

ICMCTF 47th International Conference on Metallurgical Coatings & Thin Films

April 26-May 1, 2020 • San Diego, CA

Town & Country Hotel and Convention Center

Call for Abstracts & Awards Nominations

DEADLINE: OCTOBER 1, 2019

Sponsored by the AVS Advanced Surface Engineering Division: <http://www2.avs.org/conferences/icmctf>

CONFERENCE OVERVIEW

The International Conference on Metallurgical Coatings and Thin Films (ICMCTF) is the premier international conference in the field of **thin film deposition, characterization, and advanced surface engineering** promoting global exchange of ideas and information among scientists, technologists, and manufacturers. The Conference includes more than 80 high-profile invited speakers, in over 50 sessions, across 13 technical and topical symposia, several featured **lectures**, as well as focused **topic sessions, short courses, an equipment exhibition, an awards program, and daily social networking events.**

Technical Symposia

- A - Coatings for Use at High Temperatures
- B - Hard Coatings and Vapor Deposition Technologies
- C - Fundamentals and Technology of Multifunctional Materials and Devices
- D - Coatings for Biomedical and Healthcare Applications
- E - Tribology and Mechanical Behavior of Coatings and Engineered Surfaces
- F - New Horizons in Coatings and Thin Films
- G - Surface Engineering - Applied Research and Industrial Applications
- H - Advanced Characterization Techniques for Coatings, Thin Films, and Small Volumes

Topical Symposia

- TS1 - Anti- and De-icing Surface Engineering
- TS2 - New Horizons in Boron-Containing Coatings: Modelling, Synthesis and Applications
- TS3 - In-Silico Design of Novel Materials by Quantum Mechanics and Classical Methods jointly sponsored by ICMCTF and AQS
- TS4 - Photocatalytic and Superhydrophilic Surfaces
- TS5 - Thin Films on Polymer Substrates: Flexible Electronics and Beyond

Special Interest Talks

"Materials Discoveries at Extreme Conditions: A Path Towards New Advanced Materials"

- Igor Abrikosov, Linköping University, IFM, Sweden

"Design, Metallurgy & Manufacturing Technologies of Targets for Hard Coating & Tribological Applications"

- Peter Polcik, Plansee Composite Materials GmbH, Germany

"Plasma Aspects in the Deposition of Advanced Coatings"

- André Anders, Leibniz Institute of Surface Engineering, Germany

PLENARY LECTURE



► April 27, 2020, 8:00 a.m.

"Organic Bioelectronics – Nature Connected"

- Magnus Berggren, Laboratory of Organic Electronics, ITN, Linköping University, Norrköping, Sweden

EXHIBITORS KEYNOTE LECTURE (EX)



► Tuesday, April 28, 2020, 11:00 a.m.

"Carbon based Coatings in Industrial Scale for Sustainable Surface Solutions"

- Dr. Jörg Vetter, Oerlikon, Germany

Awards Nominations

R.F. Bunshah Award & Honorary ICMCTF Lectureship -

Recognizes outstanding research or technological innovation in the areas of interest to the AVS Advanced Surface Engineering Division (ASED), with emphasis in the fields of surface engineering, thin films, and related topics.

Bill Sproul Award & Honorary ICMCTF Lectureship -

Recognizes 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, with emphasis in the fields of surface engineering, thin films, and related topics.

ICMCTF Graduate Student Awards -

Honors and encourages outstanding graduate students in fields of interest to the AVS Advanced Surface Engineering Division (ASED). ASED seeks to recognize students of exceptional ability who show promise for significant future achievement in ASED-related fields.

Upcoming Deadlines

- Abstract Submission: October 1, 2019
- Awards Nominations: October 1, 2019
- Manuscript Submission: March 20, 2020
- Pre-Registration: March 20, 2020
(Deadline is March 20th to be in the Program Book)
- Early Registration: March 20, 2020
(Presenting authors must register by March 20th to remain in the Program Book)

General Chair:

Christopher Muratore
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INTERNATIONAL CONFERENCE ON METALLURGICAL COATINGS & THIN FILMS
(ICMCTF-47), SAN DIEGO, CA, APRIL 26 – MAY 1, 2020
CALL FOR ABSTRACTS

The International Conference on Metallurgical Coatings and Thin Films (ICMCTF) is recognized as the premier international conference on thin film deposition, characterization, and advanced surface engineering. It provides a forum and networking venue for scientists, engineers, and technologists from academia, government laboratories, and industry. Attendees from all over the world come to present their findings, exchange ideas, share insights, make new friends, and renew old acquaintances. The Conference typically draws more than 800 attendees, covering more than 50 oral technical sessions and a well-attended Thursday evening poster session.

ICMCTF 2020 will have eight technical symposia A through H and five topical symposia, addressing experimental, theoretical, and manufacturing issues associated with the development of new coating materials and processes, novel methods of analysis and characterization, and approaches to scale-up for commercial applications. The conference will open with a plenary talk on Monday morning by Professor Magnus Berggren from Linköping University, Sweden on "Organic Electronics – Nature Connected." Another special highlight of the meeting is our Exhibitors Keynote Lecture, presented by Dr. Jörg Vetter, Oerlikon GmbH, Germany. He will present on the topic of "Deposition Methods and Applications of Carbon based Coatings in Industrial Scale." Three Special Interest Lectures given by top specialists will be featured throughout the conference week. Professor Igor Abrikosov from the Linköping University, Sweden will speak on "Materials Discoveries at Extreme Conditions: A Path Towards New Advanced Materials." Dr Peter Polcik from Plansee Composite Materials GmbH, Germany will share his great experience on "Design, Metallurgy and Manufacturing Technologies of Targets for Hard Coating and Tribological Applications." Professor André Anders, Leibniz Institute of Surface Engineering, Germany, will talk on "Plasma Aspects in the Deposition of Advanced Coatings."

In addition to the technical program, the Conference features a two-day industrial exhibition, Tuesday and Wednesday, April 28-29, showcasing the latest in equipment, materials and services used for the deposition, monitoring, and characterization of coatings and thin films. The Exhibition is open to the public. An educational program of Short Courses and Focused Topic Sessions (FTS) will be offered throughout the week.

Each year, the R.F. Bunshah Award Laureate and three outstanding Graduate Student Award winners are celebrated during a special convocation late Wednesday afternoon, April 29, followed by a festive buffet reception in the evening. In addition, at ICMCTF 2020, we will be recognizing the first recipient of the Bill Sproul Award and Honorary ICMCTF lectureship.

ICMCTF will again publish excellent scientific and technical work in peer-reviewed issues of the two Elsevier journals *Surface and Coatings Technology (SCT)* and *Thin Solid Films (TSF)*, so we strongly encourage all authors to [submit manuscripts](#) for consideration by March 20, 2020.

The Town and Country Resort Hotel and Convention Center, located in sunny San Diego of Southern California, will be the official conference venue, providing a relaxed atmosphere for discussion and networking among attendees.

Grzegorz (Greg) Greczynski Christopher Muratore
2020 Program Chair 2020 General Chair

PROGRAM COMMITTEE

PROGRAM CHAIR

Grzegorz (Greg) Greczynski
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SYMPOSIUM A: COATINGS FOR USE AT HIGH TEMPERATURES

Symposium Chair: Vladislav Kolarik,
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Symposium Chair: Prabhakar Mohan,
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Symposium Chair: Francisco Javier
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A1. Coatings to Resist High- temperature Oxidation, Corrosion, and Fouling

Session Chairs:
Sebastien Dryepontdt, Oak Ridge
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Shigenari Hayashi, Hokkaido
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A2. Thermal and Environmental Barrier Coatings

Session Chairs:
Sabine Faulhaber, University of
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Kang Lee, NASA Glenn Research Center,
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Pantcho Stoyanov, Pratt & Whitney,
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A3. Materials and Coatings for Solar Power Concentration Plants

Session Chairs:
Gustavo García-Martín, REP-Energy
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energysolutions.com
Vladislav Kolarik, Fraunhofer ICT,
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SYMPOSIUM B: HARD COATINGS AND VAPOR DEPOSITION TECHNOLOGIES

Symposium Chair: Farwah Nahif,
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Symposium Chair: Jyh-Ming Ting,
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Symposium Chair: Jörg Vetter, Oerlikon
Balzers Coating Germany GmbH,
Germany, joerg.vetter@oerlikon.com

B1. PVD Coatings and Technologies

Session Chairs:
Frank Kaulfuss, Fraunhofer Institute for
Material and Beam Technology (IWS),
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Yen-Hsun Su, National Cheng Kung
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Qi Yang, National Research Council of
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B2. CVD Coatings and Technologies

Session Chairs:
Raphaël Boichot, SIMaP, France,
raphael.boichot@simap.grenoble-inp.fr
Kazunori Koga, Kyushu University,
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B3. Deposition Technologies and Applications for Diamond-like Coatings

Session Chairs:
Chris Engdahl, Crystallume, USA,
cengdahl@crystallume.com
Jyh-Wei Lee, Ming Chi University of
Technology, Taiwan,
jefflee@mail.mcut.edu.tw

B4. Properties and Characterization of Hard Coatings and Surfaces

Session Chairs:
Naureen Ghafoor, Linköping Univ., IFM,
Thin Film Physics Div., Sweden,
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Fan-Bean Wu, National United
University, Miaoli, Taiwan,
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B5. Hard and Multifunctional Nanostructured Coatings

Session Chairs:
Tomas Kozak, University of West Bohemia,
Czech Republic, kozakt@kfy.zcu.cz
Vincent Moraes, Institute of Materials
Science and Technology, TU Wien,
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B6. Interplay Between Computational and Experimental Design of Coatings and Processes

Session Chairs:
Shou-Yi Chang, National Tsing Hua
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Paul Heinz Mayrhofer, TU Wien, Institute
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B7. Plasma Surface Interactions, Diagnostics and Growth Processes

Session Chairs:
Arutun P. Ehasarian, Sheffield Hallam
University, UK, a.ehasarian@shu.ac.uk
Yolanda Aranda Gonzalvo, University of
Minnesota, USA, yarandag@umn.edu

B8. HiPIMS, Pulsed Plasmas and Energetic Deposition

Session Chairs:
Jon Tomas Gudmundsson, University of
Iceland, Iceland, tumi@hi.is
Tiberiu Minea, LPGP, Université Paris-
Sud, Orsay, France, tiberiu.minea@u-
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SYMPOSIUM C: FUNDAMENTALS AND TECHNOLOGY OF MULTIFUNCTIONAL MATERIALS AND DEVICES

Symposium Chair: Peter Kelly,
Manchester Metropolitan University,
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C1. Optical Materials: Design, Synthesis, Characterization, and Applications

Session Chairs:

Nikolas Podraza, University of Toledo,
USA, nikolas.podraza@utoledo.edu
Juan Antonio Zapien, City University
of Hong Kong, Hong Kong,
apjazz@cityu.edu.hk

C2. Functional Coatings and Thin Films for Electronic Devices

Session Chairs:

Julien Keraudy, Linköping University,
Sweden, julien.keraudy@liu.se
Jörg Patscheider, Evatec AG,
Switzerland,
joerg.patscheider@evatecnet.com

C3. Thin Films for Energy Applications: Solar, Thermal, and Photochemical

Session Chairs:

Per Eklund, Linköping University,
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Tushar Shimpi, Colorado State University,
USA, mechanical.tushar@gmail.com

SYMPOSIUM D: COATINGS FOR BIOMEDICAL AND HEALTHCARE APPLICATIONS

Symposium Chair: Jean Geringer, Ecole
des Mines de St-Etienne - Université de
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Symposium Chair: Margaret Stack,
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Symposium Chair: Kerstin Thorwarth,
Empa - Swiss Federal Laboratories for
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D1. Surface Coating and Modification for Use in Biological Environments

Session Chairs:

Phaedra Silva-Bermudez, Instituto
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Mathew T. Mathew, University of
Illinois College of Medicine, USA,
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D2. Bio-corrosion, Bio-tribology and Bio-Tribocorrosion-Additive Manufacturing Impact

Session Chairs:

Steve Bull, Newcastle University, UK,
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Tennessee at Chattanooga, USA,
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Jessica Amber Jennings, University of
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D3. Biointerfaces: Improving the Cell Adhesion and Avoiding Bacteria. What Kinds of Coatings/Surfaces Should be Used?

Session Chairs:

Vincent Fridrici, Ecole centrale de Lyon,
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Sandra Rodil, Universidad Nacional
Autonoma de Mexico, México,
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Danieli B.C. Rodrigues, University of
Texas at Dallas, USA,
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SYMPOSIUM E: TRIBOLOGY AND MECHANICAL BEHAVIOR OF COATINGS AND ENGINEERED SURFACES

Symposium Chair: Michael Chandross,
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Symposium Chair: Giovanni Ramirez,
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giovanni.ramirez@bruker.com

E1. Friction, Wear, Lubrication Effects, and Modeling

Session Chairs:

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Manel Rodriguez Ripoll, AC2T Research
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E2. Mechanical Properties and Adhesion

Session Chairs:

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Ming-Tzer Lin, National Chung Hsing
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E3. Tribology of Coatings for Automotive and Aerospace Applications

Session Chairs:

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Engineering Design and Logistics Engineering,
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Christian Greiner, Karlsruhe Institute of
Technology (KIT), Institute for Applied
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Oliver Hunold, Oerlikon Balzers, Oerlikon
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SYMPOSIUM F: NEW HORIZONS IN COATINGS AND THIN FILMS

Symposium Chair: Klaus Böbel, Robert
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Symposium Chair: Ramana Chintalapalle,
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Symposium Chair: Daniel Lundin,
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F1. Nanomaterials and Nanofabrication

Session Chairs:

Ulf Helmersson, Linköping University,
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Vitezslav Stranak, University of South Bohemia,
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F2. High Entropy and Other Multi-principal-element Materials

Session Chairs:

Diederik Depla, Ghent University,
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Ulf Jansson, Uppsala University,
Angstrom Laboratory, Sweden,
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F3. 2D Materials: Synthesis, Characterization, and Applications

Session Chairs:

Suneel Kodambaka, UCLA, USA,
kodambaka@ucla.edu
Eli Sutter, University of Nebraska-
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SYMPOSIUM G: SURFACE ENGINEERING - APPLIED RESEARCH AND INDUSTRIAL APPLICATIONS

Symposium Chair: Satish Dixit, Plasma
Technology Inc., USA, dixsat@gmail.com

Symposium Chair: Christoph Schiffrers,
CemeCon AG, Germany,
christoph.schiffrers@cemecon.de

Symposium Chair: Wan-Yu Wu, Da-Yeh
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wywu@cloud.dyu.edu.tw

G1. Advances in Industrial PVD, CVD and PCVD Processes and Equipment

Session Chairs:

Ladislav Bardos, Uppsala University, Sweden,
ladislav.bardos@angstrom.uu.se
Vikram Bedekar, The Timken Company, USA, vikram.bedekar@timken.com

G2. Surface Modification of Components in Automotive, Aerospace and Manufacturing Applications

Session Chairs:

Etienne Bousser, Polytechnique Montreal, Canada, etienne.bousser@polymtl.ca
Satish Dixit, Plasma Technology Inc., USA, dixsat@gmail.com
Tetsuya Takahashi, Kobe Steel, Ltd., Japan, takahashi.tetsuya-1@kobelco.com

G3. Innovative Surface Engineering for Advanced Cutting and Forming Tool Applications

Session Chairs:

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Stepan.Kyrsta@oerlikon.com
Christoph Schiffrers, CemeCon AG, Germany, christoph.schiffrers@cemecon.de

G4. Pre-/Post-Treatment and Duplex Technology

Session Chairs:

Heidrun Klostermann, Fraunhofer FEP, Germany, heidrun.klostermann@fep.fraunhofer.de
Hiroyuki Kousaka, Gifu University, Japan, kousaka@gifu-u.ac.jp

G5. Hybrid Systems, Processes and Coatings

Session Chairs:

Hana Barankova, Uppsala University, Sweden, hana.barankova@angstrom.uu.se
Sang-Yul Lee, Korea Aerospace University, Republic of Korea, sylee@kau.ac.kr

G6. Application-Driven Cooperations between Industry and Research Institutions

Session Chairs:

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Joern Kohlscheen, Kennametal GmbH, Germany, joern.kohlscheen@kennametal.com
Kumar Yalamanchili, Oerlikon Balzers, Oerlikon Surface Solutions AG, Liechtenstein, kumar.yalamanchili@oerlikon.com

SYMPOSIUM H: ADVANCED CHARACTERIZATION TECHNIQUES FOR COATINGS, THIN FILMS, AND SMALL VOLUMES

Symposium Chair: Benoit Merle, Friedrich Alexander-University Erlangen-Nürnberg (FAU), Germany, benoit.merle@fau.de
Symposium Chair: Marco Sebastiani, Roma TRE University, Italy, seba@uniroma3.it

H1. Spatially-resolved and In-Situ Characterization of Thin Films and Engineered Surfaces

Session Chairs:

Gregory Abadias, Université de Poitiers, France, gregory.abadias@univ-poitiers.fr
Xavier Maeder, Empa - Swiss Federal Laboratories for Materials Science and Technology, Switzerland, xavier.maeder@empa.ch
Michael Tkadletz, Montanuniversität Leoben, Austria, michael.tkadletz@unileoben.ac.at

H2. Advanced Mechanical Testing of Surfaces, Thin Films, Coatings and Small Volumes

Session Chairs:

Olivier Pierron, Georgia Institute of Technology, USA, olivier.pierron@me.gatech.edu
Timothy Rupert, University of California, Irvine, USA, trupert@uci.edu

H3. Characterization of Coatings and Small Volumes in Harsh Environments

Session Chairs:

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TOPICAL SYMPOSIA

TS1. Anti- and De-icing Surface Engineering

Symposium Chair: Alina Agüero Bruna, Instituto Nacional de Técnica Aeroespacial (INTA), Spain, agueroba@inta.es
Symposium Chair: Jolanta Klemberg-Sapieha, Polytechnique Montréal, Canada, jolanta-ewa.sapieha@polymtl.ca

TS2. New Horizons in Boron-Containing Coatings: Modeling, Synthesis and Applications

Symposium Chair: Marcus Hans, RWTH Aachen University, Germany, hans@mch.rwth-aachen.de
Symposium Chair: Helmut Riedl, TU Wien, Institute of Materials Science and Technology, Austria, helmut.riedl@tuwien.ac.at
Symposium Chair: Johanna Rosén, Linköping Univ., IFM, Thin Film Physics Div., Sweden, johanna.rosen@liu.se

TS3. In-Silico Design of Novel Materials by Quantum Mechanics and Classical Methods jointly sponsored by ICMCTF and AQS

Symposium Chair: David Holec, Montanuniversität Leoben, Austria, david.holec@unileoben.ac.at
Symposium Chair: Benjamin Irving, Czech Technical University in Prague, Czech Republic, irvinben@fel.cvut.cz
Symposium Chair: Ivan Petrov, University of Illinois, USA, Linköping University, Sweden, USA, petrov@illinois.edu
Symposium Chair: Davide Sangiovanni, Ruhr University Bochum, Germany, davide.sangiovanni@liu.se

TS4. Photocatalytic and Superhydrophilic Surfaces

Symposium Chair: Peter Kelly, Manchester Metropolitan University, UK, peter.kelly@mmu.ac.uk
Symposium Chair: Carlos Jose Tavares, University of Minho, Portugal, ctavares@fisica.uminho.pt
Symposium Chair: Glen West, Manchester Metropolitan University, UK, g.west@mmu.ac.uk

TS5. Thin Films on Polymer Substrates: Flexible Electronics and Beyond

Symposium Chair: Oleksandr Glushko, Montanuniversität Leoben, Austria, oleksandr.glushko@unileoben.ac.at
Symposium Chair: Barbara Putz, Erich Empa, Swiss Federal Laboratories for Materials Science and Technology, Thun, Switzerland, barbara.putz@empa.ch

Coatings for Use at High Temperatures (A):

Symposium A addresses coatings and surface modifications whose primary purpose is to sustain system performance under high-temperature and harsh thermochemical environments. Topics of interest include high-temperature aging, stress, corrosion (e.g., oxidation, sulfidation, carburization, and water-accelerated degradation), catalytic and physical fouling (e.g., coking, ash fouling, and slagging), and wear (e.g., abrasion, erosion, and impact), characterization and mechanistic understanding of high-temperature degradation and mitigation technologies. Typical applications span gas/steam turbines, coal, geothermal, biomass energy conversion, and chemical/petrochemical processes.

A1. Coatings to Resist High-temperature Oxidation, Corrosion, and Fouling

Session A1 spans all aspects of design, processing, and performance of coatings to resist high-temperature oxidation, corrosion, and fouling. Topics include composition and process optimization, effects of applied stress, characterization of coatings and reaction products, new processing methods, and modeling of fabrication and degradation processes (e.g., coating-substrate interdiffusion, thermal cycling, water-accelerated degradation, and phase and microstructural stability). Applications include gas and steam turbomachinery, diesel engines, petrochemical and gasification plants, geothermal energy, waste incinerators, boilers and metal-forming industries. Contributions addressing issues as well as solutions are encouraged, with focus on coatings and surface modification.

A1 Invited Speakers:

Hideyuki Murakami, National Institute for Materials Science (NIMS), Japan, "PGM based Diffusion Coatings for Ni-based Superalloys by a Paste Method"

Elisa Zaleski, Pratt & Whitney, USA, "Mechanisms of CMAS Attack on Aero-Engine Components"

A2. Thermal and Environmental Barrier Coatings

Session A2 focuses on the design, development, synthesis, and applications of thermal and environmental barrier coatings for gas turbines and other high-temperature applications. Topics include process understanding and novel processing methods, characterization of coating microstructure, properties (thermal, optical, mechanical, and chemical), testing methods (destructive and nondestructive), structure-property relationships, residual stresses, aging phenomena, substrate/coating system effects, and failure mechanisms, including erosion, abrasion, and impact. These topics can be addressed for experimental and/or modeling development.

A2 Invited Speakers:

Germain Boissonnet, University of La Rochelle, France, "Influence of the Microstructural Evolution of YSZ TBCs on their Thermal Conductivity"

Molly Gentleman O'Connor, Praxair Surface Technologies Inc., USA, "Advances in the Development of Highly Crystalline EBCs by Advanced Plasma Spray Processes"

Eric Jordan, University of Connecticut, USA, "Avoiding Amorphous Phases with Solution Precursor Plasma Spray in YAG TBC s and Yb Silicate EBC"

A3. Materials and Coatings for Solar Power Concentration Plants

Session A3 focuses on materials and coatings for emerging concentrating solar power (CSP) plants. The two concepts of central tower and parabolic plants with HTF (heat transfer fluids) and STF (storage transfer fluids) will be addressed in this session. Those plants need to work at higher temperatures than conventional ones and require protective systems, such as coatings, compatible with fluids under corrosive environment to enhance the performance, efficiency and durability of the plant. The session addresses, for these new and disruptive technology concepts, any part of the plant, considering key points in the design and O&M, such as: absorbers, reflectors, piping, energy storage tanks and components. On the other hand, new plants will be operated with thermal storage with molten salts to allow the plant to operate without sunlight. All materials design related with molten salts applications will be considered as key issue in this session, as well as new high temperature hybridization technologies. Coating technologies, properties, typical degradation mechanisms, chemical and physical interactions as well as concepts for enhancing efficiency and lifetime can be discussed in this session.

A3 Invited Speaker:

Luis Crespo, ESTELA, Spain, "The Essential Role of STE/CSP Plants in the Energy Transition. Challenges on Materials to Enhance Competitiveness"

AP Coatings for Use at High Temperatures (Symposium A) Poster Session

Hard Coatings and Vapor Deposition Technologies (B):

Symposium B focuses on surface engineering and materials science of hard coatings. We are interested in fundamentals of deposition processes, properties of new single, multilayer, nanocomposite and nanostructured hard coatings, process-structure-property relationships, substrate effects, modeling, and industrial practices.

B1. PVD Coatings and Technologies

This session solicits contributions (except those covered by the topical sessions) related to sputter-deposition, cathodic and anodic arc discharges, laser ablation, electron beam (with and without additional ionization) and combinations of PVD coating methods. We welcome contributions on in-situ measurements, process modeling, plasma transport in electromagnetic fields, and multi-phase, gradient and nanostructured coatings, as well as hard and superhard coatings. Applications include but are not limited to wear-protective coatings for components and tools, low-friction thin films, high-temperature wear-, erosion-, and corrosion-resistant coatings, optical layers, biomaterials, decorative coatings, and materials for energy applications.

B1 Invited Speakers:

Yin-Yu Chang, National Formosa University, Taiwan, "Coating Design and Mechanical Properties of Multicomponent AlTi(X)N Hard Coatings"

Wolfgang Fukarek, VTD Vakuumtechnik Dresden GmbH, Germany, "Industrial Scale ta-C coating Using Laser Arc Technology"

Brian Jurczyk, Starfire Industries LLC, USA, "Multilayer nano-composite Oxidation-resistant Coatings for Accident-tolerant Nuclear Fuel Cladding using Reactive HiPIMS with Positive Kick and Precision Ion Energy Control"

B2. CVD Coatings and Technologies

Session B2 solicits experts in thin films deposition techniques, involving chemical vapor deposition, for the growth of protective coatings and multifunctional, smart or hard materials. This session will address (1) various techniques including Atmospheric Pressure CVD, LPCVD, MOCVD, ALD, HVPE, Pulsed CVD, and their plasma assisted counterparts, PECVD and PEALD; (2) novel molecular CVD precursors or original delivery systems for low vapor pressure/difficult precursors (DLI, pressure pulse, direct halogenation) ; (3) properties of materials and structures grown by these deposition techniques; and (4) CVD modeling techniques from molecular to equipment scale.

B2 Invited Speakers:

Susan Krumdieck, University of Canterbury, New Zealand, "Anatase/Rutile Nanocomposites for Cleaning and Health Applications"

Frédéric Mercier, Université Grenoble Alpes, CNRS, France, "Biopolymer-ceramic Composites by ALD: Toward New Functions and Products"

Ito Tsuyohito, University of Tokyo, Japan, "Plasma-assisted Deposition using Microdroplets"

B3. Deposition Technologies and Applications for Diamond-like Coatings

We are soliciting contributions that address the relationship between deposition methods and wear behavior, hardness, friction coefficient, and hydrogen content in diamond-like coatings (DLC). Deposition technologies include CVD, PVD, and their combination, arc, ion-beam, and laser-assisted deposition and HIPIMS. This session includes fundamentals and development of interfaces between substrate and DLC to improve adhesion, supporting layers and hybrids with hard coatings, industrial practices, scalability, and cost estimates.

B3 Invited Speaker:

Bohr-Ran Huang, National Taiwan University of Science and Technology, Taiwan, "Applications of Nanodiamond-based Hybrid Materials"

B4. Properties and Characterization of Hard Coatings and Surfaces

This session solicits contributions (except those covered by the topical sessions) on the relationships among composition, microstructure, and properties of hard coatings and surfaces, effect of deposition parameters on these properties, as well as the development and use of novel characterization techniques.

B4 Invited Speakers:

Fu-Hsing Lu, National Chung Hsing University, Taiwan, "Air-based Sputtering of Gradient Oxynitride Coatings"

Dietmar Schorr, Steinbeis Institute for Tribology; Cooperative State University in Karlsruhe, Germany, "Modern Analytical Methods for Characterizing the Tribological Material Properties of Coatings"

Ali Sharafat, Linnaeus University, Sweden, "Metal Oxynitride Thin Films: A Review on Synthesis Developments, Performance, and Applications"

B5. Hard and Multifunctional Nanostructured Coatings

This session solicits contributions related to nanostructured and nanocomposite coatings as well as multicomponent and layered films with morphological designs adapting the microstructure down to the nanoscale level. The desired functionalities range from structural properties such as high hardness, toughness, or thermal stability to chemical inertness up to adaptive mechanisms like controlled friction as well as sensing properties. The session not only emphasizes the design and synthesis of novel coating concepts but also their characterization, modeling, and applications. In addition, combined functionalities such as self-adaptive mechanisms based on phase transformations within specific architectures – just to mention one possibility – are highly appreciated to explore the next level of multifunctional coatings.

B5 Invited Speakers:

Philipp Kiryukhantsev-Korneev, National University of Science and Technology "MISiS", Russia, "Multiphase SHS Cathodes in PVD of Hard Nanocomposite Coatings – Evolution and New Horizons"

Isabella Schramm, Sandvik Coromant R&D, Sweden, "Impact of Nitrogen Deficiency on the Phase Transformation of (Ti,Al)N Thin Films at Elevated Temperatures"

B6. Interplay Between Computational and Experimental Design of Coatings and Processes

This session aims at bringing together computational and theoretical researchers and experimentalists in knowledge-based design and architectures of functional thin films and hard coatings. We are interested in both experimental and computational studies of knowledge-based chemical and structural design approaches. Studies on growth kinetics, prediction and explanation of structure and properties of surfaces, interfaces, and thin-film material systems, as well as the thermodynamic processes involved, as well as coating process technologies are particularly welcome.

B6 Invited Speakers:

David Holec, Montanuniversität Leoben, Austria, "Weakest Links in Superlattices: Insights from An Initio Modelling"

Kenji Yamamoto, Kobelco Co., Japan, "Controlling the Phase and Microstructure of Ti-Cr-Al-N Hard Coating System Deposited by Arc Ion Plating"

B7. Plasma Surface Interactions, Diagnostics and Growth Processes

Plasma diagnostics of materials synthesis and modification processes provide important insights on processing-structure-property relationships. The objective of this session is to show the utility of such correlations. Talks featuring new plasma diagnostic techniques, characterization of plasmas in novel processes, and correlation of intrinsic plasma properties to the structure and composition of materials are welcome.

B7 Invited Speakers:

Holger Kersten, Institut für Experimentelle und Angewandte Physik AG PlasmaPhysik / PlasmaTechnologie Christian-Albrechts-Universität zu Kiel, Germany, "Energy and Momentum Fluxes at Plasma Processing of Materials"

B8. HiPIMS, Pulsed Plasmas and Energetic Deposition

Energy carried to the thin film during deposition is crucial in reducing the growth temperature and improving properties of thin film materials. Higher plasma density leads to enhanced ionization of the film precursors and offers better deposition process control. This results in improved coating characteristics, valuable for e.g. optical, wear resistant, or photovoltaic applications. This session solicits contributions from academia as well as the industry which cover both the basic physics and the applications of energetic deposition. Topics of interest include, but are not limited to: plasma generation and discharge physics, simulation and modelling, reactive processes and process control, mechanisms of film growth, surface and interface engineering, industrial applications and production, up scaling and associated equipment.

B8 Invited Speakers:

Daniel Lundin, Ionautics AB, Sweden, "Optimizing Ionization and Deposition Rate in High Power Impulse Magnetron Sputtering"

Petr Vasina, Masaryk University, Brno, Czech Republic, "Evolution of Ionization Fraction of Sputtered Species in Standard, Multi-pulse and Reactive HiPIMS"

BP Hard Coatings and Vapor Deposition Technologies (Symposium B) Poster Session

Fundamentals and Technology of Multifunctional Materials and Devices (C):

This Symposium encompasses all aspects of advanced thin films, nanomaterials and metamaterials for modern optical, photonic and electronic devices with applications in energy, sensing, communications, information processing and display technologies. We welcome contributions on advanced or novel materials with enhanced process compatibility, stability in adverse environments, or improved device performance, process-structure-property relationships to optimize design, fabrication and integration of multifunctional components for smart and active devices. Contributions describing new and

improved process control, in-situ real-time monitoring, growth mechanisms and novel characterization techniques for these materials and applications are particularly welcome.

C1. Optical Materials: Design, Synthesis, Characterization, and Applications

Current applications of optical materials, thin films and advanced structured materials, impose extreme demands on their synthesis and performance. The optimisation of these devices, from design to applications, can be facilitated by optical characterization methods such as spectrophotometry, ellipsometry, scatterometry, interferometry, vibrational spectroscopies, near-field microscopies and other light-matter interactions. We welcome contributions in the design, synthesis, characterization, and applications of thin films and nanostructures for optical applications.

C1 Invited Speakers:

Alain C. Diebold, SUNY Polytechnic Institute Albany, USA, "Materials Characterization at the Nanoscale"

Ndubuisi George Orji, National Institute of Standards and Technology (NIST), USA, "Metrology for the Next Generation of Semiconductor Devices"

George C. Schatz, Northwestern University, USA, "Plasmonic Materials and Devices"

C2. Functional Coatings and Thin Films for Electronic Devices

This session is dedicated to functional coatings that may find applications in active or passive thin film-based devices utilizing electronic, optical, piezoelectric and similar properties. They consist of thin films of carbides, nitrides, oxides or mixtures and combinations thereof. They are typically prepared by PVD, CVD, ALD/PEALD or alternative deposition methods. Material characteristics like electrical and thermal conductivity, optical properties including electrochromicity, piezoelectricity, thermal stability as well as wear and oxidation resistance are considered. Application-related contributions are solicited addressing both experimental and theoretical studies on design of film properties and processes to control nucleation, microstructure, phase changes, diffusion processes and oxidation protection aimed at specific device performance.

C2 Invited Speakers:

Erwin Kessels, Eindhoven University of Technology, The Netherlands, "Thermal and Plasma-Enhanced Atomic Layer Deposition for Nanoscale Coatings"

Ivovl Koutsareff, Qualcomm, USA, "Elastic and Piezoelectric Properties Predictions of Al_{1-x}Sc_xN Materials for High Frequency Filters"

Antonio Mei, Cornell University, HRL, USA, "Controlling Phase Transitions and Ferroic Order in BiFeO₃ and FeRh for Emerging Applications"

Christophe Vallée, CEA-LTM, Grenoble, France, "High k Dielectrics for MIM Architecture: From Capacitors to Non-volatile Memories Applications"

C3. Thin Films for Energy Applications: Solar, Thermal, and Photochemical

This session focuses on the materials science, physics, chemistry and device engineering of thin films and nanostructures for energy-related applications, which include photovoltaics, thermoelectrics, photoelectrochemical water splitting and batteries. The session will cover both theoretical and experimental work on diverse materials including but not limited to inorganic group IV, III-V and II-VI semiconductors, organic semiconductors, oxides, nitrides and novel compounds of earth-abundant elements. We welcome contributions on recent developments in physical, chemical, and optical phenomena, new materials and novel device concepts in renewable energy technologies.

C3 Invited Speaker:

Eva Schubert, University of Nebraska Lincoln, USA

CP Fundamentals and Technology of Multifunctional Materials and Devices (Symposium C) Poster Session

Coatings for Biomedical and Healthcare Applications (D):

Symposium D focuses on the synthesis, characterization, and performance (both in vitro and in vivo) of coatings and modified surfaces designed for biomedical applications (biomaterials, bioimplants, biosensors, general health care, etc.). The symposium will be devoted to create a platform, a friendly hub, to promote some research discussions between material scientists, coating performers, and clinicians. Papers are solicited in areas related to: bioactive and biocompatible coatings for implants (orthopedic, dental, spinal, etc.), cardio-vascular stents, drug delivery and biosensing; hydroxyapatite coatings; biomimetic and bio-inspired coatings; anti-bacterial, anti-biofouling and eluting coatings; blood-compatible coatings; electrospun coatings; biofunctionalization of materials surfaces such as tissue engineering scaffolds by wet chemical and plasma methods; cell-surface interactions; bio-lubrication and bio-tribology; and processing and characterization of biomaterial surfaces. Concerning the interactions between the coating and the medium, some investigations were dedicated to study the corrosion degradation of the substrate. Moreover, some opening fields are

focused on the effect of the coating on the biological behavior, as cells growth, cells adhesion, etc. Some contributions in the fields of retrieval implant analysis, the release of metal ions/particles, smart/intelligent surfaces and potential clinical concerns will be also considered. A new key-interest is about 3D printing. Additive manufacturing requires most of the time some surface coatings in order to promote osseointegration and more generally biocompatibility. The D symposium will have a look at this new area.

D1. Surface Coating and Surface Modification in Biological Environments

This session is dedicated to coatings as well as surface modifications for use in biomedical applications in order to improve performance characteristics or to add additional functions to an implant or surgical instrument. The functionalities of these coatings/surface modifications should focus on the improvement of one or more attributes such biocompatibility, cell proliferation and growth, suppression of restenosis, thrombus formation, antimicrobial behavior and metallic ion release, load-bearing prostheses, corrosion resistance, wear resistance, etc. under in vitro and in vivo conditions.

D1 Invited Speakers:

Asimina Kiourti, The Ohio State University, USA, "Wireless Monitoring of the Implants and Coatings: Challenges and Opportunities in Health Care"

Sriram Ravidran, UIC College of Dentistry, USA, "Progress in the Application of Regenerative Medicine for the Implant Coatings"

D2. Bio-corrosion, Bio-tribology and Bio-Tribocorrosion-Additive Manufacturing Impact

Metallurgical materials are essential components of medical devices used to restore biological function, detect or respond to physiological or external stimuli, or modulate the response of cells at interfaces. This session seeks to explore clinical applications and physiological responses to material systems used for tissue regeneration, implantable sensors, and smart drug delivery, among others. Fabrication and testing of these materials using additive manufacturing technologies are of particular interest. Research is solicited that evaluates biological reactions to implant surface coatings as well as methods of depositing coating particles of varying size and composition. Release of molecules or particles from surfaces, either intentionally or due to wear and corrosion processes is also an area of interest.

D2 Invited Speaker:

Mobin Salasi, Curtin University, Western Australia, "Tribocorrosion Lifetime of Additive Manufacturing Materials. What are the Key Parameters and Strategies about Materials Optimization?"

D3. Biointerfaces: Improving the Cell Adhesion and Avoiding Bacteria. What Kinds of Coatings/Surfaces Should be Used?

Interaction between cells and biomaterials occur via the surface characteristics of the material, which include their topography, chemistry, mechanical properties or surface energy. These interactions trigger desired or undesired processes. For example, they can induce signaling pathways to regulate cell adhesion, migration, proliferation and differentiation into specific phenotypes desirable for the application. However, they might also promote excessive adhesion of microorganisms forming biofilms that can lead to significant health risks. Such interactions are greatly determined by the initial protein adsorption that occurs in a shorter time scale. Understanding of all these interaction processes and their correlation with the surface properties is key knowledge that will allow us to design novel surfaces or coatings to promote specific biological responses, i.e. design bioactive surfaces.

The use of coatings and/or engineering surfaces is of great advantage for this purpose, since it allows us to keep the mechanical properties of the bulk materials and also the topographical features while designing the chemical surface to prevent chronic inflammatory responses, promote a faster osseointegration or prevent bacterial adhesion, as examples.

D3 Invited Speaker:

Laszlo Sajti, AIT Austrian Institute of Technology GmbH, Austria, "Advanced Materials for Implant Applications"

DP Coatings for Biomedical and Healthcare Applications (Symposium D) Poster Session

Tribology and Mechanical Behavior of Coatings and Engineered Surfaces (E):

This symposium covers all aspects of tribology, mechanical properties, and adhesion of coatings and engineered surfaces. The scope includes both experimental investigations and modeling of static (e.g., indentation and adhesion) and dynamic (e.g., oscillating, scratching, sliding, and rolling) contacts, and contact/fracture mechanics from atomistic to macroscopic length scales. We welcome contributions that improve scientific and mechanistic understanding of tribo-mechanical responses, characterization and performance of engineered surfaces and coatings, processing-structure-property-performance relationships, design of coatings for specific applications, and size effects. Additional emphasis is given to multifunctional (hard and lubricious) and nanocomposite coatings for extreme environments, nanostructured coatings,

diamond and diamond-like carbon, and coatings for advanced aerospace, automotive, and machining applications, along with advances in instrumentation and measurement techniques.

E1. Friction, Wear, Lubrication Effects, & Modeling

This session covers all phenomena related to friction, wear, lubrication, and modeling. We solicit contributions on the development, characterization and modeling of materials, coatings or innovative structures to control friction and wear, including liquid and solid lubrication. We are interested in studies providing new understanding of tribological mechanisms of coatings and thin films. Emphasis will be given to contributions on understanding the role of coating composition and structure in friction and wear reduction. Incorporation of additional coating functionalities (thermal cycling resistance, fracture toughness, oxidation resistance, etc.) is also an important issue. Contributions on theoretical and computational modeling of tribological interactions at the atomic or molecular level are also welcome.

E1 Invited Speakers:

Tobias Brögelmann, RWTH Aachen University, Germany, "Efficiency Improvement Along the Stribeck Curve through Pvd Coatings - From Minimum Quantity Lubrication to Full Fluid Lubrication"

Robert Carpick, University of Pennsylvania, USA

Bojan Podgornik, Institute of Metals and Technologies, Slovenia, "PVD Coatings Interaction with the Environment and Influence of Substrate on Coating Performance"

E2. Mechanical Properties and Adhesion

This session is devoted to the measurement and modeling of mechanical properties of surface and near-surface regions of thin films, coatings, and surface-engineered bulk materials. We are interested in measurement methods and models for the quantitative determination of mechanical properties, residual stresses, interface adhesion, fatigue, and fracture toughness. Emphasis will be given to contributions on novel test methods, such as in situ testing in SEM or TEM, multi-axial contact mechanics, MEMS test beds, and new approaches for the extraction of mechanical and constitutive properties by modeling of indentation load-displacement curves. Finally, special consideration will be given to contributions that address processing-structure-mechanical property relationships across multiple length scales.

E2 Invited Speakers:

Bo-Shiuan Li, University of Oxford, UK

Corinne Packard, Colorado School of Mines, USA, "Controlled Spalling of Microscale, Single-Crystal Films of High-Quality, High-Value Semiconductors"

E3. Tribology of Coatings for Automotive and Aerospace Applications

Surface engineering and advanced coatings contribute to improved durability and fuel efficiency in transportation. This session welcomes contributions on the development, characterization, and tribological evaluation of coating solutions at various length scales in automotive and aerospace engineering applications. Special consideration will be given to contributions addressing the nanoscale phenomena in tribology and their impact on macroscopic sliding components.

E3 Invited Speaker:

Michael Herbig, Max-Planck-Institut für Eisenforschung GmbH, Germany, "Tribological Mechanisms Leading to Moving Cracks and to Co-Emission from Hip Implants"

EP Tribology and Mechanical Behavior of Coatings and Engineered Surfaces (Symposium E) Poster Session

New Horizons in Coatings and Thin Films (F):

This crosscutting symposium aims at expanding the scope of the conference by encouraging hot topics that are new to ICMCTF. The three sessions of the symposium will provide a forum for new pioneering topics including the latest advances in the synthesis of nanomaterials and nanofabrication, new types of coatings, with a focus on high entropy alloys and 2D materials.

F1. Nanomaterials and Nanofabrication

This session focuses on harnessing nanoscale phenomena and innovative deposition strategies for new types of nanostructures and nanomaterial coatings with multiple functionalities. Advances in thin films, nanocrystals, nanowires, nanotubes (but not 2D materials), and their applications will be addressed, as well as the development and application of novel in-situ diagnostics to understand and control these growth processes. Further areas of interest include emerging direct-write, cluster-beam, and bio-inspired deposition methods, theoretical and computational research in nanomaterials with controlled properties, processing-structure-property relationships, novel application concepts or prototypes using nano-engineered structures, and plasma fundamentals and diagnostics. These topics cover the understanding and synthesis of novel nanostructured materials and how to apply them in the next-generation nano-devices, and the development of innovative manufacturing processes.

FI Invited Speaker:

Olexander Polonskyi, University of Kiel, Germany

F2. High Entropy and Other Multi-principal-element Materials

High entropy alloys (HEAs) and other multi-principal-element materials are multicomponent systems in which high entropy of mixing, or kinetic effects, stabilize a solid solution. They exhibit unique chemical and physical properties and have therefore recently attracted a growing interest in the materials science community. This session will be a platform for thin film-related research on high entropy and multi-principal-element materials including metal alloys, carbides, nitrides, and oxides as well as other multicomponent systems in which high entropy affects phase stability. Topics of interest include, but are not limited to, modelling, thin film processing, and characterizations of HEAs and other multi-principal-element materials.

F2 Invited Speakers:

Paul Heinz Mayrhofer, Institute of Materials Science and Technology, TU Wien, Austria, "High Entropy Ceramic Thin Films: A Case Study of Nitrides, Diborides and Oxides"

Jyh-Ming Ting, National Cheng Kung University, Taiwan, "Single-phased High Entropy Oxides for Energy Applications"

F3. 2D Materials: Synthesis, Characterization, and Applications

This session focuses on exciting developments in the field of 2D materials, including but not limited to graphene, transition metal dichalcogenides (MoS₂, WS₂, etc.), BN, oxides, as well as emerging 2D carbides and nitrides. 2D materials have been extensively researched in the last decade as atomically thin metal semiconductor and insulator materials with novel and extraordinary properties. Recent advances in their synthesis have provided new possibilities to tune their structure, properties, and enhance their electrical, mechanical, lubrication, and anticorrosion performances. Researchers working in the field of 2D material synthesis and processing, characterization, and applications are encouraged to submit abstracts. We seek to advance the research and development of 2D material-based coatings by connecting researchers from diverse academic and industrial backgrounds, including tribology, materials science, physics, and chemistry. Topics include: controlled scalable synthesis of 2D materials, composite materials and heterostructures, mixed 2D phases and alloys, formation and control of defects, grain boundaries, edges, interfaces, nanopores, characterization, theoretical modeling, device fabrication, post-synthesis engineering of 2D materials using chemical treatments and ion/electron beams and applications of 2D materials in electronics, sensing, coating, friction/wear reduction, anti-corrosion, and anti-fouling.

F3 Invited Speakers:

David Geohegan, Oak Ridge National Laboratory, USA

Dhriti Nepal, Air Force Research Laboratory, Materials and Manufacturing Directorate, USA

FP New Horizons in Coatings and Thin Films (Symposium F) Poster Session

Surface Engineering - Applied Research and Industrial Applications (G):

This symposium is jointly organized by ICMCTF (AVS/ASED) and the Society of Vacuum Coaters (SVC), and will focus on applied research related to industrial manufacturing and application aspects of various surface engineering and coating technologies. Topics include recent advancements in surface engineering equipment and application of PVD/CVD deposition technologies for coatings and thin films in automotive, aerospace, component and tooling/cutting applications. Also of particular interest are surface treatments before and after the coating processes to enhance the performance of engineered surfaces, hybrid/duplex coating techniques, innovations in manufacturing practices, and cooperation between industry, research organizations, and academia to advance surface engineering applications.

G1: Advances in Industrial PVD, CVD and PCVD Processes and Equipment

This session focuses on recent developments in PVD and CVD coating technology including plasma CVD and ion hardening of surfaces. Contributions from industrial coating equipment manufacturers as well as from research groups from both industry and academia are solicited. Presentations on new technologies, devices and developments for enhancement of thin film properties in tribological, optical, electrical and other applications are welcome in this session.

G1 Invited Speakers:

Rajiv Ahuja, HEF US, USA, "Overview of DLC Technology for Automotive Applications"

Dermot Monaghan, Gencoa Ltd, UK, "New Developments in Magnetron Sputtering Devices"

G2: Surface Modification of Components in Automotive, Aerospace and Manufacturing Applications

Functional components in Automotive, Aerospace and Manufacturing applications are exposed to severe service conditions such as wear, friction, high temperature etc. The components are expensive and the downtime for their replacement is time consuming. Hence, in order to extend their life and performance, it is necessary to surface engineer them. This session will cover application oriented research and development on surface modified products and

technologies. Topics include surface modified or coated products/ components in the area of tribology, corrosion, high temperature, optical, magnetic and allied technologies. The session welcomes contributions related to any surface modified/ coated components addressing the above and related fields. The main criteria are that the surface modification/ coatings should be applied to semi/end products to enable/ improve desired physical/ chemical properties. The components used in automotive, aerospace, manufacturing, land based and aero turbines, mining, oil drilling and fracking, construction machinery and farming equipment are of primary interest in this session.

G2 Invited Speakers:

Marjorie Cavarroc, Safran Tech, France, "Enhancing TiAl Oxidation Resistance at High Temperature: A Challenge for the Aerospace Industry"

Arash Ghabchi, Blue Origin LLC, USA, "Surface Modification Applications in Aerospace Industry"

G3: Innovative Surface Engineering for Advanced Cutting and Forming Tool Applications

The requirements of manufacturing industries and recent innovative developments in coatings and surface engineering processes for advanced tooling applications are the focus of this session. Such applications include but are not limited to high demanding sheet or bulk metal forming, plastics processing, die-casting as well as cutting operations of steel, cast iron and difficult-to-cut materials like high temperature alloys or CFRP. Novelties related to the use of coating technologies like PVD arc, sputtering, HIPIMS, hybrid, electron beam as well as PECVD and CVD for application oriented design of different coating materials, architectures and properties are welcome. Insights into the combined effect of tool geometry and adapted coatings are also in the focus of the present session. Furthermore, contributions highlighting the interaction of the coatings designed for cutting and forming applications with the ambient atmosphere and/or the counterpart materials including metallic alloys and polymers are within the focus of this session.

G3 Invited Speakers:

Ricardo Alexandre, Tecnologia e Engenharia de Materiais, S. A., Portugal, "Coating Design for Components for Extreme Applications"

Albir Layyous, Layyous Consulting, Israel, "Coating for Cutting Tools"

G4: Pre-/Post-Treatment and Duplex Technology

This session focuses on the latest developments for substrate/surface pre- or post-treatment processes which incorporate novel, or integrated, treatment technology combinations (diffusional, electrochemical, physical, mechanical, or other approaches) adapted to specific coatings and their applications within the areas of cutting, forming, precision components, or automotive. Topics include but are not limited to novel substrate preparation and pre-treatment methods for various applications; substrate nitriding, carburizing, boriding, or oxidation pre-treatments; intermediate etching treatment and interlayer design during the coating processes; coating post-treatments, including laser, electron beam, annealing, ion implantation or mechanical/chemical/optical techniques; and integrated and/or novel treatments and process combinations.

Papers dealing with aspects relating to properties, processes, performance, equipment and industrial applications for such treatments are all welcome.

G4 Invited Speakers:

Koji Eriguchi, Kyoto University, Japan, "Comprehensive Characterization of Surface Modification Mechanisms in Boron Nitride Films Prepared by a Reactive Plasma-assisted Coating Technique"

G5: Hybrid Systems, Processes and Coatings

This session focuses on novel methods that employ combinations of several processes and systems during film deposition. Hybrid systems can combine different ionization sources, like lasers, hot filaments, hollow cathodes, electron- or ion-guns, etc. with conventional magnetrons or arc evaporators, in order to provide increased ionization, additional heating of the substrate, or to change the distribution of plasma density in the reactor. Hybrid systems can also combine different gas pressures, including atmospheric plasma activation, can use pulsed gas inflows synchronized with pulsed power, pulsed biasing, etc. Hybrid processes can integrate different mechanisms of production of species for film deposition, for example PVD with PECVD. Contributions on organic-inorganic hybrid coatings and hybrid processes both at reduced and atmospheric pressures are also solicited.

G5 Invited Speakers:

Ali Erdemir, Argonne National Laboratory, USA, "Hybrid Coating Systems for Low Friction and Wear"

Jongkuk Kim, Korea Institute of Materials Science (KIMS), Korea, "Stabilization of FCVAS-based Hybrid System for Deposition of Thick Tetrahedral Amorphous Carbon Films and its Application"

G6: Application-Driven Cooperations between Industry and Research Institutions

Industrial research and development is often driven by commercial interests and the current market conditions. Although the long term industrial benefits often depend on the detailed understanding and generation of basic know-how, in many cases industry is limited by their research capacity and analytical instrumentation. On the other hand, universities and government sponsored research laboratories often offer in-depth characterization methods and associated skill sets and thus a huge potential to support industrial needs. Therefore, joint partnerships between industry and basic research institutions often yield optimum results with respect to future product development.

The scope of this session is on the research results produced in cooperation between industry, research laboratories, and academia. One focus should be on companies which have the possibility to present current status and achievements, as well as to address future development trends. Academic institutions are highly encouraged to present results of background research or contributions aimed at the development of the tailored solutions to meet the industrial demands of thin film and hard coatings applications.

G6 Invited Speakers:

Marcus Morstein, Hightech Zentrum Aargau AG, Switzerland, "Tentative: Success Stories in Coating Development"

Rachid M'Saoubi, Seco Tools, Sweden, "PVD and CVD Wear Resistant Coatings from Cutting Tool Perspective"

GP Surface Engineering - Applied Research and Industrial Applications (Symposium G) Poster Session

Advanced Characterization Techniques for Coatings, Thin Films, and Small Volumes (H):

This symposium focuses on recent advances in the structural, microstructural, and mechanical characterization of coatings and thin films, which enhance our understanding of the growth and surface modification processes as well as the fundamental structure-property-processing relationships. Of interest are contributions that either highlight the application of, or draw attention to, recent advances in analytical methods, characterization techniques, and novel nano-mechanical testing methods for coating evaluation. Analytical methods may include numerical evaluation and quantification procedures (e.g., factor analysis, depth profiling, 3D mapping, etc.) to reveal the micro- and nano-structure, chemical composition, residual stress, chemical states, and phases of coatings, thin films, interfaces, and surfaces during or after surface modification. Micro- and nanomechanical methods may include compression, bending, or toughness testing to determine coating behavior, particularly at elevated/service temperatures and in harsh environments, and the relationship to coating performance and lifetime. Residual stress analysis, phase characterization, surface topography probes, compositional analysis, high-resolution spatial imaging and analysis, and hardness measurements continue to be subjects of interest in the sessions. In-situ characterization methods and other novel techniques presenting the combination between microstructural nano-mechanical probes are highly encouraged.

H1: Spatially-resolved and In-Situ Characterization of Thin Films and Engineered Surfaces:

In this session all aspects concerning novel spatially-resolved structural, microstructural and chemical characterization techniques, especially those ones that advance the in-depth understanding of the relationship between the processing, the structure and the properties of thin films and engineered surfaces. Particular attention will be given to papers providing information on novel cutting-edge experiments on the analysis of the microstructure and microstructural evolution of thin films, including in-situ measurements during film growth, spatially resolved analysis of residual stress and three-dimensional chemical mapping. Emphasis will be given to novel high-resolution techniques, such as Atom Probe Tomography, X-ray nano-diffraction, advanced TEM characterization, micro-Raman spectroscopy, etc. Papers are furthermore also solicited in the emerging area of three-dimensional microstructural characterization in small volumes, such as FIB/SEM tomography, in-situ EBSD and/or ToF-SIMS 3D mapping.

H1 Invited Speakers:

Damien Faurie, LSPM-CNRS, Université Paris13, France, "Multicracking of Thin Films and Nanostructures on Stretchable Substrates. Impact on Magnetic Properties."

Josh Kacher, Georgia Institute of Technology, USA, "Multimodal and In situ Electron Microscopy to Understand Local Deformation Mechanics"

H2: Advanced Mechanical Testing of Surfaces, Thin Films, Coatings and Small Volumes:

This session covers advanced mechanical characterization techniques for surfaces, thin films and coatings with a focus on the development of novel methods rather than the application of standard methods to new materials. This includes novel methods of performing nanoindentation testing or analysis methods and testing of micro-scale testing geometries produced using focused ion beam (FIB) machining or issues related to the FIB-machined structures. Particular attention will be given to papers providing details on developing techniques such as novel fracture testing geometries. Emphasis will be given to testing techniques performed in situ in the SEM, TEM, Raman, X-ray beamline, etc. Papers are also solicited in the emerging area of nano- or micro-testing at high strain rates.

H2 Invited Speakers:

Daniel Gianola, University of California Santa Barbara, USA, "Characterization of Defects and their Dynamics using Transmission Scanning Electron Microscopy"

Jon Molina, IMDEA Materials Institute, Spain, "Strength and Fracture Toughness at Elevated Temperature of Monolithic and Multilayered Hard Coatings"

H3: Characterization of Coatings and Small Volumes in Harsh Environments:

This session covers the characterization of the coatings microstructure and mechanical behavior under harsh and/or unusual conditions, such as high or cryogenic temperatures, radiation, hydrogen embrittlement and high strain rates. Particular attention will be given to papers providing characterization in-situ in the harsh environment, rather than ex-situ after exposure: e.g. nanoindentation testing performed at high temperatures rather than after an annealing treatment in a separate furnace. Emphasis will be given to work which shows progress pushing the testing envelope further into harsher environments or combining multiple characterization techniques to gain information on coatings' behavior under severe or aggressive environments.

H3 Invited Speakers:

Kiener, Verena Maier, Montanuniversität Leoben, Austria, "Local Deformation Mechanisms under Ambient and Non-ambient Conditions Tested via Advanced Nanoindentation"

Nathan Mara, University of Minnesota, USA, "Micro-fracture and Deformation Behavior of Tungsten and Tungsten Composites"

HP Advanced Characterization Techniques for Coatings, Thin Films, and Small Volumes (Symposium H) Poster Session

Topical Symposia (TS):

Five topical symposia will address emerging areas in surface engineering:

TS1. Anti- and De-icing Surface Engineering

Ice accretion constitute a severe issue for several sectors, which include aeronautics, maritime, powerlines, aero-generators, off-shore oil platforms and construction among others. It hinders operation and reduces efficiency posing important economic and safety concerns, sometimes with catastrophic consequences. Extensive effort has been devoted to tackling this crucial yet challenging issue. Several ice protection technologies are presently in use, but most of them have inherent negative effects such as high energy consumption, increased weight, a negative environmental impact, and the need for frequent reapplication among others. Surface engineering can provide a better alternative by reducing or eliminating ice accumulation on one hand and on the other can contribute to simplify the currently de-icing systems by facilitating ice-detachment once it is formed. Another key issue in this field is the lack of understanding of substrate-ice interactions. The scientific community tends to develop super-hydrophobic materials to be used as ice-phobic materials expecting that if super-cooled water droplets rebound, they will not freeze. Nevertheless, an ever-growing amount of experimental evidence indicates that there is no correlation between those two properties.

This topical symposium aims at bringing together the growing number of researchers working in this field employing different strategies, materials and methods to attempt to reduce ice accretion process by surface engineering while at the same time trying to gain understanding of the icing mechanism.

TS1 Invited Speakers:

Kevin Golovin, University of British Columbia, Canada, "Low Interfacial Toughness Materials for Effective Large-scale Deicing"

Jianying He, Norwegian University of Science and Technology (NTNU), Norway, "Ice Adhesion Mechanics and Durable Icephobic Surfaces"

TS2. New Horizons in Boron-Containing Coatings: Modeling, Synthesis and Applications

Borides and boron-containing thin film materials are emerging as the next generation of hard, wear-, oxidation-, and corrosion-resistant coatings. Furthermore, various boron-based materials exhibit unique properties obtaining high potential for functional and architectural designs. The aim of this symposium is to provide a platform for first-principles design, synthesis, characterization of properties and defect structure as well as applications of different types of boron-containing protective and functional thin films. A strong intent is directed towards the initiation of an in-depth discussion covering a broad range of boron-containing materials and synthesis technologies including approaches such as PVD and CVD but also on modeling and advanced characterization techniques.

TS2 Invited Speakers:

John R. Abelson, University of Illinois at Urbana-Champaign, USA, "Metal Diborides Everywhere: Conformal Coating, Infilling, and Alloying by Low Temperature CVD"

Jens Birch, Linköping Univ., IFM, Thin Film Physics Div., Sweden, "Boron Carbide Thin Films for State-of-the-Art Neutron Detectors at the ESS"

Jinn P. Chu, National Taiwan University of Science and Technology (NTUST), Taiwan, "Boron-containing Metallic Glass Thin Films"

Christian Mitterer, Montanuniversität Leoben, Austria, "Boride-based Hard Coatings - Three Decades from the Early Beginnings to a Knowledge-based Materials Design"

Christina Scheu, Max-Planck Institut für Eisenforschung, Germany, " Insights in the Structure, Defects and Stability of Mo₂BC Thin Films by Advanced Characterization Methods"

TS3. In-Silico Design of Novel Materials by Quantum Mechanics and Classical Methods jointly sponsored by ICMCTF and AQS

With increasingly complex materials being synthesized for an ever-growing range of applications, there is a great need for understanding material properties at the atomistic and electronic level. To this end, quantum mechanical and classical methods are incredibly powerful tools capable of guiding the entire design process. Tremendous improvements in computational resources, coupled with software development in recent years, make it possible to calculate real materials properties and thus provide a roadmap for experimental materials synthesis.

This TS will cover a range of computational methodologies employed in materials design, incorporating fundamental first-principles calculations probing structure-property relationships, density-functional ab initio molecular dynamics (AIMD) simulations at finite temperatures that allow us to identify atomistic processes and associated changes in electronic structure which control strength, plasticity, and fracture in materials, through to large-scale 'virtual experiments' tackled using a classical Molecular Dynamics approach.

This session will bring together world-experts in computational materials science with the broad community of thin film and coating growers within ICMCTF. It will highlight representative examples of data-driven materials design, which span from theoretical prediction to experimental validation via synthesis, characterization, and testing, showcasing rapid iteration between ideas, computations, insight and new materials development.

TS3 Invited Speakers:

Grégory Abadias, Institut Pprime - CNRS - ENSMA - Université de Poitiers, France, "Computational Modeling of 3D Thin Film Growth Morphology: Influence of Angular and Energy Distribution of Particle Flux"

Björn Alling, Linköping Univ., IFM, Thin Film Physics Div., Sweden

Giacomo Po, University of Miami, USA, Plasticity and Fracture in Transition Metal Carbides

Jochen Michael Schneider, RWTH Aachen University, Germany, "Are Hard Coatings Predictable?"

Susan Sinnott, Penn State University, USA, "Growth and Properties of Thin Films"

TS4. Photocatalytic and Superhydrophilic Surfaces

Semiconductor photocatalysis is becoming a popular method for surface depollution and decontamination in the 21st century. A photocatalytic process can be defined as the acceleration of a photoreaction in the presence of a catalyst. Practical applications of photocatalysts include water splitting and green solar fuel production, chemical synthesis, and the degradation of organic pollutants and surface disinfection. The photocatalytic phenomenon is often also associated with the development of photoinduced superhydrophilic properties, which provides a 'self-cleaning' effect at the surface, which has been exploited in, for example, large area glazing applications. Titanium dioxide remains the most studied and practically used photocatalytic material, owing to its chemical and biological stability, low cost and non-toxicity. However, for practical exploitation of the photocatalytic process to real-life processes, the quantum efficiency of pristine titanium dioxide may not be sufficient. Solving this issue is one of the main objectives in modern photocatalytic research, where the proposed techniques range from modifications of titanium dioxide (via metal and non-metal doping, coupling with another semiconductor, or the introduction of crystal lattice defects) to the use of alternative, non-titania, semiconductors with higher quantum efficiency. This Topical Symposium will address: Industrial applications of photocatalytic and superhydrophilic materials; Water splitting applications and characterisation; Chemical synthesis via photocatalysis; Measurement of photocatalytic activity and superhydrophilic behavior; film and particle characterisation techniques; Production techniques for photocatalytic thin films and particles; Alternative materials and new applications.

TS4 Invited Speakers:

Josef Krysa, University of Chemistry and Technology, Czech Republic, "Hematite and Titania Thin Films: Energy and Environmental Applications"

Suresh Pillai, Centre for Precision Engineering, Materials and Manufacturing Research & Nanotechnology and Bio-Engineering Research Division, Ireland, "Industrial Applications of Photocatalytic and Superhydrophilic Materials"

TS5. Thin Films on Polymer Substrates: Flexible Electronics and Beyond

This session focuses on all aspects of material science related to thin films and coatings deposited on polymer substrates as well as metal-polymer and ceramic-polymer composite materials in general. Both fundamental and applied contributions on the following topics are highly welcome:

- Thin films for flexible electronics applications (conductive, semiconducting, magnetic, barrier layers, encapsulation, etc.)

- Additive manufacturing and other novel methods for thin film fabrication
- Atomic layer (ALD) and molecular layer deposition (MLD)
- Fabrication and properties of metal-polymer / ceramic-polymer composites and interfaces
- 3D printing of metal-polymer composites
- Functional and mechanical properties of novel alloys deposited on polymer substrates (high-entropy alloys, metallic glasses, etc.)
- Flexible and stretchable electronic devices

TS5 Invited Speakers:

Denys Makarov, Helmholtz-Zentrum Dresden-Rossendorf e. V. (HZDR), Institute of Ion Beam Physics and Materials Research, Germany, "Flexible Electronics: From Interactive Smart Skins to In vivo Applications"

Tina Ng, University of California San Diego, USA, "Printed Flexible Electronics for Biomechanical Measurements"

TSP Topical Symposia (TS) Poster Session

SPECIAL SESSIONS & EVENTS

Plenary Lecture (PL)

"Organic Bioelectronics – Nature Connected"

Professor Magnus Berggren,

Laboratory of Organic Electronics, ITN, Linköping University, Norrköping, Sweden

Monday, April 27, 2020, 8:00 a.m.

Biological systems are mechanically soft, with complex, time-dependent 3D curvilinear shapes; modern electronic and microfluidic technologies are rigid, with simple, static 2D layouts. Eliminating this profound mismatch in physical properties will create vast opportunities in man-made systems that can intimately integrate with the human body, for diagnostic, therapeutic or surgical function with important, unique capabilities in biomedical research and clinical healthcare. Over the last decade, a convergence of new concepts in thin film materials science, mechanical engineering, electrical engineering and advanced manufacturing has led to the emergence of diverse, novel classes of 'biocompatible' electronic and microfluidic systems with ultrathin, skin-like physical properties. This talk describes the key ideas and enabling materials, and it presents some of the most recent device examples, including wireless electronic 'tattoos', with applications in continuous monitoring of vital signs in neonatal intensive care; and microfluidic/electronic platforms that can capture, store and perform biomarker analysis on sweat, with applications in sports and fitness.

Exhibitors Keynote Lecture (EX)

"Carbon based Coatings in Industrial Scale for Sustainable Surface Solutions"

Dr. Jörg Vetter, Oerlikon, Germany

Tuesday, April 28, 2020, 11:00 a.m.

The attractive properties of carbon based hard coatings include high hardness, chemical inertness, tuneable electrical resistivity and optical properties, biocompatibility, excellent tribological behaviour in many engineering applications, show a high potential for use in anti-corrosion and electrochemical applications, and have a potential for sensory applications and for fuel cell applications. The main coatings in use are amorphous carbon coatings consisting of a disordered network of carbon atoms with sp^2 and sp^3 coordinated C-C bonds. The family of amorphous carbon films is called "diamond like carbon": DLC. However also diamond coatings with nearly 100% sp^3 carbon bond hybridization are in application. Oerlikon Balzers develops and applies industrial solutions to deposit amorphous carbon coatings based on PACVD processes, vacuum arc evaporation (direct and filtered), magnetron sputtering including newer developments of HiPIMS (e.g. S3p®). The diamond coatings are deposited by a special PACVD process or by a hot filament process. Tailored batch coating systems with different sizes are used both for large scale and small lot applications. Selected industrial coating systems will be briefly described (a-C:H:Me, a-C:H, a-C:H:X, a-C, ta-C, diamond). Typical dedicated applications of the carbon based coatings and diamond coatings including surface solutions for green car developments (e.g. ICEV, HEV, FCEV) and green manufacturing are presented.

Special Interest Talks (SIT)

A new feature of highlighted presentations offers added value to the technical program. Lectures are dedicated to topics of fundamental interests for scientists and engineers in surface engineering. Presentations are individual and not "classic" day-to-day R&D business. Discussion of new developments and trends of relevance to ICMCTF, both in materials science and in methodology, in a pioneering state, with long term impact. Selected critical reviews in a field of relevance to ICMCTF. Recognition of colleagues with pioneering and lasting impact on ICMCTF.

SIT1 Special Interest Session

Igor Abrikosov, Linköping University, IFM, Sweden, "Materials Discoveries at Extreme Conditions: A Path Towards New Advanced Materials"

SIT2 Special Interest Session

Peter Polcik, Plansee Composite Materials GmbH, Germany, "Design, Metallurgy and Manufacturing Technologies of Targets for Hard Coating and Tribological Applications"

SIT3 Special Interest Session

André Anders, Leibniz Institute of Surface Engineering, Germany, "Plasma Aspects in the Deposition of Advanced Coatings"

'FIRST TIMERS' SPECIAL

We want to welcome new participants in 2020 with a special 'First Timers' offer of **free student registration** for one student accompanying any adviser/supervisor registering for ICMCTF 2020 for the first time. Both the mentor and student are required to stay in the conference hotel to be eligible for the offer. Please contact the ICMCTF 2020 General Chair, Christopher Muratore (cmuratore1@u Dayton.edu) if you have any questions regarding this opportunity.

ICMCTF VENDOR EXHIBIT

Visit the exhibit hall on Tuesday, April 28, from 12:00-7:00 p.m. and Wednesday, April 29, from 10:00 am – 2:00 p.m. to learn about new products, services and application techniques that will help improve all facets of R&D, Engineering, Manufacturing, Quality Control and general laboratory operations. This is a great opportunity for attendees to interface with vendors who are eager to introduce their products that will satisfy your laboratory requirements and your specific research criteria. The exhibit hall is also a great place for networking. Join us each day for lunch and the exhibit hall reception on Tuesday at 5:30. For questions regarding the exhibits, please contact Jeannette DeGennaro at jeannette@avs.org

Call for ICMCTF Awards

- **Graduate Student Awards:** The ICMCTF Graduate Student Awards are intended to honor and encourage outstanding graduate students in fields of interest to the Advanced Surface Engineering Division (ASED) of the AVS. ASED seeks to recognize students of exceptional ability who show promise for significant future achievement in ASED-related fields. The nominee must be a graduate student in science or engineering who is in good standing at a University with a recognized graduate degree program and the presenting author of an oral presentation at the annual ICMCTF conference. Nominees who receive their final research degree after the ICMCTF Abstract Submission deadline are still eligible for that year. However, previous Graduate Student Award winners are ineligible. Submission Deadline: October 1, 2019. Click here for [Nomination Procedures](#).
- **Bunshah Award:** R.F. Bunshah Award and Honorary ICMCTF lectureship is intended to recognize outstanding research or technological innovation in the areas of interest to the Advanced Surface Engineering Division (ASED) of the AVS, with emphasis in the fields of surface engineering, thin films, and related topics. The nominee shall have made pioneering contributions to the science or technology of surface engineering, thin films, or related fields of interest to ASED. Submission Deadline: October 1, 2019. Click here for [Nomination Procedures](#)
- **Bill Sproul Award:** The Bill Sproul Award and Honorary ICMCTF lectureship is intended 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, with emphasis in the fields of surface engineering, thin films, and related topics. Submission Deadline: October 1, 2019. Click here for [Nomination Procedures](#)

ONLINE ABSTRACT SUBMISSION ONLY: www.icmctf.org

Deadline: 11:00 p.m. ET, TUESDAY, October 1, 2019

Supplemental data (1-2 pages, 1MB) will also be accepted via the submission site. Instructions may be found at the web site above.

*****Please Note: A presenter may present one (1) ORAL and one (1) POSTER presentation at ICMCTF*****

ORAL Sessions: Rooms will be set up with projectors, screens, microphones, and laptops (PCs).

POSTER Sessions: Each poster presenter will be allotted space that is 4 feet wide by 4 feet high. Please make your poster no larger than 46 inches wide by 46 inches high to ensure it fits nicely into the allotted space.

Any Questions? Please email icmctf@icmctf.org