabriel@pvtvacuum.de
Lucia Mendizabal, *Tekniker,* lucia.mendizabal@tekniker.es

Two-Dimensional (2D) Materials and Heterostructures – Applications, Large-Scale Growth and Advanced Characterization

Two-dimensional (2D) materials with thicknesses of only several molecular layers realize the ultra-thin limit of crystalline materials. This material class demonstrates unique combinations of electronic, optical, mechanical, and thermal properties owing to their anisotropic structure. Applications leveraging these functionalities include transistor and memory technologies, wearable electronics, photovoltaics, and sensors. Significant efforts focused on controlled, large-area synthesis of 2D materials and integration into diverse device constructs are the focus of multidisciplinary teams worldwide. In addition to new applications, development of new approaches to understand the properties of 2D materials at the ultra-thin limit and when integrated with other materials is the topic of vital and ongoing research.

The objective of this session is to discuss advances in synthesis and fabrication of 2D materials and devices to address impactful applications, with a special emphasis on large-scale integration.

Processes of particular interest include controlled low-temperature synthesis of 2D materials, chemical vapor deposition, sputtering, and atomic layer deposition. Talks on new device designs integrating crystalline and polycrystalline 2D materials and their heterostructures for electronic and photonic device applications are welcome. Advanced characterization methods, especially in situ and/or high-throughput methods focused on the structure-property correlation in 2D materials are also topics for this session.

Topics will include:

- Large-scale synthesis of 2D materials and their heterostructures
- Low-temperature synthesis
- New 2D device concepts
- Scalable device fabrication and heterogeneous 2D materials integration
- In situ and high-throughput characterization techniques
- 2D device reliability and failure mechanisms
- Industry-related 2D materials activities

INVITED SPEAKER:

2D Materials for Next-Generation Electronics: From Low-Power Logic to Monolithic Memory

Deep Jariwala
University of Pennsylvania, Philadelphia, PA

Silicon has been the dominant material for electronic computing for decades and very likely will stay dominant for the foreseeable future. However, it is well-known that Moore's law that propelled Silicon into this dominant position is long dead. Therefore, a fervent search for (i) new semiconductors that could directly replace silicon or (ii) new architectures with novel materials/devices added onto silicon or (iii) new physics/state-variables or a combination of above has been the subject of much of the electronic materials and devices research of the past 2 decades. The above problem is further complicated by the changing paradigm of computing from arithmetic centric to data centric in the age of billions of internet-connected devices and artificial intelligence as well as the ubiquity of computing in ever more challenging environments. Therefore, there is a pressing need for complementing and supplementing Silicon to operate with greater efficiency, speed and handle greater amounts of data. This is further necessary since a completely novel and paradigm changing computing platform (e.g. all optical computing or quantum computing) remains out of reach for now.

The above is however not possible without fundamental innovation in new electronic materials and devices. Therefore, in this talk, I will try to make the case of how novel layered two-dimensional (2D) chalcogenide materials and three-dimensional (3D) nitride materials might present interesting avenues to overcome some of the limitations being faced by Silicon hardware. I will start by presenting our ongoing and recent work on integration of 2D chalcogenide semiconductors with silicon[3] to realize low-power tunnelling field effect transistors. In particular I will focus on In-Se based 2D semiconductors for this application and extend discussion on them to phase-pure, epitaxial thin-film growth over wafer scales, at temperatures low-enough to be compatible with back end of line (BEOL) processing in Silicon fabs.

I will then switch gears to discuss memory devices from 2D materials when integrated with emerging wurtzite structure ferroelectric nitride materials namely aluminium scandium nitride (AlScN). First, I will present on Ferroelectric Field Effect Transistors (FE-FETs) made from 2D materials when integrated with AlScN and make the case for 2D semiconductors in this application.

I will end the talk with a broad perspective on the role of novel materials and heterostructures that could turbo-charge pervasive semiconductor technologies for electronic computing.

TAC Co-Chairs:
Michael Altvater, *Blue Halo/Air Force Research Laboratory - Materials and Manufacturing Directorate*, michael.altvater.ctr@afrl.af.mil
Christopher Muratore, *University of Dayton,* cmuratore1@udayton.edu

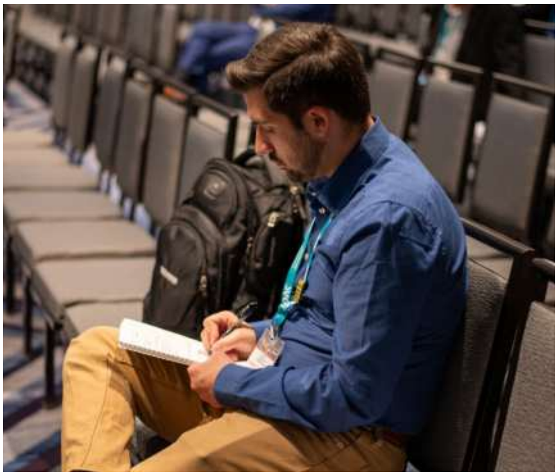
WebTech Roll-to-Roll Technologies and Innovation

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 materials, 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 (polymer, flexible glass, fabrics & non-wovens etc. Novel deposition sources and deposition modalities
- Inline process diagnostics & control (particularly for non-transparent coatings)
- Modeling and simulation of R2R processes
- Examples and approaches to utilize Artificial Intelligence (AI), machine learning, and other "Industry 4.0" modalities in R2R
- 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



INVITED SPEAKER:

Market Insights into the Role of Vacuum Coating in Roll-to-Roll Production of Flexible Devices

Helia Jalili, Poornima Kadengodlu, Saransh Parmar
BCC Research, Wellesley, MA

Roll-to-Roll (R2R) technologies are transforming the manufacturing of flexible devices by providing scalable, cost-effective solutions for producing thin, lightweight, and versatile products. With growing demand for flexible electronics such as displays, solar cells, and sensors, vacuum coating techniques like physical vapor deposition (PVD) and sputtering have become integral to R2R processes. These methods allow for precise thin-film deposition on flexible substrates, such as polymers and metals, enhancing device performance and durability.
This presentation will examine the current landscape and future trends in vacuum coating technologies within the R2R framework. We will provide insights into market growth forecasts, driven by the rising adoption of R2R technologies, and highlight innovations in deposition methods that enhance scalability in the production of flexible electronics.

TAC Chair:
Chris Stoessel, *Stoessel Consulting*, cstoessel@stoesselconsulting.net
Assistant TAC Chairs:
Neil Morrison, *Applied Materials,* Neil_Morrison@amat.com
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Wolfgang Decker, *Kurt J. Lesker Company,* wolfgangd@lesker.com
Jaime Li, *Eastman Chemical Co.,* Jaime.Li@eastman.com

Conference Calendar

Start planning now for your trip to Nashville, TN USA

SATURDAY May 17	SUNDAY May 18	MONDAY May 19	TUESDAY May 20	WEDNESDAY May 21	THURSDAY May 22
Education Program 31 Tutorial Courses					
TechCon Registration Counter Hours:		**Technical Program**			
			Exhibit Exhibit Open Hours 11 a.m. – 6:00 p.m. Tuesday 10 a.m. – 4 p.m. Wednesday		
Conference Registration Open Gaylord Opryland Hotel					

TechCon Registration Counter Hours:

Saturday, May 17	7:00 a.m. – 10:00 a.m.
Sunday, May 18	7:00 a.m. – 10:00 a.m. and 4:00 p.m. – 7:00 p.m.
Monday, May 19	7:00 a.m. – 6:00 p.m.
Tuesday, May 20	7:00 a.m. – 5:30 p.m.
Wednesday, May 21	7:00 a.m. – 5:00 p.m.
Thursday, May 22	7:00 a.m. – 12:00 p.m.

CONFERENCE REGISTRATION FEES*

Back AGAIN for 2025!

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 April 18, 2025/after April 18, 2025)

- ❏ Full Conference .... $995.00/$1095.00
- ❏ 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 2025 or join SVC on-line

Exhibitor Registration

(through April 18, 2025/after April 18, 2025)

- ❏ Exhibitor Booth Personnel and Manufacturer's Representative $0.00
- ❏ Exhibitor with Full Conference Registration .... $995.00/$1095.00

Special Events at the TechCon

- ❏ SVC Foundation 5K Run $40.00
- ❏ 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 Gaylord Opryland Hotel*

Networking Opportunities at the 2025 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.

Exhibit Networking

Enjoy more opportunities than ever to visit the Exhibit Hall on May 20-21, 2025.

- Welcome Reception
- 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 Sixth Annual SVC Foundation Casino Night on Monday, May 19, 2025. ***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.

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 TFBs 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 TFBs 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

Back by Popular Demand:

FREE Technical Conference Admission for all Exhibit Visitors May 20th & 21st | www.svctechcon.com

Networking Opportunities at the 2025 TechCon

2025 SVC TechCon Farewell Social

Date: **Thursday, May 22, 2025**

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.

2025 SVC Awards Ceremony and Welcome Reception

Date: **Tuesday, May 20, 2025**

Everyone is invited to attend

The **Awards Ceremony** will introduce and recognize the Nathaniel Sugerman Memorial Award recipient, SVC Fellow-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.

Job Board

There will be a Job Board in the lobby adjacent to the TechCon registration desk. Open positions as well as resumes of those looking for a position can be posted. Messages for interested parties, either potential employer or employee, can also be posted on the board.

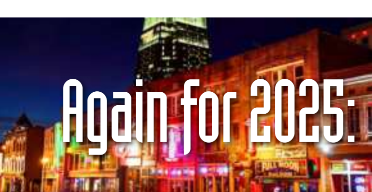
FROM THE **EDUCATION DIRECTOR**

The buzz. Or is it the vibe? Or maybe both. Regardless, it sure felt like this year's TechCon had that old familiar feeling. It can be very hard to say just what that is or what's driving it when your experiencing it. Hindsight can sometimes help. Here's one for you to consider: 344 of your friends and colleagues registered for a tutorial at this year's TechCon. That is the largest enrollment we have on record. It beats the previous high in 2019 by 20 and the decade average by more than 100. That will contribute to the buzz!

Digging a bit deeper, we find the most popular courses this year include topics associate with optical coatings such as, Advanced Design of Optical Thin Films and Thin Film Debugging and Optimization, both taught by Dr. Ronald Willey. Topics covering PVD techniques such as, Manufacture of Precision Evaporative Coatings, taught by Dr. James Oliver; Sputter Deposition for Industrial Applications, taught by David Glocker; and, Fundamentals of High Power Impulse Magnetron Sputtering (HIPIMS), taught by Dr. Arutiun Ehiasarian were also well attended. Other popular courses included topics needed to practice our craft such as, Design and Specification of Vacuum Deposition Systems, taught by Rob Belan; and, Troubleshooting for Thin Film Deposition Processes, taught by Dr. Mike Miller.

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, please reach out and let us know.

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



About Our Venue

Gaylord Opryland Resort & Convention Center, Nashville, Tennessee

Situated in the heart of Nashville, the Gaylord Opryland Resort & Convention Center allows you to hit all the high notes of Music City. The landmark Nashville hotel is just minutes from Nashville International Airport and a short drive or riverboat cruise from downtown Nashville. The resort invites you to experience a host of entertainment and fun while in Nashville. Marvel at the gorgeous gardens, sparkling waterways and cascading waterfalls. The hotel is easily accessible to Music City's legendary attractions, including the Grand Ole Opry®, Ryman Auditorium®, Wildhorse Saloon® and the General Jackson® Showboat.

The Grand Ole Opry®, the show that made country music famous, features a wide array of chart-toppers, newcomers, and living legends. The General Jackson Showboat offers cruises for special occasions and afternoon shows spiced up with authentic Southern specialties. The Wildhorse Saloon is home to Nashville's largest dance floor and the cover charge is waived for guests of Gaylord Opryland Resort. Other local attractions include: Madame Tussauds Nashville, Ryman Auditorium, Country Music Hall of Fame, Nashville Zoo at Grassmere, Cheekwood Botanical Garden & Museum of Art, Cooter's Museum and Store Nashville, Texas Troubadour Theater, The Redneck Comedy Tour, Opry Mills, Nashville Nightlife Theater, Music Valley Antiques and Marketplace, The Cowboy Church, Adventure Science Center, Andrew Jackson's Hermitage, and Lane Motor Museum.

Whether you are interested in music, history, shopping, or dining, Nashville has much to offer.

- $269.00 USD/night (resort fee included).
  A limited number of Premium rooms are available for $319.00 USD/night (resort fee included).

  Gaylord Opryland Resort & Convention Center,
  2800 Opryland Drive, Nashville, TN 37214
  615-889-1000

SVC INSTRUCTORS SCHEDULE

Saturday, May 17 – Thursday, May 22

TECHCON EDUCATION SOLVES VACUUM COATING PROBLEMS!

36 Tutorial Sessions Offered

The TechCon Education Program complements the technologies and applications featured in both the Technical Program and the Exhibit, presented by highly-respected professionals in the vacuum coating industry.

SVC Tutorials provide problem-solving and practical knowledge of vacuum coatings and processes. Return to work with solutions to your everyday vacuum coating challenges.

You do not have to register for the conference or be an SVC Member to take a Tutorial Course.

Note: All paid conference registrations include a free tutorial as well as a 30% discount on all additional tutorials that are purchased.

Full Day Course times:
9:30 a.m. – 5:30 p.m.

Half Day Course times:

AM: 9:30 a.m. –1:00 p.m.
PM: 2:00 p.m. – 5:30 p.m.

All courses are full day unless specified AM or PM

Saturday, May 17, 2025

C-103 An Introduction to Physical Vapor Deposition (PVD) Processes
Shah

C-205 Introduction to Optical Coating Design
Sargent

C-310 Sputtering
Bandorf

C-333 Practice and Applications of High Power Impulse Magnetron Sputtering
Ehiasarian

VT-201 Vacuum Systems, Materials, and Operations
O'Hanlon

Sunday, May 18, 2025

C-212 Troubleshooting for Thin Film Deposition Processes – Session 1
Miller

C-218 Advanced Design of Optical Thin Films
Willey

C-323 Fundamentals of High Power Impulse Magnetron Sputtering (HIPIMS)
Ehiasarian

C-329 Properties and Applications of Tribological Coatings
Matthews/Doll

C-338 Application of Reactive Sputtering
Bandorf/Gerdes

M-240 Basics and Applications of Electron Beam Technology for Manufacturing Processes ***PM***
Saager

VT-203 Understanding and Using Residual Gas Analyzers
O'Hanlon

Monday, May 19, 2025

C-110 Materials for PVD Applications NEW!
Pernagidis/Ghailane

C-220 Introduction to Two-Dimensional Materials ***AM***
Muratore

M-110 Introduction to X-Ray Photoelectron Spectroscopy ***AM*** NEW!
Linford

M-140 Mass Flow Controllers: Fundamentals, Troubleshooting, and Calibration ***AM***
Baker

M-201 Flexible Electronics ***PM***
Muratore

M-210 Introduction to Solid-State Thin Film Batteries ***PM***
Gaines

M-230 Nanoscale Heat Transfer in Thin Films and Interfaces
Hopkins

M-250 Deposition Process Simulation ***PM***
Barton

VT-240 Practical Elements of Leak Detection
Deluca

SCHEDULE

CONTINUED

Tuesday, May 20, 2025

C-210 Introduction to Plasma Processing Technology ***AM***
Baránková/Bárdos

C-214 Thin Film Debugging and Optimization ***AM***
Willey

C-230 Processing of Plastics for Better Protection, Reflection, and Decoration ***AM***
Vergason

C-306 Non-Conventional Plasma Sources and Methods in Processing Technology ***PM***
Baránková/Bárdos

C-337 ITO and Alternative TCO: From Fundamentals to Controlling Properties
Bright

M-102 Introduction to Ellipsometry ***PM***
Hilfiker

VT- 230 Design and Specification of Vacuum Deposition Systems
Belan

Wednesday, May 21, 2025

C-204 Basics of Vacuum Web Coating ***AM***
Simmons

C-217 Practical Production of Optical Thin Films
Willey

C-272 Biomedical Coatings for Antimicrobial Applications ***AM***
Hettinger/Caputo

C-316 Introduction to Atomic Layer Deposition (ALD) Processes, Chemistries, and Applications
Biyikli

C-320 Diamond-Like Carbon Coatings – From Basics to Industrial Realization ***AM***
Savva/Haubold/Keunecke/Stein/Petzold

Thursday, May 22, 2025

C-212 Troubleshooting for Thin Film Deposition Processes – Session 2
Miller

C-322 Characterization of Thick Films, Thin Films and Surfaces
Christensen

M-120 Design of Experiments for R&D
Grace

SVC INSTRUCTORS

Douglas H. Baker
is the Director of Sales & Business Development at Teledyne Hastings Instruments in Hampton, Virginia. He received his PhD in physics from the College of William & Mary in 1992. He has over 30 years of experience working with customers to solve gas flow and vacuum instrumentation challenges. In addition, Baker has worked as an engineer in research and development of new products. He is a past-chair of the Vacuum Technology Division of the American Vacuum Society (AVS) and currently serves as treasurer of the Mid-Atlantic Chapter of AVS.

Ralf Bandorf
born 1973, studied Physics at Friedrich-Alexander University Erlangen/Nuremberg, Germany and received his diploma in 1998. His work focused on preparation of metastable ironsilicides and phase characterization by LEED. In 1998 he joined Fraunhofer IST for his PhD thesis. Ralf Bandorf received his PhD in Mechanical Engineering in 2002 from Fraunhofer IST / Carolo-Wilhelmina Technical University Braunschweig, Germany. His thesis focused on sub-micron tribloogical coatings for electromagnetic microactuators. Ralf continued at Fraunhofer IST as a scientist, specifically as Project leader in Group Micro and Sensor Technology with a Focus on PVD and PACVD coatings. He worked in the field of plastic metallization for flexible circuits, piezoresistive materials (especially based on DLC), electrical conductive and insulating coatings as well as magnetic thin films. In 2007, he became Head of Group "Sensoric Functional Coatings" and since 2015 he has been Head in Group "PACVD and hybrid processes" at Fraunhofer IST. His focus is on PACVD with different excitation, plasma sources, hollow cathode processes, especially gas flow sputtering, and HIPIMS.

Ralf Bandorf is internationally recognized expert in the field of HIPIMS. He was session chair of the HIPIMS session at ICMCTF, US from 2009-2012. He has served as assistant TAC Chair at the Society of Vacuum Coaters since 2009. Ralf is the conference Chairman of the International Conference on Fundamentals and Applications of HIPIMS and Action Chair of the COST Action MP0804: Highly ionized pulse plasma processes (HIPP processes, 2009-2013), a European scientific networking activity gathering experts worldwide in the field of HIPP plasmas, especially HIPIMS.

Hana Baránková
is Professor at the Uppsala University and Research Leader of the Plasma group at the Angstrom Laboratory. She has been director and manager of several energy related projects and programs. She received her PhD in Electronics and Vacuum Technique from the Czech Academy of Science. Her primary interests are development of plasma sources and processes, innovation in coating technology, and plasma treatment of surfaces, gases and liquids. She has published over 160 scientific papers and conference contributions and holds several industrial patents on plasma systems. She is an inventor of metastable assisted deposition and co-inventor of the Linear Arc Discharge (LAD) source, the Magnets-in-Motion concept in plasma sources and Fused Hollow Cathode and Hybrid Hollow Electrode Activated Discharge (H-HEAD) cold atmospheric plasma sources. Hana Baránková has been serving 6 years on the SVC Board of Directors, and as TAC Chair of Emerging Technologies and organizer of Atmospheric Plasma Technologies session over the years. She is Secretary of SVC, Chair of the Student Sponsorship Committee, TAC Co-Chair of the Coatings for Biomedical Applications, and member of the Education and International Outreach Committees. Hana is

SVC INSTRUCTORS

2006 Mentor Award recipient for the development of numerous novel plasma sources. She acts as a consultant and is a co-founder of two companies, BB Plasma HB and BB Plasma Design AB. She teaches several courses at the Uppsala University and abroad, for example, she has taught annual courses for SVC since 1997.

Ladislav Bárdos

is Professor at Uppsala University in Sweden and Research Leader of the Plasma group at the Angstrom laboratory. He received his PhD in Applied Physics from the Czech Acad. Sci. and a Doctor of Science degree from Charles University in Prague. He was awarded the Czechoslovak State Prize for outstanding research results in the plasma deposition of thin films. He has more than 35 years of experience in the field of applied plasma physics and thin films. He has published over 200 scientific papers and conference contributions, designed several plasma sources for industry and has 15 Czech, 7 Swedish and several international patents. His primary interests are microwave plasmas, including downstream ECR and surface-wave generation, and particularly the radio frequency generated hollow cathodes and hybrid sources at both low and atmospheric pressures. Lad Bardos was Program Chair for 2009 and 2010 SVC TechCons, has been serving 6 years on the SVC Board of Directors and is member of the SVC Education and Awards Committees and Co-Chair of International outreach Committee. Ladislav is 2010 Mentor Award recipient for leading research in plasma processes. He is a co-founder of two companies, BB Plasma HB and BB Plasma Design AB. He teaches several courses at the Uppsala University and abroad, for example, he has taught annual courses for SVC since 1997.

Dennis Barton

has studied Mathematics, Engineering and Chemistry at the Universities of Magdeburg, Braunschweig and Münster. In 2013 he received his master's degree at the Institute for Physical Chemistry at TU Braunschweig. In the following years, he worked on modelling of on-surface coupling processes and the development of embedding methods to combine periodic and non-periodic quantum chemistry frameworks for which he received his PhD from the University of Münster in 2017 ("Quantum-chemical investigation of on-surface reactions and the foundation of periodic density embedding"). Afterwards he moved to the University of Luxemburg for a two-year Postdoc position, where he implemented semi-empirical methods to describe Vander-Waals interactions in different quantum chemistry codes. From 2020 to 2022, he worked in industry in the field of simulation data management. In August 2022, Dennis joined the group of Andreas Pflug at the Fraunhofer Institute for Surface Engineering and Thin Films (IST), where he is working on development and application of the PICMC code for the simulation of thin film coating processes.

Rob Belan

graduated from Rutgers University with a BS in Physics and took graduate courses in Physics at City College of NY. Has worked in Vacuum Science since 1982 specializing in magnetron sputtering and other PVD techniques. He is currently the Technical Director at the Kurt J. Lesker Company and has lectured at many universities and companies across the world in PVD techniques and thin film growth.

Necmi Biyikli

was born in Utrecht, The Netherlands, in 1974. He received the B.S., M.S., and Ph.D. degrees in Electrical & Electronics Engineering from Bilkent University, Ankara, Turkey in 1996, 1998, and 2004 respectively. Dr. Bıyıklı's Ph.D. research concentrated on GaN/AlGaN-based ultraviolet and solar-blind photodetectors. Afterwards, during his postdoctoral research at the Virginia Commonwealth University, he worked on the MOCVD growth of AlGaN/GaN hetero-structures for various applications including high-performance transistors. Dr. Bıyıklı also worked as a research scientist at the Cornell Nanoscale Science and Technology Facility (CNF) where he developed RF-MEMS integrated multifunctional reconfigurable antennas. At the end of 2008 he joined UNAM – Materials Science & Nanotechnology Institute at Bilkent University, leading the "Functional Semiconductor Materials and Devices Research Group". After spending one year at Utah State University, in 2017 he joined the Electrical & Computer Engineering Department at University of Connecticut, where he leads the Atomic Layer Engineering Laboratory within the Center for Clean Energy Engineering (C2E2). His current research interests include atomic layer deposition of III-nitride, metal-oxide, and metal thin-films and nanostructures, selective atomic-scale processing, III-Nitride opto-electronics, piezo-electric thin-films for chemical and biological sensing, photovoltaics, and smart RF-antenna architectures. Dr. Biyikli is the recipient of EU-Marie Curie International Reintegration Grant Award in 2010 and METU-Parlar Foundation Research Incentive Award in 2013. Dr. Biyikli is a member of American Vacuum Society (AVS) and Materials Research Society (MRS) and has contributed to 300+ journal and conference publications.

Clark Bright

has worked in thin film technology for more than 45 years including research, development, and new product introduction. He co-founded the R&D department at Sierracin Corporation (now PPG Aerospace) and led the development of metallic thin film transparent conductive coatings (TCC) for aircraft windshields and canopies. He joined Xerox Electro-Optical Systems in 1972, to create and direct the Electro-Optical Device Technology Center (EODTC) for R&D and fabrication of EO devices used in Xerox products. In 1975, he founded Optical & Conductive Coatings (OCC) to perform R&D and production of TCC for military, industrial and scientific applications. OCC designed and manufactured (over 3000) M1 Tank windows with TCC heater deicing/defogging, EMI shielding and high transmittance in 3 wavebands: visible, NIR, and 1.06 µm laser range finder. He also led what is believed to be the first development of continuous thin film TCC for the mid-infrared (3µm - 5µm) waveband. Another OCC unique development was a patterned metallic coating for heating infrared windows with transmittance at visible through Far-IR wavelengths. OCC was acquired by Southwall Technologies (now Eastman Chemical) in 1992, and he became Director of Product Development. He led R&D and played a critical role in 2 production scale-ups of a durable 4-layer (ITO/SiO_2) AR/antistatic coating, magnetron sputter deposited, roll-to-roll on plastic film used by display manufactures (e.g., Sony). He was Vice President at Presstek, Inc., and its Delta V Technology subsidiary in 1998, where he directed the R&D of transparent conductive oxides (TCO), polymer multilayer (PML) technology, and transparent vapor barrier coatings, including the first barrier coatings using a TCO, (ITO). 3M acquired Delta V in 2000. As Senior Staff Scientist and Group Technical Leader with the 3M Corporate Research Laboratory he developed roll-to-roll coated, vacuum deposited, organic and inorganic multilayer thin film products for optical, transparent conductive, barrier and other applications. Retiring in 2013 after 13 years at 3M, he founded his current consulting practice -

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Bright Thin Film Solutions LLC. He served 12 years on the SVC Board of Directors and was President in 2004. In 2009, he received the SVC Fellow-Mentor Award, and in 2012 the Nathaniel Sugerman Award. He has been an invited, keynote and plenary speaker at many domestic and foreign conferences. He has published numerous papers on optical thin films, and transparent conductive coatings, including book chapters on transparent conductors in "Transparent Electronics: From Synthesis to Applications" (Wiley, 2010), and "Optical Thin Films and Coatings, from Materials to Applications" (Woodhead, 2013), (2nd edition, Elsevier, June 2018). He is inventor or co-inventor on at least 28 U.S. patents in the field.

Gregory Caputo

is a Professor in the Department of Chemistry & Biochemistry at Rowan University. He earned his undergraduate degree in Chemical Biology at Stevens Institute of Technology, his PhD in Molecular & Cellular Biology/Biochemistry at Stony Brook University, and completed two postdoctoral fellowships at Texas A&M University Health Sciences Center and at the University of Pennsylvania School of Medicine. His research primarily focuses on the development and characterization of novel antimicrobials including peptides, polymers, small molecules, ionic liquids, and coatings. His other research interests include biophysical analysis of peptide and protein folding, especially those which interact with biological membranes. Additionally, Dr. Caputo serves as a member of the American Chemical Society's "Committee on Professional Training" which is responsible for the review of ACS accredited institutions across the US. He was named a Fellow of the American Chemical Society in 2019.

Tom Christensen

is a Professor Emeritus 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. He is the author of "Understanding Surface and Thin Film Science" (CRC Press, 2023).

Jean-Pierre Deluca

retired from LACO Technologies in 2019, he recently started his own consulting Company (www.bdlredwood.com). Jean-Pierre holds a bachelor's degree in science (Electrical Engineering) from Century University NM and has over 39 years of experience in the leak testing afield (helium mass spectrometry, hydrogen, pressure decay, vacuum decay and mass flow). He has worked in numerous roles for leak instrument and leak testing equipment manufacturers, specifically as a product manager, applications engineer, international leak detection director and finally vice president of sales. Jean-Pierre has extensive experience and expertise in many industries including, automotive, medical, pharmaceutical, refrigeration and air conditioning, semiconductor, aerospace and defense, vacuum industry and assisted thousands of customers with their leak testing applications and projects. Additionally, he has audited hundreds of leak testing equipment/systems and helped customers to improve functionality, reliability, test quality and reduced cycle time. Jean-Pierre has written many technical articles and contributed to many others. He has presented over 500 training classes at customers' facilities and trade shows.

Gary Doll

is the Timken Professor of Surface Engineering at the University of Akron. Prior to joining the University of Akron, Dr. Doll was the Chief Technologist of Tribology at the Timken Company, and Staff Scientist of Physics for General Motors Research Laboratories. Dr. Doll was elected as an ASM Fellow in 2009, and as an STLE Fellow in 2016 for his contributions to the field of Surface Engineering. He is a member of the SVC, STLE, ASME, and the ASM International organizations, and is an associate editor for Tribology Transactions. In 2016, he was awarded a Distinguished Fellowship by the Royal Academy of Engineering. Over his career, Dr. Doll has published over 300 articles and book chapters, edited numerous proceedings, and received more than 25 US Patents.

Arutiun P. Ehiasarian

joined the Nanotechnology Centre for PVD Research at Sheffield Hallam University, UK in 1998 where he obtained his PhD in Plasma Science and Surface Engineering. His research within NTCPVD has concentrated on development of plasma PVD technologies for substrate pretreatment prior to coating deposition to improve adhesion, deposition of coatings with dense microstructure, low-pressure plasma nitriding and hybrid processes of plasma nitriding/coating deposition. He has experience with cathodic vacuum arc discharges, dc and pulsed magnetron discharges, and radio-frequency coil enhanced magnetron sputtering. He utilizes plasma diagnostics such as optical emission spectroscopy (OES), electrostatic probes, energy-resolved mass spectroscopy and atomic absorption spectroscopy. Materials characterization includes high-resolution TEM, STEM, STEM-EDS, SEM, and XRD as well as mechanical testing available at NTCPVD. Arutiun is one of the pioneers of high power impulse magnetron sputtering (HIPIMS) technology and his work in the field has been acknowledged with the R.F. Bunshah Award (2002), the TecVac Prize (2002) and the Hüttinger Industrial Accolade. In 2011 he received the AVS Peter Mark Memorial Award as a top young investigator, and in 2012 he received the SVC Mentor Award. He is an author of more than 50 publications, 10 invited lectures, 3 patents and 1 book chapter in the field of PVD and HIPIMS.

J.R. Gaines

is the Technical Director of Education for the Kurt J. Lesker Company (Jefferson Hills, PA). The Lesker Company is a global scientific equipment manufacturer supplying materials and tools for vacuum-enabled innovation. Gaines has more than 40 years of experience in the research, development and commercialization of advanced materials technologies including superconductivity, semiconductors, cryogenics, space simulation, energy generation, energy conversion and storage. His experience includes vacuum systems, thin film deposition, inorganic chemistry, nanotechnology and advanced ceramic processing. He currently develops and delivers the Company's many educational programs through Lesker University teaching events.

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Holger Gerdes

graduated from the Technical University in Braunschweig with a diploma in Physics in 2004. Afterwards, he was Research Fellow at the Institute of Micro Production Technology (IMPT) at the Leibniz University, Hannover. Since 2008, Holger has worked as a project leader in the group "Highly Ionized Plasmas and PECVD" at the Fraunhofer Institute for Surface Engineering and Thin Films IST. One of his main topics is the development of reactive processes especially in combination with HIPIMS (High Power Impulse Magnetron Sputtering).

Anas Ghailane

started his career in 2014, the year at which he received a Master of Science and Engineering degree from Saarland University, Germany; and EEIGM – University of Lorraine, France; respectively.

From 2014 – 2016, as a materials engineer, he occupied research and development engineer positions in corrosion of steel as well as metal forming. Then in 2017, Anas started a PhD in physics focusing on development of corrosion and wear resistant coatings using HiPIMS and dcMS. The PhD degree was received from University of Koblenz, Germany and did his experimental work at NTTF coatings GmbH, Germany, and University Mohammed 6 Polytechnique, Morocco.

Since 2022, Dr. Anas Ghailane works as a physical vapor deposition (PVD) consultant at Avaluxe Coating Technology GmbH & Co KG (ACT), Fürth, Germany.

Jeremy M. Grace

is currently a principal engineer at Idex Health & Science | Semrock, where he works in the area of thin-film interference filters for life sciences and other applications. Prior to his position at Semrock, he was a senior principal scientist at the Eastman Kodak company, where he worked in the areas of plasma surface modification, thin-film adhesion, sputter deposition, and organic vapor deposition. As a young scientist at Kodak, Jeremy learned DOE principles, and he has applied them in his work for the past 25 years. His experience has provided him knowledge and perspective that have helped him to mentor scientists and engineers in the application of DOE principles. Most recently, he presented a tutorial on DOE to fellow engineers at Idex Health & Science. Jeremy has written several patents and journal articles in the area of plasma modification of polymers. He is a member of the Society of Vacuum Coaters and the American Vacuum Society, and served as chair of the Upstate New York Chapter of the AVS (UNY-VAC) from 1998-2000.

Lars Haubold

graduated in Manufacturing Engineering at the University of Applied Sciences Dresden, Germany in 2002. For more than 15 years he does contract R&D at Fraunhofer USA in the area of vacuum thin film deposition and diamond-like carbon materials in particular. His projects cover the entire range from feasibility studies to industrial commercialization. His current position is Manager of Coatings Technology Group at Center for Coatings and Diamond Technologies. He has been a SVC member since 2007 and instructor at the annual conference since 2017.

Jeffrey Hettinger

earned a Ph.D. in Physics from Boston University, spent five years at Argonne National Laboratory, and is currently a Professor and former Chair of the Department of Physics and Astronomy at Rowan University in Glassboro, NJ. His research has included the synthesis and characterization of thin film coatings for more than 30 years. Though his research roots were established in thin film superconducting materials, he currently works on materials for "on-chip" energy storage, such as thin-film ultracapacitors, and biomedical coatings, such as bactericidal and neurostimulation electrode coatings. Most of the research has involved coating synthesis using reactive magnetron sputtering techniques.

James N. Hilfiker

graduated from the Electrical Engineering Department of the University of Nebraska in 1995, where he studied under John Woollam. His graduate research involved in-situ ellipsometry applied to both sputter-deposition and electrochemical reactions, and optical characterization of magneto-optic thin films. He joined the J.A. Woollam Company upon graduation, where his research has focused on new applications of ellipsometry, including characterization of anisotropic materials, liquid crystal films, thin film photovoltaics, and Mueller matrix optical characterization. He has authored over 50 technical articles involving ellipsometry, including Encyclopedia articles and four book chapters on topics as varied as Vacuum Ultraviolet Ellipsometry, In-Situ Spectroscopic, and Dielectric Function Modeling. In 2015, James co-authored a book titled "Spectroscopic Ellipsometry: Practical Application to Thin Film Characterization."

Patrick Hopkins

is the CSO and co-founder of Laser Thermal, Inc, a company in based in Charlottesville, Virginia that has commercialized thermal conductivity measurement systems that provide non-contact metrologies for thermal properties of thin films, coatings and bulk materials. The mission of Laser Thermal is to provide accessible thermal measurements of materials, focusing on thin-film thermal conductivity with nanoscale resolution. By utilizing optical technologies, Laser Thermal provides simple, accurate, and rapid measurements of thermal properties, leading to increased customer knowledge of material properties.

Patrick is also a Professor in the Department of Mechanical and Aerospace Engineering at the University of Virginia, with courtesy appointments in the Department of Materials Science and Engineering and the Department of Physics. Patrick has been on the faculty of UVA since 2011, following a Harry S. Truman Postdoctoral Fellowship at Sandia National Labs. Patrick's current research interests are in energy transport, laser-material processes and nanoscale and ultrafast processes in condensed matter, soft materials, liquids, vapors and plasmas. Patrick's group at the UVA uses various optical thermometry-based experiments to measure the thermal conductivity, thermal boundary conductance, thermal accommodation, strain propagation and sound speed, and electron, phonon, and vibrational scattering mechanisms in a wide array of bulk materials and nanosystems.

In the general fields of nanoscale heat transfer, laser interactions with matter, and energy transport, storage and capture, Patrick has authored or co-authored over 275 technical papers (peer reviewed), and has been awarded 5 patents focused

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on materials, energy and laser metrology for measuring thermal properties. Patrick has been recognized for his accomplishments in these fields via an Air Force Office of Scientific Research Young Investigator Award, an Office of Naval Research Young Investigator Award, the ASME Bergles-Rohsenhow Young Investigator Award in Heat Transfer, the ASME Gustus L. Larson Memorial Award, and a Presidential Early Career Award for Scientists and Engineering, for which Patrick met President Barack Obama in 2016. Patrick is a fellow of ASME and a recipient of an Alexander von Humboldt Fellowship for Experienced Researchers.

Martin Keunecke

joined in the Fraunhofer Institute for Surface Engineering and Thin Films (IST) in Braunschweig, Germany in 1998, after university studies in physics and mechanical engineering. He completed his thesis on the development and application tests of tool coatings 2007. He is responsible for new coating and process development with PVD and PECVD technologies and other surface treatment technologies in the field of friction reduction, hard and wear resistant coatings for tools and components for industrial applications, e.g. diamond-like carbon coatings for automotive applications. From 2012 till 2015 Martin Keunecke was the head of the department "New Tribological Coatings" at the Fraunhofer IST. Since 2016 he is the head of the group "Tribological Systems" in the "Center for Tribological Coatings" at the Fraunhofer IST.

Matthew Linford

graduated with a B.S. in chemistry from Brigham Young University in 1990 and received M.S. and Ph.D. degrees in materials science and chemistry, respectively, from Stanford University in 1996. While at Stanford he published the first two papers on monolayers on hydrogen-terminated silicon with his adviser Chris Chidsey. By Google Scholar these papers have been cited ca. 800 and 1300 times. After a post-doc at the Max Planck Institute of Colloids and Interfaces in Germany with Helmut Möhwald studying polyelectrolyte multilayers, he worked in industry for three years – one year with a large chemical company and two years with two start-up companies. In 2000, he became a faculty member at Brigham Young University and is now a full professor there. While at BYU, Linford has studied thin film deposition and characterization, new materials for separations science, statistical methods for data analysis, new materials for long-term digital data storage, and the chemomechanical functionalization of silicon. His work in separations science led to the launch of the Flare chromatography column that was sold by Diamond Analytics. His work in data storage led him to co-found Millenniata (now Yours.co), which sells a DVD disc that lasts 1000 years and a Blu-ray disc that will last at least 300. Linford has more than 350 publications, which include peer-reviewed papers, conference proceedings, book chapters, peer-reviewed contributions to Surface Science Spectra, commercial application notes, tutorial articles, and more than 40 patents. He is an editor for Applied Surface Science, an Elsevier journal with an impact factor of ca. 5.0. He is a contributing editor for Vacuum Technology & Coating (VT&C) for which he writes a ca. monthly column on surface and material characterization. He has been an associate editor for Surface Science Spectra since 2003. In 2014 he was made a fellow of the American Vacuum Society (AVS). In 2015 he was named an Alcuin Fellow at Brigham Young University (an award for excellence in teaching). By Google Scholar, his h-index is 40, his i10-index is 118, and his total number of citations is more than 9200.

Allan Matthews

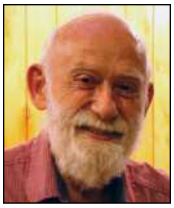
is a Fellow of the Royal Academy of Engineering and is Professor of Surface Engineering and Tribology in the School of Materials at the University of Manchester, UK. He is also Director of the BP-sponsored International Centre for Advanced Materials (ICAM). He spent his early career in the aerospace industry and carried out research into ion plating processes at the University of Salford before moving to the University of Hull, where he built up the Research Centre in Surface Engineering as Director for over 20 years. He moved the Centre to the University of Sheffield in 2003 and then to Manchester in 2016. His group researches plasma assisted processes, mostly for tribological coatings and diffusion treatments. He is Editor-in-Chief of the Elsevier journal Surface and Coatings Technology, a former member of the SVC Board of Directors and a former Chair of the British Vacuum Council and the AVS Advanced Surface Engineering Division Executive Committee.

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.

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.



John F. O'Hanlon

is Professor Emeritus of Electrical and Computer Engineering, the University of Arizona. He retired from IBM Research Division in 1987, where he was involved in thin-film deposition, vacuum processing, and display technology. He retired from UA in 2002, where he directed the NSF Ind./Univ. Center for Microcontamination Control. His research focused on particles in plasmas, cleanrooms, and ultrapure water contamination. He and Tim Gessert are co-authors of "A Users Guide to Vacuum Technology", 4th Edition, John Wiley and Sons, 2023

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Christos Pernagidis

a materials science graduate, began his career in 1993 as part of the R&D group of major German producer of coating materials. His initial role involved overseeing and ramping up the production of TiAl for Oerlikon Balzers.

After three years of leading the production of coating materials, Christos transitioned into a sales role, becoming the sales manager with world-wide responsibility. In 2004, Christos and his partner co-founded Avaluxe International GmbH. This new venture focused on coating materials while also establishing strong partnerships with leading companies for magnetrons and power supplies. Under Christos's leadership, Avaluxe expanded its services to include thin film consulting and hands-on development of coatings with both decorative and functional properties.

Throughout his career, Christos has demonstrated expertise in materials science, particularly in the field of coatings and thin films. His experience spans research and development, production management, sales, and entrepreneurship, showcasing his versatility and comprehensive understanding of the industry.

Stefan Saager

studied physics at the Technical University Dresden with specialization to semiconductor physics. In 2015, he graduated to PhD in the topic of deposition and crystallization of silicon thin films by using e-beam technology. Since 2010 he is a research fellow at the Fraunhofer Institute for Organic Electronics, Electron Beam and Plasma Technology FEP in Dresden. Since 2023 he leads the group Coating Metal & Energy Applications. His research interests include the development and the optimization of new vacuum-based deposition methods such as electron beam physical vapor deposition (EB-PVD) as well as the simulation of related thermal processes.

Robert Sargent

received his BA in Physics from UC Berkeley and his PhD in Optical Sciences from the University of Arizona. He has nearly 40 years of experience in optical coatings, including 10 years with Optical Coating Laboratory, Inc. and 24 years with Viavi Solutions (formerly JDSU). His industrial experience has included the development of deposition processes and filter designs for applications such as aerospace, biomedical instrumentation, and fiber-optic telecommunications. He currently leads R&D projects focused on the development of new thin film deposition processes.

George Savva

obtained his Ph.D. from McMaster University, Canada where he studied ceramic/metal interface structures and diffusion paths related to high temperature oxidation. He has also worked in the area of materials for electrical vehicle batteries. His present position is Engineering Manager for Ionbond North America.

S. Ismat Shah

graduated from the University of Illinois at Urbana-Champaign in 1986 from the Department of Materials Science and Engineering. He worked for the DuPont Company as senior Staff Scientist for 12 years before joining the University of Delaware in 1999, where he has a joint appointment in the Department of Materials Science and Engineering and the Department of Physics and Astronomy. He has been involved in the fields of thin films and nanostructured materials for the last 25 years. He has over 250 publications in these fields and six patents awarded.

Michael Simmons

is President of Intellivation, LLC, a vacuum coating equipment manufacturing company he founded in 2009. Since 2009, Intellivation has grown into one of the leading companies providing Roll to Roll vacuum coating systems and process support. Mike's extensive background in plasma processing and equipment continues to be enhanced by the installation of a R2R Lab system at Intellivation which has enabled Mike and Intellivation to become vacuum process knowledge leaders in the industry. Process knowledge includes a wide range of sputtering technologies as well as other PVD techniques. Mike is responsible for designing, manufacturing and installing a wide variety of equipment over the past 15 years, from production vacuum deposition R2R tools to R&D systems, and automation machinery. Roll to roll vacuum deposition is the primary focus for Mike and his team, as exemplified by Intellivation's innovative R2R series product line. He is a member of the Board of Directors of the Society of Vacuum Coaters (SVC), SVC Instructor for Web Coating, past Chair of AIMCAL's Vacuum Web Coating Committee, an active member of AVS and continuously supports the vacuum community through multiple initiatives. Mike earned his mechanical engineering degree (BSME) from the University of Idaho where he graduated with honors, and is a licensed Professional Engineer. Mike has published multiple technical papers and presented at global conferences on Vacuum Coating Processes, including but not limited to Vacuum Technology and State of the Art Roll to Roll Equipment and Processes.

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Christian Stein

is a researcher at the Fraunhofer Institute for Surface Engineering and Thin Films in Braunschweig, Germany. He studied physics at the Philipps-University Marburg and graduated in 2008 with a diploma thesis on surface science. Fascinated in transferring research results to application, he completed his doctoral thesis on the development of tool coatings at the Technical University Braunschweig in 2015. His main research interests are hard and wear resistant multifunctional coatings for industrial tools and components and their deposition by PVD and PECVD processes.

Gary Vergason

has been working in the PVD industry for over 38 years, from engineering and operations to executive management. His cathodic arc source designs, developed while he was employed by Multi-Arc (IonBond), are still used around the world today. Gary founded Vergason Technology, Inc. (VTI) in 1986 and under his leadership the company has become a leading international supplier of innovative rapid-cycle PVD coating equipment and toll coating services. Gary has served as an SVC instructor, a member of the Board of Directors, served as President from 2016 to 2018 and chaired its first Topical Conference in 2009. He holds several patents in the PVD field and continues to influence this industry.

Ronald R. Willey

graduated from the MIT in optical instrumentation, has an M.S. from FIT, and over 40 years of experience in optical system and coating development and production. He is very experienced in practical thin films design, process development, and the application of industrial Design of Experiments methodology. He is the inventor of a robust plasma/ion source for optical coating applications. He worked in optical instrument development and production at Perkin-Elmer and Block Associates. He developed automatic lens design programs at United Aircraft Research Laboratories. He formed Willey Corporation in 1964 and served a wide variety of clients with consulting, development, prototypes, and production. In 1981 he joined Martin Marietta Aerospace and was Director of the Optical Component Center where he was responsible for optical fabrication, coating, and assembly. He joined Opto Mechanik in 1985 where he was responsible for the development of all new technologies, new instruments, and production engineering. He was a Staff Scientist at Hughes Danbury Optical Systems. He holds four patents and has published many papers on optical coating design and production, optical design, and economics of optical tolerances. He has published books on optical thin film coating design and production since 1996. His recent books are "Practical Design of Optical Thin Films", 4th Ed. (2014) and "Practical Production of Optical Thin Films," 2nd Ed. (2012) He is a fellow of the Optical Society of America and SPIE and a past Director of the Society of Vacuum Coaters. He now is a consultant in the above-listed technical and forensic areas. Here he is concentrating on teaching optical thin film design and production, and also aiding clients in process development and improvement. Ron received the SVC Mentor Award in 2019 and is one of the SVC's most prolific technical contributors.

EDUCATION PROGRAM TUTORIAL COURSES

Saturday, May 17, 2025	Professional	Student/Young Member
❑ C-103 An Introduction to Physical Vapor Deposition (PVD) Processes *Shah*	$690	$280
❑ C-205 Introduction to Optical Coating Design *Sargent*	$690	$280
❑ C-310 Sputtering *Bandorf*	$690	$280
❑ C-333 Practice and Applications of High Power Impulse Magnetron Sputtering *Ehiasarian*	$690	$280
❑ VT-201 Vacuum Systems, Materials, and Operations *O'Hanlon*	$690	$280

Sunday, May 18, 2025		
❑ C-212 Troubleshooting for Thin Film Deposition Processes *Miller*	$690	$280
❑ C-218 Advanced Design of Optical Thin Films *Willey*	$690	$280
❑ C-323 Fundamentals of High Power Impulse Magnetron Sputtering -HIPIMS *Ehiasarian*	$690	$280
❑ C-329 Properties and Applications of Tribological Coatings *Matthews/Doll*	$690	$280
❑ C-338 Application of Reactive Sputtering *Bandorf/Gerdes*	$690	$280
❑ M-240 Basics and Applications of Electron Beam Technology for Manufacturing Processes *Saager* ***PM***	$470	$180
❑ VT-203 Understanding and Using Residual Gas Analyzers *O'Hanlon*	$690	$280

Monday, May 19, 2025		
❑ C-110 Materials for PVD Applications *Pernagidis/Ghailane* NEW!	$690	$280
❑ C-220 Introduction to 2-Dimensional Materials *Muratore* ***AM***	$470	$180
❑ M-110 Introduction to X-ray Photoelectron Spectroscopy *Linford* ***AM*** NEW!	$470	$180
❑ M-140 Mass Flow Controllers Fundamentals, Troubleshooting, and Calibration *Baker* ***AM***	$470	$180
❑ M-201 Flexible Electronics *Muratore* ***PM***	$470	$180
❑ M-210 Thin Film Batteries PM *Gaines* ***PM***	$470	$180
❑ M-230 Nanoscale Heat Transfer in Thin Films and Interfaces *Hopkins*	$690	$280
❑ M-250 Deposition Process Simulation *Barton* ***PM***	$470	$180
❑ VT-240 Practical Elements of Leak Detection *Deluca*	$690	$280

Tuesday, May 20, 2025		
❑ C-210 Introduction to Plasma Processing Technology *Baránková/Bárdos* ***AM***	$470	$180
❑ C-214 Thin Film Debugging and Optimization *Willey* ***AM***	$470	$180
❑ C-230 Processing of Plastics for Better Protection, Reflection, and Decoration *Vergason* ***AM***	$470	$180
❑ C-306 Non-Conventional Plasma Sources and Methods in Processing Technology *Baránková/Bárdos* ***PM***	$470	$180
❑ C-337 ITO and Alternative TCO From Fundamentals to Controlling Properties *Bright*	$690	$280
❑ M-102 Introduction to Ellipsometry *Hilfiker* ***PM***	$470	$180
❑ VT-230 Design and Specification of Vacuum Deposition Systems *Belan*	$690	$280

EDUCATION PROGRAM

TUTORIAL COURSES

Wednesday, May 21, 2025	Professional	Student/Young Member
❑ C-204 Basics of Vacuum Web Coating *Simmons* ***AM***	$470	$180
❑ C-217 Practical Production of Optical Thin Films *Willey*	$690	$280
❑ C-272 Biomedical Coatings for Antimicrobial Applications *Hettinger/Caputo* ***AM***	$470	$180
❑ C-316 Introduction to Atomic Layer Deposition (ALD) Processes, Chemistries, and Applications *Biyikli*	$690	$280
❑ C-320 Diamond Like Carbon Coatings-From Basics to Industrial Realization *Keunecke/Haubold/Stein/Savva /Petzold* ***PM***	$470	$180
Thursday, May 22, 2025		
❑ C-212 Troubleshooting for Thin Film Deposition Processes *Miller*	$690	$280
❑ C-322 Characterization of Thick Films, Thin Films, and Surfaces *Christensen*	$690	$280
❑ M-120 Design of Experiments for R & D *Grace*	$690	$280

Tutorial Classification

V/VT- VACUUM TECHNOLOGY
C - VACUUM COATING DEPOSITION PROCESSES AND TECHNOLOGY
M - MISCELLANEOUS TOPICS
B - BUSINESS TOPICS

The tutorial number indicates the level of topic specialization. Lower numbers are basic or introductory in nature, and higher numbers are a more specialized treatment of a specific topic.

Registration for Tutorial Courses

- Use the On-line TechCon resgistration system – opening December 2024. All paid conference registrations include a free tutorial as well as a 30% discount on all additional tutorials that are purchased.
- You do not have to register for the TechCon to attend tutorial courses
- Tutorial course fees include entrance to the Exhibit Hall and all Exhibit Visitor privileges

Times

FULL-DAY COURSE TIMES: 9:30 a.m. - 5:30 p.m.
HALF-DAY COURSE TIMES: **AM** (9:30 a.m. - 1:00 p.m.) and **PM** (2:00 p.m. - 5:30 p.m.)
All courses are full-day unless specified ***AM*** *or* ***PM****.*

Discounts Offered to Multiple Registrants from One Organization

Receive 25% off each tutorial course registration for the second or more employee from the same company, enrolling in the same tutorial as the first employee. (Does not apply to the student tutorial course fee). Send an E-mail to **svcinfo@svc.org** and request the discounted fee. Discounts will be refunded after the TechCon.

Tutorial Course Cancellation Policy

Tutorial course cancellations received on or before April 18, 2025 will be refunded. Refunds will be made upon receipt of a written notice, less a $25 service fee for each cancelled tutorial course. No refunds will be made after April 18, 2025. Please send your written cancellation request to **svcinfo@svc.org**.