SVC™
SOCIETY of VACUUM COATERS

TechCon 2024 Chicago

Chicago Hilton
Chicago, Illinois, USA

May 4 – May 9, 2024

Extended Call for Papers

Featuring Select Keynote and Invited Speakers & Preview of the 2024 In-Person Tutorial Program

Technical Program: May 6 – 9

- Technical Sessions
- Interactive Networking Forums
  + Technology Forum Breakfasts

Education Program: May 4 – May 9

- 35 Problem-Solving Tutorial Courses

Including Sessions on:

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

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

www.svc.org

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 2024 Chicago

Technical Program
May 6 – May 9
Education Program
May 4 – May 9
Technology Exhibit
May 7 – May 8

67th Annual SVC Technical Conference • May 4 – May 9, 2024

Chicago Hilton, Chicago, Illinois, USA

Technical Program May 6 – May 9

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 7 and 8

Education Program May 4 – May 9

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

Technology Exhibition May 7 – 8

Over 150 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 2024 SVC TechCon in Chicago, Illinois focuses on the essential role that Thin Films, Coatings, and Surface Engineering play in the products and services that drive our daily lives. 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:

- Atomic Layer Processing
- Coatings and Processes for Biomedical Applications
- Coatings for Energy Conversion and Related Processes
- Digital Transformation of Industrial Deposition Processes
- Emerging and Translational Technologies and Applications
- High-Powered Electron Beam Technology
- High-Powered Impulse Magnetron Sputtering (HiPIMS)
- Large-Area Coatings
- Optical Coatings
- Plasma Processing and Diagnostics
- Process Monitoring, Control, and Automation
- Protective, Tribological and Decorative Coatings
- Thin Film Sensors
- Thin Film Superconductors
- Exhibitor Innovator Showcase
- WebTech Roll-to-Roll Coatings

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 Chicago venue is an industry favorite, offering both professional networking as well as recreational value in a relaxed atmosphere. See you in Chicago!

***CLICK HERE* to submit an abstract to TechCon 2024**

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

With the calendar turning to a new year, suddenly the 2024 TechCon appears to be much more imminent than just a few weeks ago! The excitement is building, and the "Program Wheels" are turning as we prepare exciting new content for you to enjoy at our Chicago meeting.

After steadfastly honing our skills to present yet another successful in-person TechCon format last year, the team is thrilled to announce a multi-faceted program for the 2024 Chicago TechCon. This program highlights what the SVC does best: in-person networking, learning from each other, sharing experiences in our technical and business environment, and communicating innovation. While the 2023 TechCon experience in Washington/ National Harbor had exceeded expectations, we continue our planning for 2024 with a cautiously growth-focused stance - the "crystal ball" is still hazy on the economic outlook and the unforeseeable impact of current global events and continues to add uncertainty for all stakeholders. However, we are fortunate to host the upcoming TechCon in a very attractive venue right in the center of a premier city that is easily accessible for our global constituents. Chicago offers a rich experience for tourists as well as business interactions. Be sure to book your hotel room in the SVC's room block at the Chicago Hilton to take advantage of the most cost-efficient and convenient way to experience the TechCon.

To allow you to make attendance commitments as late as possible, we have extended the abstract submission deadline to February 31st, and will make every effort to accommodate your talk or poster.

The 2024 TechCon program structure builds on the "refresh" we refined over the last couple of years while retaining its familiar format. We start the day with an updated line-up of Technology Forum Breakfasts, a Keynote talk, finally followed by sessions dedicated to our technical and applications topics. The technical program will be coordinated with the Exhibit, our educational tutorial offerings, and the various networking events for maximum

SVC™ Society of Vacuum Coaters

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

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

Publication Options:

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

WITHOUT PEER REVIEW

Submission Deadline: August 4, 2024

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

PEER REVIEWED

Submission Window Open May 1 – July 15, 2024

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

VIDEO PRESENTATIONS

Submission window open

May 1 – September 15, 2024

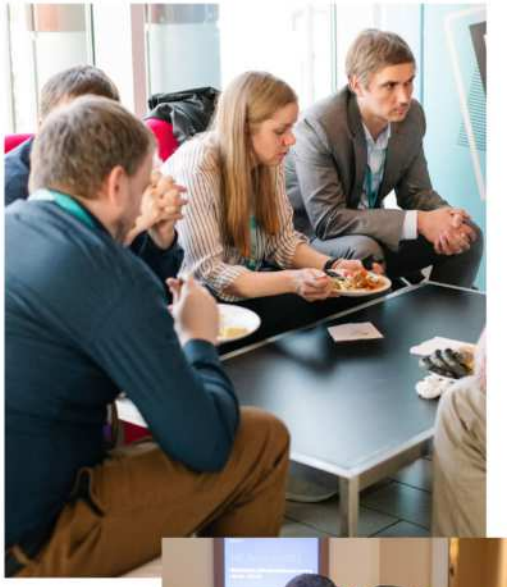
Narrated mp4 or PowerPoint video to be posted to the SVC's dedicated YouTube Channel

Message from the Program Director

continued

impact, reflecting the integrative approach that we apply to the core activities to best serve the varying interests of our stakeholders.

For 2024, we continue to offer two extremely well-received new session topics that showcase pertinent developments and trends in our technology arena: "**Process Monitoring, Control and Automation**" and "**Digital Transformation of Deposition Processes**". Also, a special session on **"Thin Film Contributions to the Hydrogen Economy"** examines the "enabling" role of our industry to deliver on the promise of a very important sustainability initiative.



As one of the more radical innovations, we are again proud to offer the "**Colloquium 2.2 @ TechCon**". This program's components are pragmatic, applications-relevant roundtable forum discussions that are embedded right into the line-up of some of our most pragmatic sessions – HiPIMS, WebTech/R2R, Optical Coatings and Tribo/Deco Coatings. These refreshing program elements complement the traditional session format with a critically valuable interactive element. We adapted those interactive "trouble-shooting" events from our successful virtual "Colloquium 2.0" workshops where an expert talk kicks off an invigorating moderated discussion, and these forums are intended to further connect exhibitors and experts with practitioners in the field to address pertinent challenges in the respective industrial fields. These "ask, listen, and learn" events will be open to all TechCon attendees, and pragmatically complement the talks/posters, tutorials, Technology Forum Breakfasts, and the Exhibit. These events will provide you with yet another attractive incentive to join us in Chicago, even if you are not prepared to give a talk or poster.

We are grateful for the experience and many lessons learned over the last couple of years – and especially the continued support of our SVC community that appreciates experimentation and welcomes innovation in our topic line-up and program format. We are now on "final approach" for the 2024 TechCon in Chicago. I encourage you as a member of the SVC family and thin film/surface engineering community to register as a presenter for the TechCon, whether it is with a contributed talk or poster that highlights your innovation and achievements, or as an attendee that wants to connect with experts, or just "ask, listen & learn" in the many interactive events the refreshed "in-person" TechCon offers.

Only the SVC TechCon offers a premier technical program alongside a best-in-class exhibit and a stellar educational program (remember – your full-conference registration includes access to a tutorial of your choice!). Sharing innovation, learning, networking – all in one attractive location. It doesn't get better than that.

I look forward to seeing you in a few weeks at the SVC TechCon in Chicago – we couldn't do it without you!

– Chris Stoessel
Program Director

SVC and SVC Foundation Travel Support for Students and Young Professionals

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

SVC Student/Young Professional Travel Sponsorship Program

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

Requirements for Participation:

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

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

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

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

Please visit www.svcfoundation.org for more information

College Scholarship application deadline: October 15, 2023

Industry Scholarship application deadline: January 15, 2024

Student Travel Sponsorship application deadline: October 6, 2023

Introducing the SVC's Keynote Speakers for the 2024 TechCon

Co-Authors: Koichi Tanaka[2], Aditya Deshpande[2], Pedro Arias[2], Angel Aleman[2], Hicham Zaid[2], Michael Liao[2], Cristian Ciobanu[3], and Mark Goorsky[2]

[1]Department of Materials Science and Engineering, Virginia Polytechnic Institute and State University, Blacksburg, VA, USA

[2]Department of Materials Science and Engineering, University of California Los Angeles, Los Angeles, CA, USA

[3]Department of Mechanical Engineering and Materials Science Program, Colorado School of Mines, Golden, CO, USA

Composition and crystallinity are probably two of the most important material characteristics that dictate properties and life-time performance of materials. Compositional control in sputter-deposited thin films is typically achieved via changing the deposition parameters, such as partial pressure of the reactive gases, substrate temperature, deposition fluxes, and the target composition. Common approaches to improve crystallinity, to increase grain size and the grain orientation in thin solid films typically involve the use of single-crystalline substrates, high substrate temperatures combined with low deposition fluxes, and energetic ion beams.

In this talk, I will present approaches involving the use of ultra-low (e.g., 0.002%) partial pressures of the reactive gases and van der Waals (vdW) layers as buffer layers to grow thin films of desired composition and enhanced crystallinity. Using Ta-C and Mo-S as model materials systems, we demonstrate compositional tunability and improved crystallinity. We also shown that Ta_2C thin films grown on $Ta_2C(0001)$ covered with hexagonal boron nitride (hBN), a vdW-bonded material, are more highly oriented than those films grown directly on bare $Ta_2C(0001)$ under identical deposition conditions. That is, heteroepitaxial growth across a vdW layer seemingly yields better crystalline quality than homoepitaxy. We observe similar highly-oriented growth of face-centered cubic Pd, body centered cubic Mo, and hexagonal MoS_2 thin films on hBN-covered substrates. Our results provide new insights into the factors underlying the growth of highly-oriented thin films.

Suneel Kodambaka is the head of the department of materials science and engineering at Virginia Tech (VT). Prior to joining VT in 2022, Suneel was a professor in the department of materials science and engineering and the area director for structural materials for master of science in Engineering Online Program at the University of California Los Angeles (UCLA). Suneel graduated with a bachelor of technology degree (B.Tech.) from the Indian Institute of Technology, Madras, M.S., from Southern Illinois University at Carbondale (SIUC), and Ph.D. from the University of Illinois, Urbana-Champaign (UIUC). Suneel is a recipient of the 2010 Alumni Achievement award from the SIUC College of Engineering, 2009 AVS Thin Film Division's Paul Holloway Young Investigator Award, and 2008 Best Paper award from the IBM Materials Research Community. His research relies on in situ microscopy (SEM, TEM, LEEM, and STM) studies to develop fundamental understanding of the nucleation and growth kinetics and thermo-chemical and mechanical stabilities of crystalline solids. Suneel can be reached at kodambaka@vt.edu.

Boeing Corporation, Seattle, WA

Dr. Marvi Matos Rodriguez currently serves as the P-8 Air Vehicle IPT Director at Boeing, as a member of the National Science Board, as a member and secretary of the Great Minds in STEM Board of Directors and as a member of the Washington State Academy of Science. These roles and organizations are driven by different visions, missions and goals. However, they are also characterized by overarching themes: engineering leadership, engineering and scientific innovation and service. This talk explores the journey of an engineer and scientist turned into a leader and manager in aerospace, while focusing on values of servant leadership and engineering excellence. The keynote section will be designed as an interactive discussion with the audience to cover emergent trends in science and technology, the significance of public policy in the science and engineering enterprise and the pipeline of STEM professionals needed to drive the enterprise.

Dr. Marvi Matos Rodriguez works as Director of BDS Engineering, Mobility & Surveillance P-8 Air Vehicle IPT. Marvi has a BS in Chemical Engineering from the University of Puerto Rico, a PhD in Chemical Engineering and a MS in Colloids, Polymers and Surfaces from Carnegie Mellon University. In addition, Marvi has an executive MBA from the Massachusetts Institute of Technology. She worked as postdoc at the National Institute of Standards and Technology (NIST) under a fellowship from the National Research Council. She served as Lecturer in Chemical Engineering and later as a Senior Research Scientist in Bioengineering at the University of Washington. She also worked as an independent consultant in the field of engineering innovations prior to joining aerospace. Marvi transitioned to Boeing as Scientist and Engineer. At Boeing she served as Thin Films research team lead, as Manufacturing Engineering manager, as Research and Technology manager and as director of Chemical Technologies, Metals and Ceramics.

Marvi worked at Blue Origin, where she served as director of Materials and Processes, as director of Crew Capsule team in the New Shepard Program and as the director for Mechanical Engineering leading structures, mechanical systems, fluids systems, technical design and materials and processes.

In her way back to Boeing, Marvi led the establishment of Design Practices as Director of Engineering, building a powerful Engineering knowledge system with an ecosystem of engineering functions, technical boards and councils, product family leaders and business unit leaders.

In her capacity as scientist and leader, Marvi has led the development of novel super alloys, thermal protection systems, and advanced manufacturing technologies and has supported rocket launches and rocket engine qualification work. Marvi is a servant leader, focused on Innovation and Outreach.

Introducing the SVC's Keynote Speakers for the 2024 TechCon

Dr. Sean McGregor is a machine learning research engineer who has worked with hundreds of organizations successfully (and unsuccessfully) shipping models all over the world. Most recently, Dr. McGregor Founded the Responsible AI Collaborative which is a leading index of AI incidents in the real world. He was also a lead consultant for the XPRIZE Foundation where he audited the safety, ethics, and impacts of 150+ teams competing for the $5 million IBM Watson AI XPRIZE. Prior to founding the Responsible AI Collaborative, Dr. McGregor was a founding engineer with the neural accelerator startup Syntiant, a deep learning researcher at NASA Ames where he worked on an interdisciplinary team of heliophysicists and computer scientists to forecast solar flares, and founded the Privly Foundation where he designed and built a method for sharing content privately via third-party social media.

Underwriters Laboratories, Rancho Mission Viejo, CA

Adopting artificial intelligence systems capable of operating at fantastical speed and no marginal cost is a business imperative. However, every successful AI system is built on a mountain of failed attempts. Making a system safe for the complexities of the real world without first adding to the mountain of doomed projects requires learning from past successes and failures. This presentation details the elements of successful and failed machine learning programs as experienced by the startups and corporations producing them.

Jochen M. Schneider, Ph.D., is Professor of Materials Chemistry at RWTH Aachen University, Germany. His research focus is quantum-mechanically guided design of thin films regarding thermal and chemical stability as well as elasticity. He also designs self-reporting materials.

Jochen was awarded the Sofya Kovalevskaya Prize by the Alexander von Humboldt Foundation for excellence in thin film materials science research in 2001 and was named a Fellow of American Vacuum Society (AVS) in 2013. In 2015 he was appointed as a Max Planck Fellow. Outstanding university professors at German universities are appointed by the Max Planck Society to address a scientific subject of common interest and to develop and lead a corresponding scientific research group. Also, in 2015 Jochen was named RWTH Fellow. In 2020 he was the Bill Sproul Award and Honorary ICMCTF Lecture Recipient; The Bill Sproul Award and Honorary ICMCTF lectureship is to recognize the achievements of a mid-career researcher who has made outstanding scientific and/or technological contributions in areas of interest to the Advanced Surface Engineering Division (ASED) of the AVS. In 2022 he received the Rudolf-Jaeckel-award of the German Vacuum Society to recognize outstanding achievements in vacuum-based sciences. In 2023 he was appointed as Honorary Doctor of the Faculty of Science and Technology, Uppsala University, Sweden.

Materials Chemistry, RWTH Aachen University, Germany

It is well known that HIPIMS offers control over ion energy and ion flux of coating forming species. This fact can be utilized to affect the defect structure and hence the coating properties. Here, coating material design approaches focusing on enhanced thermal stability and improved mechanical behavior are presented that utilize ion energy and ion flux to affect structural complexity. The implications thereof for sustainability are discussed. Furthermore, it is demonstrated that chemical complexity can be utilized to enhance the thermal stability of coatings, again in a sustainable fashion.

Both sustainability inspired design approaches are enabled by quantum mechanical predictions pertaining to phase formation, thermal stability and mechanical behavior. These causal relationships showcase material design opportunities in the context of sustainability.

Colloquium @ TechCon 2024 Chicago

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-five 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 2024!

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 9, 2024 | *Sponsored by the SVC's WebTech Roll-to-Roll Coatings for High-End Applications TAC*

Coating Thousands of Meters of Flexible Substrate in a Vacuum Coater – What Could Possibly Go Wrong?

Moderator: **Liz Josephson** *(Intellivation)*


Liz Josephson

Event Description: Roll-to-roll coating is a well-established high-productivity manufacturing method for functional films. However, quality and productivity are easily compromised by a myriad of environmental, handling, materials, hardware and maintenance issues. This event is aimed at both newcomers to roll-to-roll coating as well as process veterans, with the goal of discussing common questions and challenges in this important vacuum coating field. While the primary focus is on vacuum roll-to-roll coating, there are important pre- and post-processing techniques provided at ambient pressures that are also in-scope for this event.


Andy Jack

The panel will open with a commemoration by **Andy Jack** (Emerson & Renwick) of the invaluable contributions that Dr. Charles Bishop has made to the Roll-to-Roll coating community.

A panel of seasoned industry experts will highlight "best practices" and address common issues under the following topic areas:

- Deposition processes, cross-talk, gas- and vacuum system
  – **Mike Simmons**, *Intellivation*
- Pre-, in- and post-processing of roll-to-roll substrates (in-/ex-situ, in vacuum or at ambient atmospheres)
  – **Chris Stoessel**, *Stoessel Consulting*
- In-vacuum patterning and other specialty operations
  – **Wolfgang Decker**, *K.J. Lesker Company*
- Process monitoring and in-situ metrology
  – **Marcus Klein**, *Suragus*


Mike Simmons


Chris Stoessel


Wolfgang Decker


Marcus Klein

After brief introductions of the panelists, this highly interactive panel discussion welcomes questions and sharing of experiences from practitioners in the audience, and provides a unique opportunity to connect with topic matter experts and peers in the interest of improving industrial practice in vacuum roll-to-roll coating technology."

Colloquium 2.2

Thursday, May 9, 2024 | *Sponsored by the SVC's Optical Coatings Technical Advisory Committee*

The Challenge of Managing Defects in Production Optical Coating Processes

Event Description: Surface defects are an unpleasant reality for optical coating producers. They can occur unexpectedly and ruin batches of critical product, often for reasons that are difficult to detect. They may cause customer returns and even result in a loss of business. They will certainly cause you distress!

How can this be avoided? What are the best ways to detect them early in the process? How can you analyze them to find a clear root cause? What are some best practice methods to minimize defects, whether they occur in handling, loading, or deposition?

Let's discuss your problems in detail with the help of a diverse group of panelists representing defect metrology, coating system manufacturers, and coating producers themselves. In this interactive, collaborative session our panelists will present unique perspectives based on their experience, then hand the conversation to the audience to so that your specific problems can be discussed and hopefully solved!

Panelists:

Binyamin Rubin

Binyamin devoted ten years to developing ion thrusters for space propulsion before joining Veeco. Initially focusing on developing ion beam deposition equipment for optical coatings he progressed to become a technology manager. In this role he is responsible for plasma based thin film deposition and etch products with applications in semiconductors, optics, and data storage. Binyamin holds a BS and MS in Aerospace Engineering from the Moscow Institute of Physics and Technology and a PhD in Aerospace Engineering from Technion –the Israel Institute of Technology

Timothy Potts

BS, Engineering: Northeastern University; MS, Engineering: Northeastern University; MBA: University of Connecticut

Over forty years experience in all phases of the capital equipment business; development, engineering, marketing, sales and international operations. Last thirty years have been dedicated to laser and camera inspection businesses.

President of Dark Field Technologies, a high-resolution laser and camera inspection systems company, since 1997. Prior to Dark Field, President and CEO of Sira and Image Automation.

Jay Anzellotti

Jay spent his early career as a hands-on engineer depositing optical coatings for high power lasers. He then held coating development roles in various areas including industrial lighting, optical communications, fluorescence instrumentation, and semiconductor inspection tools. Jay is currently the Director of Filter Design and Coating Engineering in the Optical Filters business at Idex, Inc. Jay has a BS from the University of Rochester.

For more information contact the SVC at 505-897-7743 or CLICK HERE

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

Thursday, May 9, 2024 | *Sponsored by the SVC's Protective, Triboligical, and Decorative Coatings TAC*

CVD Today and Going Forward

Moderator: **Kalpak Shaha** (*IHI Ionbond Group*)

Dr. Kalpak Shaha
IHI Ionbond

Event Description: The requirements of Chemically Vapor Deposited (CVD) coatings for protective application has increased enormously over the past 50 years. The progress from simple monolayer coatings of the 1960s to the complex coating systems of today were made possible through increased development work, tailored to different applications needs. CVD technology has maintained an outstanding position for decades in the field of many applications. This success can be explained by the excellent mechanical properties and the thermochemical stability of the coatings. CVD is now a well-known technology in several industrial areas, like semiconductors, machining tools, components, coatings on fibre filaments, and powders.

Today's development trends are towards the capability of coating complex geometries, hard and wear resistant coatings at high temperatures and also deposition of very dense coatings that provide diffusion protection barriers at harsh conditions (corrosive atmosphere, high temperature, …). Other developments are in several niche markets which ask for specifically designed coating material systems. In dedicated niche markets, CVD has the potential to fulfil very specific requirements as the coatings can be modified by either defined micro-structures, controlling the interface to different substrate materials and tailoring specific coating properties (for example electrical resistivity) by addition of doping elements. A good example is applying CVD technology in the optic and photovoltaic industries, where the coating properties are controlled to the required transparency or optical properties. It is applied on surfaces of multiple m^2, including continued motion methods.

Prof. Dr. Urban Forsberg
Linköping University

Dr. Dev Banerjee
Kennametal

Dipl.-Ing. Frank Mumme
Gemeinnützige KIMW Forschungs- GmbH

Dr. Christoph Czettl
Ceratizit

Dr. Hristo Strakov
Bernex

The coating processes are based on the chemical reactions on hot surfaces between reactant gases, which directly yield the solid coating materials. Besides rather simple shaped parts, it can be applied on complex shaped catalyst carriers, single fibres or powders (up to some µm and even nm). The performance of CVD coatings is strongly dependent on the match with the base materials of the to be coated products (diffusion phenomena, phase changes, residual stresses, etc.) A successful application of a CVD coating includes dedicated pre- and post-treatment concepts, modern etching, surface texturing methods, and in some cases special annealing steps.

During the colloquium, we will discuss how the CVD technology can address current market needs, present different concepts on how new developed solutions can be applied in industries with high capacity and quality requirements (multiple tools to be coated versus single semiconductor part or multiple kilometres of fibre filaments). Further topics are the impact of environmental regulations and new concepts of dealing with sensitive chemicals (the precursors).

The expert panel represents academia, end users and equipment OEM's. In that way, a broad overview of future CVD technology trends and solutions will be discussed, that will enable you to understand deeper your current processes or to find coating solutions that you may be looking for.

SVC™ Society of Vacuum Coaters

2.2 Colloquium

For more information contact the SVC at 505-897-7743 or CLICK HERE

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

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

SVC

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

Atomic Layer Processing (ALP)

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

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

Session Topics will include:

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

INVITED SPEAKER:

Atomic Layer Processing Approaches for Advanced Thin Film Heterojunctions

Virginia D. Wheeler, David R. Boris, Scott G. Walton, Marc Currie, Andrew C. Lang, Neeraj Nepal, Matt Hardy, Eric Jin, Steven P. Bennett, Brian P. Downey, David J. Meyer

U.S. Naval Research Laboratory, Washington D.C.

As devices continue to shrink in this technological world and approach nanoscale dimensions, requisite devices continually grow in complexity, often resulting in 3D architectures, multifunctional composites, and other intricate material stacks. This reduction in size often leads to new interesting phenomena, such as quantum confinement effects in electronics or strong localization of light in nanophotonics, which can potentially enable new technological advancements in many applications. Realization of novel planar and nanostructured heterojunctions that exploit these effects often require direct integration of scalable dissimilar thin films unattainable with traditional deposition approaches. Thus, we have recently focused on developing unique deposition tools and approaches needed to enable direct integration of dissimilar epitaxial films with proper structure and properties, as well as abrupt, pristine interfaces necessary for advanced heterojunctions. In this talk, we will use several case studies based on functional oxides, dielectric coatings, and ultra wide bandgap materials to discuss the advantages and limitations of atomic layer deposition towards achieving unique heterostructures for use in optical and electronic applications.

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Coatings and Processes for Biomedical Applications

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

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

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

INVITED SPEAKER:

A Hitchhiker's Guide to Antimicrobial Thin Film Coatings

Gregory Caputo

Professor in the Department of Chemistry & Biochemistry at Rowan University, Glassboro, NJ

With antimicrobial resistance, hospital acquired infections, and device-associated infections all on the rise, the need for novel approaches to antimicrobial treatments and materials is of significant need in the biomedical field. Research endeavors across multiple disciplines have been addressing this issue from various perspectives including traditional small molecules, peptides, proteins, polymers, probiotics, phage, and combinatorial approaches. Vacuum approaches, such as sputtering and other physical vapor deposition techniques, have been evolving to make coatings with bactericidal characteristics. Antimicrobial surface development has been an area of great interest for materials and devices and have also involved numerous specific functional modalities.

Our team has focused on the development of metal based, thin film coatings for medical device applications, specifically bone/joint implants, and electrostimulation devices. Testing the bactericidal activity of these vacuum applied coatings requires modifications to traditional biochemical testing techniques. After modifying the testing techniques, we have shown that these coatings demonstrate remarkable broad-spectrum antimicrobial activity, high bioavailability of the active compounds to interact with bacterial targets, minimal cytotoxicity, and retention of conductivity properties essential in electrostimulators. The coatings are versatile, with significant tunability to tailor the active component release profiles to the application of the material.

Our current approaches and results will be discussed, with a focus on the antimicrobial methodology used to evaluate the efficacy of antibacterial activity specifically on vacuum applied coatings. These techniques will also be discussed regarding their potential role in the investigation of nature-inspired topographies controlling biofilm adhesion. In general, these updated or modified assays will be discussed to describe how they can interact and synergize with traditional surface/materials characterization approaches to enhance the understanding of antimicrobial mechanisms

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Coatings for Energy Conversion and Related Processes

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

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

Energy Harvesting:

- RF Harvesting
- Piezoelectrics
- Kinetic harvesting through body movement

Energy Storage:

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

Efficient Functional Coatings:

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

Business Topics:

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

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

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

INVITED SPEAKER:

Vertically Aligned Carbon Nanotube Coatings for Dendrite-Free and Stable Lithium-Metal Battery Anodes

Abdul-Rahman O. Raji, Tuqeer Nasir, Tuo Wang, Li He, William Ceren, Mina Moradnia, Sarathy Gopalakrishnan

Zeta Energy Corp., Houston, TX

Developing high energy density, fast-charging, and long cycle life lithium-metal batteries requires reversible deposition and dissolution of the lithium-metal anode without dendrite formation over many cycles in the battery cell. Dendrite formation is well-known to occur in lithium-metal deposited during electrochemical cycling of the anode, and its safety hazards are documented and severe. The resulting formation of dead lithium causes battery capacity degradation due to progressive deactivation of the lithium-metal, which is the active anode material. We hereby present a case for the use of a host structure with high specific surface area and porosity as a viable approach for addressing these fundamental issues. We demonstrate that vertically aligned carbon nanotubes (VACNT) coating is the ideal host material due to its high surface area, porosity, electrical conductivity, lightweight, and tunable properties; and we can reversibly deposit dendrite-free lithium-metal within the VACNT coating, thus forming a stable and practical Li-VACNT

anode. The VACNT coating is deposited using vacuum processes via a combination of physical vapor deposition (PVD) and chemical vapor deposition (CVD). For the first time, we demonstrate not only that VACNT can be coated on both sides of the copper current collector, but also that the dual-sided coating can be achieved simultaneously over a large area. While vacuum coating of electrode materials is novel to the battery industry, we show that our processes are compatible with roll-to-roll coating, a requirement for battery material commercialization in the industry. With VACNT representing only a small fraction of the mass of the Li-VACNT anode, the advances presented here lay the foundation for the safe use of the ultimate lithium battery anode material, namely lithium-metal. The desirable combination of the tunable material properties, stable electrochemical performance, and commercial viability of the VACNT presents a model system for lightweight, compact, and fast-charging advanced lithium batteries.

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Digital Transformation of Industrial Deposition Processes

Industrial deposition processes are subject to strong competitive pressure, as better productivity is always demanded with a higher precision and increasing complexity of coating products. This increased complexity requires optimized coating processes, model-based process control and a view of the complete process chain. Therefore, a digital transformation, which will be one of the key drivers in the future for industrial deposition processes, is needed. The digital transformation includes the systematic collection of data which is generated in the different processes and the representation of the (coating) processes by means of real-time capable, digital twin. Already nowadays, the simulation, which can be part of digital twin, is a well-established tool for predicting and optimizing deposition processes. It is possible to use physical and/or chemical models to predict the behavior of the process.

Another approach of predicting processes is the use of generated data and utilize the artificial intelligence. Therefore, the data acquisition, storage, and accessibility of the data plays an important role. Artificial intelligence is already deployed for example in image recognition, predictive maintenance, and process control.

This session will cover all topics in which digitalization plays an important role. It will bring the experts for simulation and artificial intelligence together and offers a perfect floor to discuss the benefits of the digital transformation of industrial deposition processes from point of view of different technology fields.

INVITED SPEAKER:

How Will Our Vacuum Coater and Deposition Processes Look Like Tomorrow?

Wilmert De Bosscher
Soleras Advanced Coatings, Deinze, Belgium

Digitalization has come a long way and adoption into industry is happening at an ever-increasing pace. The revolution in high volume and large area vacuum coating applications is happening today at many different levels across our industry.

This presentation tries to capture the various activities of digital transformation in industrial deposition processes and how these may significantly impact our expectations and way of working in the near-future coating businesses.

In the first part, we want to highlight some generic approaches allowing us to make better, higher performing and flexible coating equipment. It all started about 30 years ago with 3D CAD software, extended with some FEA (Finite Element Analysis) modules for making the most efficient mechanical constructions. The past 20 years, many have contributed in modelling gas flow, plasma and coating processes enabling to predict and better understand deposition performance in layer thickness, morphology and composition. In the past decade, deposition source positioning and substrate movement have allowed to anticipate forming uniform coating on more complex shaped substrate geometries. Today, generative AI (Artificial Intelligence) may allow proposing a coater equipment concept (e.g., number and size of chambers, geometry of coat zones, gas and pumping needs, infrastructure boundaries, …) fulfilling the expectations of the envisioned product performance and throughput.

The second part will focus on data management. Although most recent coaters have plenty of possibilities for logging sensor data of process parameters in real time, often data mining and correlation analysis is insufficiently explored. In addition, many companies develop coater components (e.g., pumps, power supplies, magnetrons, in-situ metrology tools, …) for which powerful standalone datalogging tools and dashboards are being developed. Again, limited integration into overall coater data management systems may limit the extended capabilities of those advanced tools. Having an appropriate IT framework and connection data gateways may enable linking all setting parameters and sensor data to the performance of individual coated products. A new and flexible control and monitor interface is desired, allowing to see exactly what you need, when you need it and with user specific (e.g., operator, R&D scientist, coater manager, …) configuration tools.

The third and final part discusses the capabilities of incorporating generative artificial intelligence into coater and coating performance while using aggregated data from prior operations. By linking historical metrology data from the coated product with related sensor and process data, performance of the coated product may be predicted during the coating process. Furthermore, critical variables may be tuned (single or multivariate analysis) in-situ to sustain the required coating performance. However, this is not a straightforward approach and requires

acquisition of and providing context to all relevant data variables. In addition, component performance and the potential need for preventive maintenance on the coating equipment may be monitored, allowing optimal functionality of the system.

A combination of these approaches will enable us to optimize complex coating functionalities, at a desired high throughput, at minimized costs and while providing reliably high yield product performance.

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Emerging and Translational Technologies and Applications

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

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

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

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

INVITED SPEAKER:

FlexGlass Pilotlab – An Innovative Platform for Emerging Use Cases

Jörg Neidhardt[1], Matthias Fahland, Wiebke Langgemach, Manuela Junghähnel[2]

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

[2] Fraunhofer Institute for Reliability and Microintegration IZM, All Silicon System Integration Center Dresden – ASSID, Moritzburg, Germany

Flexible glass with thicknesses of 100 µm is an emerging substrate material with already established applications for foldable displays as well as for micro-electronic packaging applications. Beyond that, it is readily considered for e.g. weight saving solutions combining the beneficial properties of glass with its flexibility, may it be for smart glazing applications for building and automotive, thin bendable displays for surface integration or as a functionalized barrier material/substrate for photovoltaics and flexible electronics.

Beyond the proof of concept, however, the scalability of the functionalization process must be demonstrated between TRL3-7. This often poses a serious challenge as processing, handling, cleaning, and inspection procedures must be adapted and demonstrated at appropriate equipment platforms. Moreover, crucial parameters like mechanical thin film stress and the substrate strength must be evaluated and controlled.

Fraunhofer's mission is therefore to support product and process development for ultrathin flexible glass. For this purpose, Fraunhofer FEP has established equipment and processing competences for the transfer of lab-scale results to pilot-level. The platforms for roll-to-roll, sheet-to-sheet as well as stationary wafer processing will be introduced alongside with the dedicated installations for cleaning, inspection and handling of flexible glass substrates up to 600 x 1200 mm^2 size.

Special emphasis will be on the mechanical characterization of the sensitive ultra-thin glass substrates. Here, the impact of the various processing steps will be correlated to damage thresholds and mitigation strategies will be introduced.

Initial results for emerging use cases such as smart glazings, bendable displays, and for advanced heterogenous integration solutions such as ultrathin glass interposer will be presented and discussed.

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High-Powered Electron Beam Technology

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

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

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

INVITED SPEAKER:

EBPVD Thermal Barrier Coatings for the Aerospace Industry. Current Status, Challenges, and Future Outlook

Jason Van Sluytman

Honeywell R&D Coatings Division, Phoenix, AZ

Despite the impact attributed to the COVID pandemic, today's aerospace market forecast is steadfast – continued growth well past 2030. Consequently, the reliance of EBPVD processing for thermal barrier coatings (TBCs) applied to critical high pressure turbine components within the aero-engine will remain unabated as well. This talk starts with the current status of EBPVD utilized on the de facto industrial material standard: (7-8) weight percent yttria-stabilized-zirconia (7YSZ). Aside from the desired intrinsic properties offered by 7YSZ, the process stability and reproducibility to evaporate this ceramic oxide under the e-beam results in high throughput with minimal downtime. Yet, as this ceramic made inception into modern aero-engines, unanswered questions lingered, such as evaporative species, vapor cloud dynamics and in-situ monitoring. As the industry pivoted toward Lower-k TBC materials, these questions became challenges, revealing material advantages and limitations compared to 7YSZ. If these challenges can be understood and addressed, then the final part of this talk offers perspective concerning the future use of EBPVD within 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:

The Use of HiPIMS in an Industrial Setting

Jon W. Paggett

Kyocera Hardcoating Technologies, Cuyahoga Falls, OH

High power impulse magnetron sputtering (HiPIMS) has been widely used in manufacturing for many years. Kyocera Hardcoating Technologies has employed HiPIMS technology for over a decade in tool coating applications. The benefits of HiPIMS, such as improved adhesion, dense coatings, smooth surfaces, and the ability to deposit a wide range of materials, lends itself to numerous cutting and forming applications. This presentation will give an overview of Kyocera Hardcoating Technologies' history with HiPIMS, compare HiPIMS with other PVD methods common to the tool coating industry, and discuss some of the challenges of using HiPIMS in an industrial setting.

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Large Area Coatings

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

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

Along with the technical challenges, there are complex decisions that need to be made regarding Capital Expenditures (CapEx) versus Cost of Ownership (CoO). The facility requirements, substrate handling, and product yield are also key considerations.

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

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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:

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

INVITED SPEAKER:

Coatings for Laser Fusion Ignition and Beyond

Christopher J. Stolz

Lawrence Livermore National Laboratory, Livermore, CA

On December 5, 2022, Ignition (gain >1) was demonstrated at the National Ignition Facility (NIF) and repeated on July 30, 2023. On the NIF there are 832 high fluence 1ω transport mirrors of which ~36 are exchanged annually due to laser damage initiated typically from debris within the beam tubes or 3ω backscatter from the target. Multiple technologies are currently used to mitigate these laser damage sources including spectral filtering, gas knives, and spot blockers. One of the contributing factors for achieving Ignition was an increase from 1.9 to 2.05 MJ of 3ω laser energy on target. New technologies are being developed to safely ramp up NIF in energy with minimal laser damage, to achieve a goal of even higher gain. For the transport mirrors, these new technologies include non-stick monolayers that would be deposited over the e-beam deposited multilayer mirrors to improve the efficiency of the gas knives at removing debris, femtosecond laser machining to arrest laser damage growth thus enabling increasing the range of laser conditioning before installation, and the substitution of alumina for hafnia as the high index material for improved 3ω laser damage resistance of the mirrors closest to the target chamber.

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Plasma Processing & Diagnostics

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

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

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

Plasma-Enhanced Chemical Film Conversion

R. Mohan Sankaran

Department of Nuclear, Plasma, and Radiological Engineering, University of Illinois at Urbana-Champaign, Il

Low-temperature plasmas have played a vital role in materials manufacturing such as the fabrication of semiconductor-based electronics. Plasmas are typically used to etch and deposit thin films subtractively, in which undesired areas of a larger material are removed to produce the desired pattern or shape. Recently, additive methods to materials manufacturing have emerged that create structures with minimal wasteage by building up a structure layer-by-layer. With the ability to process materials at low temperature, carry out non-equilibrium chemistry, and conform to three-dimensional shapes, plasmas offer enticing possibilities for additive manufacturing, much like the contributions that have already been made in subtractive manufacturing. In this talk, I will present our recent development of a method called plasma-enhanced chemical film conversion in which a plasma process is combined with printing methods to treat or convert deposited precursors. Films or patterned structures can be directly obtained on polymer or silicon substrates to facilitate applications. The method is general and has been applied to metals, semiconductors, and insulators.

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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 & energy, lower operating costs, and increased overall efficiency.

Reliable monitoring and control solutions are far from readily available, and intense development efforts are underway in industry and academia across the globe. It is intensely hot around the topics related to the development and industrial application of (1) embedded sensors & actuators, (2) cyber-physical monitoring and control systems, (3) holistic process control methods and systems and (4) 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 to-

ward 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:

Equipment Control in 2024 – from Must Haves to Future Dreams

Frank Geissler

Director Sales, Kontron AIS, Dresden, Germany

The effective control of thin-film systems' equipment is an essential aspect of modern manufacturing and research processes, in various industries from optics to photovoltaics. Vacuum thin-film technologies are broad reaching from CVD, PVD and ALD to Ion Beam applications, enabling the creation of high-performance and functional surfaces. Achieving precise control over equipment parameters such as temperature, pressure, gas composition, and deposition rates is a must have to ensure consistent and reproducible quality.

In this context, data control and management play an important role in enhancing process efficiency, product quality, and innovation. The large volume of data generated during a process requires very robust control systems capable of storing, executing, and analyzing data for repeatable process execution. Advanced analytics can uncover hidden correlations, enabling real-time adjustments to equipment settings, minimizing defects, and maximizing yields.

Connectivity further elevates the potential of vacuum system control by enabling basic functionality as remote access to the equipment allowing experts to troubleshoot issues without travel, reducing maintenance costs and downtime but also overall cost. A standard in various industries is the connectivity to IT (information technology) and OT (operational technology) systems which is not common for typical thin-film equipment. Manufacturing execution systems (MES) are in place in larger production facilities or special industries (e.g., semiconductor) but typically without equipment connectivity enabling remote control and data collection of KPI (key performance indicators) or simply alarms and process values. The potential for production and process optimization is very high.

With the possibilities of equipment connectivity data can be transmitted real-time to centralized platforms (on-premise or cloud) for data storage in the first and data analytics in the second step. Data consistency and integrity is a must in this content also looking into the future of machine learning and AI (artificial intelligence). Here first promising steps are made already.

In conclusion, modern equipment control in vacuum thin-film systems is a must for achieving consistent and high-quality products. Data management and connectivity amplify the benefits by enabling remote control, data collection as well as data analytics now and machine learning in the future. For manufacturing but also research facilities, establishing advanced data strategies and technological connectivity will be key to remain at the forefront of innovation.

30 Years of Industrial Vacuum Robots: Leveraging Statistical Process Control to Enhance Performance and Reliability

Yehoram Yosubash, Hsiao-Lung Chang, **Louis Dagenais, Nate Spiker, Chris Aitken, Stu Beale**

Brooks Automation, Chelmsford, MA

Since its founding in 1978, Brooks Automation has been a leading automation provider and trusted partner to the global manufacturing industry. The first wafer-handling MagnaTran® vacuum robot was introduced in 1994. More than 35,000 have since been shipped and are found in manufacturing facilities worldwide, transferring substrates to produce highly advanced logic and memory chips, LEDs and optoelectronics, hard-disk drives, and optical lenses and components.

Traditional wafer-handling robots use belts and gears to transfer rotary servomotor motion of robot joints to an S-curve motion profile at the end effector. The Brooks Automation MagnaTran® robot is the world's first direct-drive vacuum robot that uses an innovative in-vacuum rotor and shaft-coupled encoders to deliver infinite rotation, precision substrate placement, and fast substrate-swapping. Complex motion controls have also been developed to harness the direct-drive torque.

The semiconductor industry aggressively demands improved throughput, high yield, and energy efficiency, as well as a lower cost of ownership. The MagnaTran® LEAP™ robot provides these solutions with best-in-class performance and longevity for leading edge Memory and Logic chip production.

A ground-up redesign of the robot's hardware and its manufacturing process further strengthens and differentiates performance and capabilities over alternative solutions for leading-edge applications. Statistical Process Control (SPC) and automated monitoring are utilized during the build and test environment. Re-written software paired with on-board diagnostic and motion analysis bolsters the MagnaTran®'s hardware capabilities.

Template move motion analysis is an SPC-like monitoring and alerting capability that can detect small variations in movement trajectories for specific station-to-station paths over the lifetime of individual robots. Like traditional SPC, template move motion analysis collects initial benchmark motion performance data of the robot for specific station-to-station motion paths to capture the normal range of variability in movement trajectories. This, in turn, allows the robot to monitor its performance and alert host software whenever the robot starts to deviate outside of its established level of variability. Monitoring like this can detect more subtle changes in the performance of individual robots, such as peak torque and acceleration.

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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 in the field of vacuum coatings and surface engineering processes, materials characterization and equipment for applications to protect components, tools, as well as decorative parts.

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

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

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

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

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

INVITED SPEAKERS:

CVD Coatings for Cutting Tools: Evolution and Challenges

Dev Banerjee

Kennametal, Latrobe, PA

Almost all tools used to machine metals and alloys, and some for machining emerging materials such as carbon fiber reinforced composites (CFRP), powder metallurgy processed alloys, solid graphite, etc. are coated by either a CVD or a PVD process. The substrates are primarily made of cemented carbide, cermets, ceramics or cubic BN, high speed tool taking a backseat in a low performing range. Among the various application types, CVD coatings have been almost exclusively used in turning tools, even though some new CVD coatings are finding applications in niche milling applications. The CVD coating materials, coating architecture and CVD coating reactors used are somewhat unique for this industry. This talk will explore some of these uniquenesses, their evolution and trends, and recent challenges faced by the CVD coating technologists in the metalcutting industry.

Application of Thermal Barrier Coatings on Hotter Parts of Aero-engines Using EB-PVD Technology

Ravisankar Naraparaju, Uwe Schulz

German Aerospace Center (DLR), Cologne, Germany

Thermal Barrier Coatings (TBCs) offer protection against excessive heat to the parts that are used in the hot-sections of aero-engines. In general, hot components of gas turbine engines operating at high temperatures for propulsion and power generation are mainly made up of nickel-based superalloys. Currently 7 wt. % Yttria Stabilized Zirconia (7YSZ) is the state-of-the art TBC material primarily because of its low thermal conductivity and high toughness. These TBCs are commonly deposited by electron beam physical vapor deposition (EB-PVD) and by air plasma spraying (APS) techniques. EB-PVD is a physical vapor deposition technique in which a high energy electron beam targeted towards the ceramic material (ingot) causes it to melt and vaporize in the form of a cloud within the vacuum chamber. Microstructure formed by EB-PVD TBC entirely depends on processing conditions, but is primarily a columnar microstructure with porosity within the coating (inter-columnar gaps, voids between feather arms and intra columnar pores) which contributes towards better strain tolerance and thermal shock resistance properties with respect to plasma sprayed TBCs. The influence of process parameters on the microstructures of various TBCs will be presented in this talk.

Application of Various Coatings on Aircraft Jet Engine Parts

Tsunao Tezuka

IHI Corporation, Akishima-shi, Tokyo, Japan

An aircraft jet engine is composed of a Fan that takes in air and expels it to produce thrust, a Compressor that compresses the incoming air, a Combustion chamber that mixes and burns fuel, and a Turbine that converts the combustion gases into rotational force. Jet engine components are exposed to harsh environment, such as extreme temperatures ranging from below -60 degrees Fahrenheit to over 2500 degrees Fahrenheit, vibrations, and centrifugal forces from high-speed rotation. Depending on the part, various functionalities like anti-erosion, anti-wear, anti-corrosion, anti-oxidation, and thermal barrier are needed on the surface. These characteristics, which the base material itself does not possess, are provided by the coatings. The methods to achieve these coatings are diverse, including general techniques such as painting, plating, welding, and air plasma spraying, as well as special techniques such as Metallic Vapor Deposited Diffusion Coating, Vacuum Plasma Spray (VPS), Chemical Vapor Deposition (CVD), and Physical Vapor Deposition (PVD).

TAC Chair:
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Thin Film Sensors

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

Topics of interest to this session will include:

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

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

INVITED SPEAKER:

Complex Germanates Thin Film Growth by Sub-Oxide Source Molecular-beam Epitaxy

Hanjong Paik

School of Electrical and Computer Engineering and Center for Quantum Research and Technology, University of Oklahoma, Norman, OK

We focus on exploring the intricate phase diagram of the Sr-Ge-O thin film system using molecular-beam epitaxy. Under ultra-high vacuum (UHV) conditions, we employed a suboxide GeO-flux and elemental Sr-flux to successfully grow single-crystalline complex strontium germanates on $LaAlO_3$ (001) substrates. The growth of these films in a single phase is highly dependent on the ratio of Sr-flux/GeO-flux and substrate temperature. Through in-situ RHEED observation, we observed a transition in growth mode from an initial complicated 3D nucleation-dominant growth to a smoother 2D layer growth, which was consistent with Atomic Force Microscopy (AFM) observations. XRD measurements confirmed the presence of single-phase Sr_2GeO_4-like thin films with an out-of-plane d-space of 4.05 Å, indicating a strain-relaxed growth mechanism as evidenced by wider ω-rocking curves. Large area reciprocal space mapping revealed a unique domain structure. STEM imaging further demonstrated the epitaxial relationship between the thin films and $LaAlO_3$ (001) substrate, exhibiting a relatively sharp interface structure. This complex germanates system holds promise as a potential candidate for high-mobility oxide semiconductors in power electronics applications. We are currently conducting further studies involving optical and electrical doping to expand our understanding of this system's properties.

TAC Co-Chairs:
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Binbin Weng, *University of Oklahoma*, binbinweng@ou.edu

Thin Film Contributions for the Hydrogen Economy

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

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

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

Exhibitor Innovator Showcase

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

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

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

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

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

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

INVITED SPEAKER:

Monitoring of Conductive Thin Films in Challenging Vacuum Environments by Eddy Current Sensors

Marcus Klein, Senthil Vinodh
SURAGUS GmbH, Dresden, Germany

In the digital age of big data, the decade-old Trillion Sensors Roadmap predicted the generation of bronto-bytes (1000 trillion) of data. True to the expectation, extensive amounts of data are generated, stored, processed and analyzed in this new sensor economy. Likewise, process control and monitoring strategies in industrial manufacturing are now reliant on the information generated by a variety of physical and virtual sensors. One such physical sensor

based on eddy current technology enables non-contact, high-speed measurement with excellent repeatability, high sensitivity and abundant data. For high-speed inline processes, the measured data provide insight into thin film coating parameters viz., sheet resistance, resistivity, layer thickness, anisotropy etc. Instantaneous data and statistics of the process behavior is often desired in vacuum conditions to increase the throughput and uptime.

Nevertheless, the challenge for vacuum coating line developers and process engineers is the selection of technologies, data architecture, equipment suppliers and the setups of such techniques. This talk provides an overview of parameters for the assessment of such concepts and suggests a procedure for finding the most cost- and performance-effective testing setup for S2S/R2R inline and cluster/ batch tools. Furthermore, it explores challenges and potentials provided by the introduced global technological trends.

Specific examples across various industries and application including hot environments and narrow spaces are included in this paper to explain the capabilities of non-contact, non-destructive eddy current technology for material characterization.

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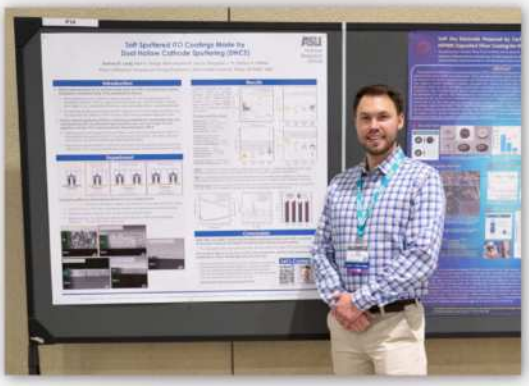
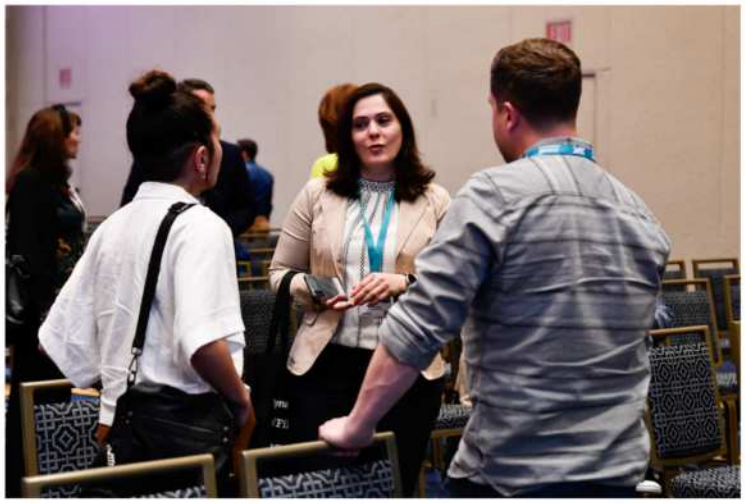
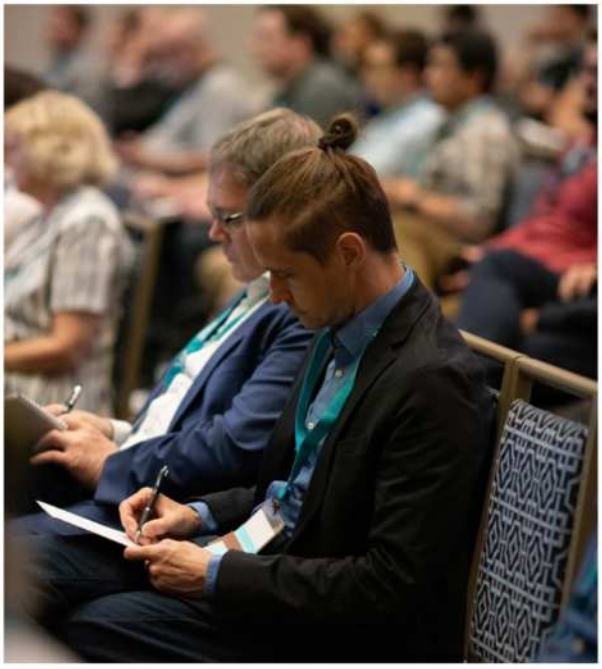


Technical Poster Session

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





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

Conference Calendar

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

SATURDAY May 4	SUNDAY May 5	MONDAY May 6	TUESDAY May 7	WEDNESDAY May 8	THURSDAY May 9
Education Program 31 Tutorial Courses					
TechCon Registration Counter Hours: Saturday, May 4 7:00 a.m. – 10:00 a.m. Sunday, May 5 7:00 a.m. – 10:00 a.m. and 4:00 p.m. – 7:00 p.m. Monday, May 6 7:00 a.m. – 6:00 p.m. Tuesday, May 7 7:00 a.m. – 5:30 p.m. Wednesday, May 8 7:00 a.m. – 5:00 p.m. Thursday, May 9 7:00 a.m. – 12:00 p.m.		**Technical Program**			
			Exhibit **Exhibit Open Hours** **1 p.m. – 6:00 p.m. Tuesday** **10 a.m. – 4 p.m. Wednesday**		
Conference Registration Open Chicago Hilton Hotel					

CONFERENCE REGISTRATION FEES*

NEW for 2024!

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

Attendee Registration

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

- ❑ Full Conference ..... $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 2024 or join SVC on-line

Exhibitor Registration

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

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

Special Events at the TechCon

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

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

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

Networking Opportunities at the 2024 TechCon

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 7 – 8, 2024.

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

Additional Networking:

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

SVC Foundation Networking Events

CASINO NIGHT

Come and join us for an evening of fun and networking, all to help a great cause at the Fifth Annual SVC Foundation Casino Night on Monday, May 6, 2024.

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 TFB's; problems are solved, new ideas are vetted, relationships are made and rekindled; all in the spirit of camaraderie that has made the SVC the most unique technical conference in our field. This year we are expanding the program even further and will offer more than 20 meetings during the TechCon Please be sure to check the daily schedule (the TFB's are offered on Monday, Tuesday, and Thursday of the TechCon) to find those topics that interest you! And remember, we are always looking for new topics as well as moderators to get the discussion going in the mornings. Good luck and have fun!

– Frank Zimone, Executive Director

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

Networking Opportunities at the 2024 TechCon

2024 SVC Awards Ceremony and Welcome Reception

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

Everyone is invited to attend

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

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

2024 SVC TechCon Farewell Social

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

Everyone is invited to attend

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

Job Board

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

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2024 SVC TechCon Exhibit Committee Co-Chairs:

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

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

FROM THE EDUCATION DIRECTOR

Winter is typically the time when I do a little inventory – what I have, what I do not have, and what I likely need. The latter can be a bit of rabbit hole. When it comes to my skill sets and knowledge base, I often find I need to learn something new. Other times, it's a matter of what I forgot and what I need to reacquaint myself with. If this sounds familiar, let me suggest you take a look at this year's TechCon education program.

Our 6-day education program includes 32 tutorials that cover a range of topics and perspectives associated with the skills needed to be successful in the broad field of vacuum coating and surface engineering. We will continue to offer our most popular courses focusing on vacuum systems, deposition basics, troubleshooting, and process optimization. For example, our historically popular tutorials: "**High Vacuum Systems and Operations**," (VT-201), taught by Dr. John O'Hanlon. "**Sputter Deposition for Industrial Applications**," (C-208), taught by Dr. David Glocker and "**Troubleshooting for Thin Film Deposition Processes**" (C-212), taught by Dr. Mike Miller will again be presented. We are also offering some new courses this year. These new offerings include: "**Antimicrobial coatings and a field guide to evaluating their antimicrobial activity**" (C-272), taught by Drs. Jeff Hettinger and Gregory Caputo; "**Basics and Applications of Electron Beam Technology for Manufacturing Processes**" (M-240) taught by Dr. Stefan Saager; "**Mass Flow Control**" (M-140), taught by Dr. Douglas Baker; and "**Deposition Process Simulation**" (M-250) taught by Dr. Dennis Barton. The full listing of courses is found later in this issue or at the TechCon website under the "education program" link.

We feel strongly that the best way to experience the SVC TechCon is to immerse yourself in all three "pillars" of the event, which include the education program, technical conference, and exhibition. In fact, over the last few years we have added opportunities that help enable that experience. For example, all tutorial registrants receive complimentary access to the morning Keynote presentations, Technology Forum Breakfasts, and the two-day Exhibition. Similarly, all full conference registrants receive a complimentary tutorial. There are also discount rates for students and young members. We hope you take advantage of these unique opportunities.

So, whether you want to add to your skills or refresh your old ones, understand the technology or the science behind an application, or look into emerging science and technology, I'm sure we have a course and opportunity that satisfies your needs. As always, if you have some questions, please ask. We are happy to help!

We look forward to seeing you in Chicago!

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

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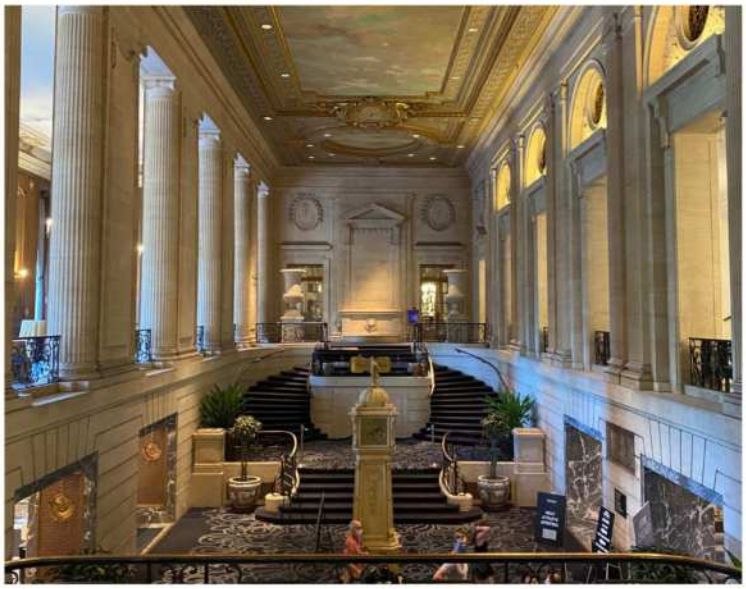
Two-day free passes will be heavily promoted to drive in foot traffic to the SVC Exhibition from local industry and adjacent expositions.

About Our Venue

Chicago Hilton Hotel, Chicago, Illinois

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



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

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

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

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2024 SVC TechCon Exhibit Committee Co-Chairs:
Jason Hrebik, Kurt J. Lesker Company, jasonh@lesker.com
Steve Simons, Manitou Systems Inc., ssimons@manitousys.com

Saturday, May 4 – Thursday, May 9

TECHCON EDUCATION SOLVES VACUUM COATING PROBLEMS!

35 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.

This year the SVC is offering a "Masterclass Program" that for a fixed fee of $1,250, the registrant can sign up for an unlimited number of tutorials. All tutorial registrants are encouraged to attend all SVC Technical Forum Breakfasts, evening social events, and morning Keynote presentations.

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

SCHEDULE

Saturday, May 4, 2024

C-103 An Introduction to Physical Vapor Deposition (PVD) Processes
Shah
C-205 Introduction to Optical Coating Design
Sargent
C-208 Sputter Deposition for Industrial Applications
Glocker
C-230 Processing of Plastics for Better Protection, Reflection, and Decoration *AM*
Vergason
C-333 Practice and Applications of High Power Impulse Magnetron Sputtering
Ehiasarian/Bandorf
VT-201 High Vacuum Systems and Operation
O'Hanlon

Sunday, May 5, 2024

C-212 Troubleshooting for Thin Film Deposition Processes – Session 1
Miller
C-218 Advanced Design of Optical Thin Films
Willey
C-316 Introduction to Atomic Layer Deposition (ALD) Processes, Chemistries, and Applications
Biyikli
C-323 Fundamentals of High Power Impulse Magnetron Sputtering (HIPIMS)
Ehiasarian
C-329 Properties and Applications of Tribological and Decorative Coatings
Doll/Matthews
VT-203 Residual Gas Analyzers and Analysis
O'Hanlon

Monday, May 6, 2024

C-217 Practical Production of Optical Thin Films
Willey
C-322 Characterization of Thick Films, Thin Films and Surfaces
Christensen
C-334 Manufacture of Precision Evaporative Coatings
Oliver

Tuesday, May 7, 2024

C-214 Thin Film Deposition Optimization *AM*
Willey
C-220 Introduction to Two-Dimensional Materials *AM*
Muratore
C-320 Diamond-Like Carbon Coatings – From Basics to Industrial Realization *AM*
Savva/Haubold/Keunecke/Stein/Petzold
C-337 ITO and Alternative TCO: From Fundamentals to Controlling Properties
Bright
M-102 Introduction to Ellipsometry *AM*
Hilfiker
M-201 Flexible Electronics *PM*
Muratore
VT-230 Design and Specification of Vacuum Deposition Systems
Belan

EDUCATIONAL PROGRAM

SCHEDULE
CONTINUED

Wednesday, May 8, 2024

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

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

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

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

C-338 Application of Reactive Sputtering
Bandorf/Gerdes

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

M-240 Basics and Applications of Electron Beam Technology for Manufacturing Processes *AM* **NEW!**
Saager

VT-240 Practical Elements of Leak Detection
Deluca

Thursday, May 9, 2024

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

M-120 Design of Experiments for R&D
Grace

M-140 Mass Flow Controllers: Fundamentals, Troubleshooting, and Calibration *PM* **NEW!**
Baker

M-250 Deposition Process Simulation *AM* **NEW!**
Barton

SVC INSTRUCTORS

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.

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.

is Professor at the Uppsala University and Research leader of the Plasma group at the Angstrom Laboratory. She is manager/director of several energy related projects/centers. 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 Chair of the Coatings for Biomedical Applications, co-organizer of Heuréka sessions and member of the Education, Strategic Planning

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and International Relations, Committees. Hana is 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.

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 1978 from the Czech Acad. Sci. and a Doctor of Science degree from Charles University in Prague in 1995. In 1984 he was awarded the Czechoslovak State Prize for outstanding research results in the plasma deposition of thin films. He has more than 25 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. He runs a consulting company in plasma sources and processing technology. 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 is Program Chair for 2009 and 2010 SVC TechCons, is currently serving on the SVC Board of Directors and is TAC chair of a special session Heuréka at the SVC TechCon and a member of the SVC Publications and Strategic Planning Committees.

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 Van-der-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

was a Senior Staff Scientist and Group Technical Leader with 3M Corporate Research Laboratory for thirteen years, before retiring, and in 2013 founding a consulting practice - Bright Thin Film Solutions LLC. At 3M he developed roll-to-roll coated, vacuum deposited, organic and inorganic multilayer thin film products for optical, transparent conductive, barrier and other applications. Previously, he was Vice President at Presstek, Inc., and Delta V Technology subsidiary, where he directed the R&D of transparent conductive oxides (TCO), barrier coatings and polymer multilayer (PML) technology. While Director of Product Development at Southwall Technologies, he led teams developing sputter deposited transparent low e and solar control coatings, transparent conductive metal and oxide coatings, and durable conductive (ITO) multilayer antireflection coatings on plastic film. He served 12 years on the Board of Directors and was President of the Society of Vacuum Coaters (SVC). In 2009, he received the SVC Mentor Award, and the Nathaniel Sugerman Award in 2012. He has presented, as 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), (second edition, Elsevier, June 2018). He is inventor or co-inventor on 34 U.S. patents in the field.

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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.

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

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.

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.

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.

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.

founded Isoflux Incorporated, a manufacturer of magnetron equipment, in 1993. He has more than 30 years' experience in thin film research, development, and manufacturing and has taken a number of new processes from laboratory-scale feasibility studies through successful production. He is an inventor or co-inventor of 31 U.S. patents and an author of more than 30 research papers in the areas of sputter source design, plasmas and plasma characteristics, sources of substrate heating in sputtering, and the control of sputtering processes and sputtered film properties. He also is the co-editor of The Handbook of Thin Film Process Technology, a major reference work in the field.

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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.

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).

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.

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."

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.

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.

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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 is the author of A User's Guide to Vacuum Technology, 3rd edition. (John Wiley & Sons, 2003).

is founder and owner of Vacuum Innovations, LLC and is a research engineer at the University of Rochester's Laboratory for Laser Energetics. A graduate of the University of Rochester's Institute of Optics, his work has focused on process design and modeling for precision evaporated coatings. Thin-film uniformity control is of particular interest, having developed advanced distribution models and planetary rotation systems. He also teaches optical coating design at the Institute of Optics as well as at the Institute's annual thin film summer school program.

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.

received his BA in Physics from UC Berkeley and his PhD in Optical Sciences from the University of Arizona. He has 30 years of experience in optical coatings, including 10 years with Optical Coating Laboratory, Inc. and 15 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 an R&D team at Viavi Solutions developing new optical coating products, serves on the SVC Optical Technical Advisory Committee, and is a former member of the SVC Board of Directors.

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.

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 field of thin films and nanostructured materials for 22 years. He has over 174 publications in the field and six patents awarded. He teaches the first on-line course offered by the SVC, in collaboration with the University of Delaware on Vapor Deposition Processes.

EDUCATION PROGRAM

SVC INSTRUCTORS

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.

Dr. 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.

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 4, 2024	Professional Conference/No Conference	Student/Young Member Conference/No Conference
❑ C-103 An Introduction to Physical Vapor Deposition (PVD) Processes *Shah*	$565/$690	$230/$280
❑ C-205 Introduction to Optical Coating Design *Sargent*	$565/$690	$230/$280
❑ C-208 Sputter Deposition for Industrial Applications *Glocker*	$565/$690	$230/$280
❑ C-230 Processing of Plastics for Better Protection, Reflection, and Decoration *Vergason* **AM**	$410/$470	$160/$180
❑ C-333 Practice and Applications of High-Power Impulse Magnetron Sputtering *Ehiasarian/Bandorf*	$565/$690	$230/$280
❑ VT-201 High Vacuum Systems and Operation *O'Hanlon*	$565/$690	$230/$280
Sunday, May 5, 2024		
❑ C-212 Troubleshooting for Thin Film Deposition Processes – Session 1 *Miller*	$565/$690	$230/$280
❑ C-218 Advanced Design of Optical Thin Films *Willey*	$565/$690	$230/$280
❑ C-316 Introduction to Atomic Layer Deposition (ALD) Processes, Chemistries, and Applications *Biyikli*	$565/$690	$230/$280
❑ C-323 Fundamentals of High-Power Impulse Magnetron Sputtering (HIPIMS) *Ehiasarian*	$565/$690	$230/$280
❑ C-329 Properties and Applications of Tribological and Decorative Coatings *Doll/Matthews*	$565/$690	$230/$280
❑ VT-203 Residual Gas Analyzers and Analysis *O'Hanlon*	$565/$690	$230/$280
Monday, May 6, 2024		
❑ C-217 Practical Production of Optical Thin Films *Willey*	$565/$690	$230/$280
❑ C-322 Characterization of Thick Films, Thin Films and Surfaces *Christensen*	$565/$690	$230/$280
❑ C-334 Manufacture of Precision Evaporative Coatings *Oliver*	$565/$690	$230/$280
Tuesday, May 7, 2024		
❑ C-214 Thin Film Deposition Optimization *Willey* **AM**	$410/$470	$160/$180
❑ C-220 Introduction to Two-Dimensional Materials *Muratore* **AM**	$410/$470	$160/$180
❑ C-320 Diamond-Like Carbon Coatings – From Basics to Industrial Realization *Savva/Haubold/Keunecke/Stein/Petzold* **AM**	$410/$470	$160/$180
❑ C-337 ITO and Alternative TCO: From Fundamentals to Controlling Properties *Bright*	$565/$690	$230/$280
❑ M-102 Introduction to Ellipsometry *Hilfiker* **AM**	$410/$470	$160/$180
❑ M-201 Flexible Electronics *Muratore* **PM**	$410/$470	$160/$180
❑ VT- 230 Design and Specification of Vacuum Deposition Systems *Belan*	$565/$690	$230/$280
Wednesday, May 8, 2024		
❑ C-204 Basics of Vacuum Web Coating *Simmons* **AM**	$410/$470	$160/$180
❑ C-210 Introduction to Plasma Processing Technology *Baránková/Bárdos* **AM**	$410/$470	$160/$180
❑ C-272 Biomedical Coatings for Antimicrobial Applications *Hettinger/Caputo* **AM** **NEW!**	$410/$470	$160/$180
❑ C-306 Non-Conventional Plasma Sources and Methods in Processing Technology *Baránková/Bárdos* **PM**	$410/$470	$160/$180
❑ C-338 Application of Reactive Sputtering *Bandorf/Gerdes*	$565/$690	$230/$280
❑ M-210 Introduction to Solid-State Thin Film Batteries *Gaines* **PM**	$410/$470	$160/$180
❑ M-240 Basics and Applications of Electron Beam Technology for Manufacturing Processes *Saager* **AM** **NEW!**	$410/$470	$160/$180
❑ VT-240 Practical Elements of Leak Detection *Deluca*	$565/$690	$230/$280
Thursday, May 9, 2024		
❑ C-212 Troubleshooting for Thin Film Deposition Processes – Session 2 *Miller*	$565/$690	$230/$280
❑ M-120 Design of Experiments for R&D *Grace*	$565/$690	$230/$280
❑ M-250 Deposition Process Simulation *Barton* **AM** **NEW!**	$410/$470	$160/$180

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 2023
- 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 1, 2024 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 1, 2024. Please send your written cancellation request to **svcinfo@svc.org**.

Technical Advisory Committees (TAC)

Atomic Layer Processing (ALP)

TAC Co-Chairs:
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Coatings and Processes for Biomedical Applications

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Coatings for Energy Conversion and Related Processes

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Digital Transformation of Industrial Deposition Processes

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Emerging and Translational Technologies and Applications

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High-Powered Electron Beam Technology

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High Power Impulse Magnetron Sputtering – HIPIMS

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Optical Coatings

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

SVC

Technical Advisory Committees (TAC)

Processing Monitoring, Control, and Automation

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Protective, Tribological, and Decorative Coatings

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Exhibitor Innovator Showcase

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

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