stle

Society of Tribologists and Lubrication Engineers

Virtual Annual Meeting & Exhibition

Program Guide

May 17-20, 2021

Plus:

Annual Meeting Exhibitor Directory, pg. 75

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#STLE2021

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Contents

The **2021 STLE Virtual Annual Meeting & Exhibition** is sponsored by the Society of Tribologists and Lubrication Engineers, an international organization headquartered at 840 Busse Highway, Park Ridge, Illinois (USA) 60068-2376. Telephone: (847) 825-5536. Fax: (847) 825-1456. Email: **information@stle.org**. Web: **www.stle.org**. STLE is a not-for-profit professional society founded in 1944 to advance the science of tribology and best practices in lubrication engineering.

Message from the STLE president

Hello STLE Members and Friends,

As STLE President, it is my pleasure to welcome the more than 1,000 participants from nearly 40 countries that will be attending the **2021 STLE Virtual Annual Meeting & Exhibition** during the week of May 17-20. First, I would like to congratulate the STLE Annual Meeting Program Committee (AMPC), and especially chair Dr. Min Zou (University of Arkansas), for the great work in organizing this event. The AMPC has assembled a superb technical program featuring 300 papers, eight keynote and plenary speakers, poster presentations, the popular Commercial Marketing Forum sessions, virtual exhibit booths and an array of networking opportunities to connect with lubricant industry professionals from around the world during the four-day meeting.

STLE is excited and proud to be offering you our first Virtual Annual Meeting! While we would have preferred to see you in New Orleans for the 75th STLE Annual Meeting, providing you with timely content and the ability to network with your peers is the ultimate goal of any meeting—be it in-person or virtual. We know we will accomplish both by leveraging a user-friendly, virtual platform that will safely provide attendees with a full conference experience from the comfort of your local office or home. This year's virtual format makes it possible for many of our members and industry colleagues to attend the Annual Meeting, maybe for the first time. Also, all sessions will be recorded and made available to participants for up to 90 days following the conclusion of the meeting.

In addition to the technical sessions, to better accommodate and maximize the opportunities, the education courses usually held the same week as the Annual Meeting will be segregated in the weeks before and after the meeting. STLE's Education Committee has converted five courses dealing with basic and advanced lubrication and metalworking fluids to be presented online, starting in early May and concluding during the first full week of June. No course will be presented during the Annual Meeting dates, allowing you greater flexibility to attend the meeting, trade show, and take as many courses as you desire. If you haven't done so, visit the STLE website (**www.stle.org**) to register for courses still available.

Don't forget to make time in your schedule to check out the **2021 trade show** and visit with the more than 65 exhibitors with virtual booths displaying the lubricant industry's newest technologies, products and services. You'll be able to talk directly with technical experts and engage with the industry's leading companies looking to help provide you with solutions and strategies to improve your company's bottom line.

Another positive with the virtual format is that you can spend extra time during the week engaging with the exhibitors and still be able to catch up on all of the recorded technical presentations on demand for the next 90 days. In theory, there are no lost opportunities with the virtual format compared to traditional in-person meetings.

Details on the technical program and other aspects of the Annual Meeting are included in this convenient **Program Guide** to help you prepare in advance, with up-to-date information available on the STLE website and in the virtual platform when the meeting starts.

This is going to be a great week and I look forward to following many of the technical presentations, keynote and plenary talks, and visiting the exhibits from my home office in British Columbia.

Look forward to connecting with you online at the 75th STLE Annual Meeting!

Paul Hetherington, STLE President
(HollyFrontier Lubricants & Specialties)

2021 STLE Virtual Annual Meeting & Exhibition

NETWORKING & SPECIAL EVENTS

Attending an in-person meeting is more than just education, it's catching up with old friends and meeting new faces. While the STLE Virtual Annual Meeting & Exhibition changes the way we network, it's not impossible.

Virtual Networking Breaks have been scheduled in the mornings & afternoons between each breakout technical sessions and will last for 30 minutes. While this does allow for you to catch up on work or at-home responsibilities, it's also a chance to recap the previous sessions, ask a burning question, or just say "hello!" and connect virtually with a colleague. In addition to networking with your peers, be sure to visit the virtual exhibit booths and view the student research posters in the Poster Gallery.

"Industry Insights" Chat Sessions will be hosted in the mornings or afternoons each day where you can connect with industry and academic leaders for a more informal networking exchange discussing the latest hot topics in the field of tribology and lubrication.

Virtual Networking Reception will occur on Monday evening, May 17 (6:30-8 pm EDT). Bring your libation of choice and plan to add to the conversation! This isn't your traditional networking setting, but it's designed to really get people to engage and find real value in connecting with your colleagues in the field.

Exhibitor Appreciation Hours will occur with 90 minutes of dedicated exhibit time: Monday, May 17 (3-4 pm EDT) and Tuesday, May 18 (3-3:30 pm EDT)—no need to worry about missing a Commercial Marketing Forum presentation or technical session! This year's virtual setting will feature three halls of booths that will link attendees to the industry's latest new products and technologies with more than 60 companies that will be represented looking to do business with you.

STLE Virtual Business Meeting – May 18

Paul Hetherington

Ken Hope

The annual meeting's major business function goes virtual on Tuesday, May 18 (1-2 pm EDT) honoring STLE's incoming and outgoing presidents, award winners and top volunteers.

Join us as we salute **2020-2021 STLE President Paul Hetherington** with HollyFrontier Lubricants & Specialties and **2021-2022 STLE President Ken Hope** with Chevron Phillips Chemical.

Visit **www.stle.org/annualmeeting** for the most up-to-date list on additional exhibitors that will be participating.

ANNUAL MEETING EXHIBITORS • Preliminary as of April 12, 2021

STLE's annual trade show is where you can catch up on the lubricant industry's latest products, services and technologies. This year's event features more than 60 companies with virtual booths. Check out the **Exhibitor Directory on page 75** for details about each of these companies.

Acme-Hardesty Company
ADEKA Corporation
Advanced Chemical Concepts Inc.
Afton Chemical Corporation
Analytik Jena US
ANGUS Chemical Company
BASF Corporation
Beckman Coulter
Biosynthetic Technologies
Bruker
BYK USA Inc.
Cannon Instrument Company
Chevron Phillips Chemical Company
Clariant
Colonial Chemical Inc.
Compass Instruments
CRC Press/Taylor and Francis
Croda Inc.
Dow
Eastman
Emery Oleochemicals
Ergon, Inc.
Evonik Oil Additives USA, Inc.
ExxonMobil Chemical Company
Falex Corporation
FedChem/Federal Process
Functional Products, Inc.
GREEN FRIX
Huntsman
INEOS Oligomers
Italmatch Chemicals
Kao Chemicals GmbH
King Industries, Inc.
Koehler Instrument Company Inc.
LANXESS Corporation
LSI Chemical
Microtap USA, Inc.
Münzing
Napoleon Engineering Services
OilDoc GmbH
Oil Filtration Systems
Optimol Instruments Prüftechnik GmbH
OQ Chemicals Corporation
Palmer Holland Inc.
PCC Chemax, Inc.
PCS Instruments
PerkinElmer, Inc.
Pilot Chemical Company
Ravago Chemicals North America
Savant Labs
Sea-Land Chemical Company
Shanghai Million Chemical Limited
Soltex, Inc.
SONGWON Industrial Group
Tannas Company & King Refrigeration
Teknor Apex Company
The Lubrizol Corporation
Troy Corporation
United Soybean Board
Vanderbilt Chemicals, LLC

2021 STLE Virtual Annual Meeting & Exhibition

KNOW BEFORE YOU GO!

It's almost time for the first STLE Virtual Annual Meeting & Exhibition! We have included a few important details in advance of the meeting to help you prepare. For more helpful tips, visit www.stle.org/annualmeeting or look for the login invitation email to arrive a few days prior to the event.

- An invitation email to access the virtual conference platform, **e-Attend™**, powered by Image Audiovisuals (STLE's virtual event partner) for the Annual Meeting will be sent to the email address used with online registration (we cannot change this email) a week before the meeting starts. **Be sure to know your email address that you used to register on the STLE website.**

- The login instructions will be sent from this email address: **STLE Annual Meeting (kphipps@stle.org)** and will be titled **"2021 STLE Virtual Annual Meeting & Exhibition – Registration Login Details."** Monitor your email for this notice and check your spam/junk folder. If you have not received the email notice, please email us ASAP at **information@stle.org**.

- Visit the virtual event site (**https://stle2021annualmeeting.e-attend.com**) to make sure your login process goes smoothly. Initial login requires just your email address. Once logged in, please update your profile and add a photo that will facilitate networking with other attendees. Bookmark the site address and your email for easy access.

- In your profile, you can view the program agenda and manually set your itinerary schedule to your preferred time zone. **Please Note: All times listed in the program agenda are US Eastern Daylight Time (EDT).**

- We strongly recommend using **Google Chrome, Firefox, Safari** or **Microsoft Edge** internet browser to access the virtual event.

- Be sure to join your peers in our virtual **"Networking Lounge,"** to share ideas and key takeaways from the event with other attendees and make new connections. If you wish to engage in 1:1 chat, you can select an attendees' name in the Chat box at the bottom of your screen to start a private conversation, or you can arrange small group chats by sharing a link in your profile to your preferred virtual conferencing platform (Zoom, Microsoft Teams, etc.). **A virtual Networking Reception will be held on Monday evening, May 17 (6:30-8 pm EDT).**

- Technical sessions will not begin until the original date and time listed in the program schedule. Session chairs will serve as moderators for each technical session and attendees will be able to join the online chat in the platform for discussion with other attendees and can type questions in the Chat box. Speakers will be asked to join for live Q&A during their designated presentation times and address the questions posted. You can also reach out directly to speakers through the private chat function in the platform.

- If you have questions about navigating the site, you can email **support@e-attend.com** for technical support from Image Audiovisuals. If you have STLE-related questions, you can chat with STLE staff at our virtual booth in the lobby area.

- Prepare as you would for an in-person event. Plan your day with adequate time and have what you need for the sessions you are attending. Come to the sessions focused so you can fully participate.

PS: Don't forget you'll have 90 days of access to all sessions on the platform after the Annual Meeting. Most of the sessions will be prerecorded and available on-demand on the platform shortly after each presentation is broadcast during the Annual Meeting.

Education Courses

New for this year, five education courses are being offered virtually before and after the STLE Annual Meeting.

Each course is a two-day event on Tuesday and Wednesday of its respective week. The course modules will be pre-recorded presentations, followed by a live Q&A with the presenter.

STLE 2021
Education Course Schedule

May 4-5	Basic Lubrication 101
May 11-12	Basic Lubrication 102
May 25-26	Metalworking Fluids 105
June 1-2	Advanced Lubrication 301
June 8-9	Advanced Lubrication 302

If you registered for any courses, participants will receive a separate email from **customercare@gotowebinar.com** a few days before your designated course starts, with a GoToWebinar link and password. Course handouts will be available on the day of the course, downloadable from the GoToWebinar platform. Each course will have its own unique link and password. Please check your spam/junk folder. If you do not have the link for your specific course(s), please contact STLE at **information@stle.org** ASAP!

ASME Journal of Tribology to Host Special Symposium on Additive Manufacturing at the STLE 2021 Annual Meeting & Exhibition

Additive manufacturing (AM) enables rapid fabrication of parts with complex geometries, which cannot easily be manufactured with traditional methods. While originally limited to rapid prototyping, recent advances in AM technology also enable direct fabrication of functional end-use parts in, e.g., aerospace, medical devices, and military applications. However, the transition from rapid prototyping to fabricating end-use parts has also revealed technology barriers, including surface quality, accuracy, part variability, and uncertainty about the process-structure-property relationship, to only name a few. Crucially, fundamental questions about friction, wear, and lubrication of AM parts have led to substantial research interest in the tribology community.

The symposium, sponsored by the ASME Journal of Tribology, provides significant value to the tribology community by highlighting recent advances of tribology research related to AM, defining the state-of-the-art of tribology knowledge, and framing the challenges and opportunities for future tribology research in this exciting field. Many of the papers presented in this symposium have been peer-reviewed and are scheduled to appear in a special May issue of the ASME Journal of Tribology. **The symposium sessions will take place on Tuesday, May 18 – Session 4B Additive Manufacturing I (2-5:30 pm EDT) and Thursday, May 20 – Session 8F Additive Manufacturing II (2-5:30 pm EDT).**

ANNUAL MEETING SPONSORS

Sponsors as of April 12, 2021

STLE wishes to thank the following sponsors for their generous support of the 2021 STLE Virtual Annual Meeting & Exhibition. Visit **www.stle.org/annualmeeting** for the most up-to-date sponsors list.

Palladium Plus Level ($5,000)

Monson—An Azelis Company
Keynote Session

PCS Instruments, Inc.
Exhibit Hall Ambassador

Pilot Chemical Company
Keynote Session

Shell
Keynote Session

Palladium Level ($4,000)

Afton Chemical Corporation
General Conference Sponsorship

ExxonMobil Chemical Company
General Conference Sponsorship

Palmer Holland Inc.
General Conference Sponsorship

The Lubrizol Corporation
General Conference Sponsorship

Titanium Plus Level ($3,500)

Chevron Phillips Chemical Company
President's Luncheon/Ceremony

Eastman
General Conference Sponsorship

Evonik Oil Additives
Recharging Lounge

Titanium Level ($3,000)

ANGUS Chemical Company
General Conference Sponsorship

BASF Corporation
Education Courses

Sea-Land Chemical Company
General Conference Sponsorship

Vanderbilt Chemicals, LLC
General Conference Sponsorship

Platinum Level ($2,000)

King Industries, Inc.
General Conference Sponsorship

Zschimmer & Schwarz
General Conference Sponsorship

Gold Level ($1,000)

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General Conference Sponsorship

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Falex Corporation
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Optimol Instruments Prüftechnik GmbH
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Songwon Industrial Group
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Southwest Research Institute
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The Timken Company
General Conference Sponsorship

(All times listed are US Eastern Daylight Time)

2021 STLE Virtual Annual Meeting & Exhibition

PROGRAM SCHEDULE AT A GLANCE • Preliminary as of April 12, 2021

Monday, May 17, 2021

8:30 – 10 am
Opening Welcome and Monday Keynote Session

Keynote Speakers:

- Dr. Said Jahanmir, Assistant Director of Federal Partnerships, National Institute of Standards and Technology (NIST) Office of Advanced Manufacturing
- Dr. Mike Lovell, President, Marquette University
- Dr. Kathy Wahl, Head of Molecular Interfaces and Tribology Section, Naval Research Laboratory

10 – 10:30 am
Networking Break & Special Programming

10 am – 4 pm
Virtual Exhibits and Student Posters

10:30 am – 1 pm
Monday Technical Sessions:

- 1A – Seals I
- 1B – Environmentally Friendly Fluids I
- 1C – Fluid Film Bearings I
- 1D – Gears I
- 1E – Metalworking Fluids I
- 1F – Nanotribology I
- 1G – Power Generation and Wind Turbine Tribology I
- 1H – Commercial Marketing Forum I
- 1I – Synthetic Lubricants and Hydraulics I

1 – 2 pm
Networking Break & Special Programming

2 – 6 pm
Monday Technical Sessions:

- 2A – Engine & Drivetrain Session on Electric Vehicles I
- 2B – Environmentally Friendly Fluids II
- 2D – Materials Tribology I
- 2E – Metalworking Fluids II
- 2F – Nanotribology II
- 2G – Power Generation and Wind Turbine Tribology II
- 2I – Commercial Marketing Forum II
- 2J – Synthetic Lubricants and Hydraulics II

3 – 4 pm – Exhibitor Appreciation Hour & Networking Break

6:30 – 8 pm
Virtual Networking Reception

Tuesday, May 18, 2021

8:30 – 10 am
Tuesday Keynote Session

Keynote Speaker:

- Dr. Melissa Orme, Vice President, Boeing Additive Manufacturing

10 – 10:30 am
Networking Break & Special Programming

10 am – 3:30 pm
Virtual Exhibits and Student Posters

10:30 am – 1 pm
Tuesday Technical Sessions:

- 3A – Condition Monitoring I
- 3B – Lab to Field: Bridging the Gap Between Bench and Engine: Engine & Drivetrain & Lubrication Fundamentals Joint Session I
- 3C – Nonferrous Metals I
- 3D – Materials Tribology II
- 3E – Metalworking Fluids III
- 3F – Nanotribology III
- 3G – Rolling Element Bearings I
- 3H – Lubrication Fundamentals I: Non-Tribological Oil Properties
- 3I – Commercial Marketing Forum III

1 – 2 pm
STLE Virtual Business Meeting

2 – 6 pm
Tuesday Technical Sessions:

- 4A – Condition Monitoring II
- 4B – Additive Manufacturing I: Special Symposium
- 4C – Nonferrous Metals II: Tribology and Biobased Session in Memory of Dr. Girma Biresaw
- 4D – Materials Tribology III
- 4E – Metalworking Fluids IV
- 4F – Nanotribology IV
- 4G – Rolling Element Bearings II
- 4H – 2D Materials/Superlubricity: Material Tribology & Nanotribology Joint Session I
- 4I – Commercial Marketing Forum IV

3 – 3:30 pm
Networking Break & Exhibitor Appreciation

Wednesday, May 19, 2021

8:30 – 10 am
Wednesday Keynote Session

Keynote Speaker:

- Dr. Armit Parikh, Research Manager, Smith & Nephew, Inc.

10 – 10:30 am
Networking Break & Special Programming

10 am – 3:30 pm
Virtual Exhibits and Student Posters

10:30 am – 1 pm
Wednesday Technical Sessions:

- 5A – Biotribology I
- 5B – 2D Materials/Superlubricity: Material Tribology & Nanotribology Joint Session II
- 5C – Engine & Drivetrain I
- 5D – Lubrication Fundamentals II: Additives I
- 5E – Wear I
- 5F – Tribotesting I
- 5G – Rolling Element Bearings III
- 5H – Nonferrous Metals III
- 5I – Commercial Marketing Forum V

1 – 2 pm
Plenary Program – Session #1

Plenary Speaker:

- Dr. Jack Zakarian, Consultant, JAZTech Consulting LLC

2 – 6 pm
Wednesday Technical Sessions:

- 6A – Biotribology II
- 6B – 2D Materials/Superlubricity: Material Tribology & Nanotribology Joint Session III
- 6C – Engine & Drivetrain II
- 6D – Lubrication Fundamentals III: Additives II
- 6E – Wear II
- 6F – Tribotesting II
- 6G – Rolling Element Bearings IV
- 6H – Tribochemistry – Materials Tribology & Nanotribology Joint Session I
- 6I – Grease I
- 6J – Commercial Marketing Forum VI

3 – 3:30 pm
Networking Break & Special Programming

Thursday, May 20, 2021

8:30 – 10 am
Thursday Keynote Session

Keynote Speaker:

- Dr. Christopher Williams, Professor of Mechanical Engineering, Virginia Tech

10 – 10:30 am
Networking Break & Special Programming

10 am – 3:30 pm
Virtual Exhibits and Student Posters

10:30 am – 1 pm
Thursday Technical Sessions:

- 7A – Grease II
- 7B – Contact Mechanics I
- 7C – Engine & Drivetrain III
- 7D – Lubrication Fundamentals IV: EHL
- 7E – Tribochemistry – Materials Tribology & Nanotribology Joint Session II
- 7F – Tribotesting III
- 7G – Rolling Element Bearings V
- 7H – Surface Engineering I

1 – 2 pm
Plenary Program – Session #2

Plenary Speaker:

- Dr. Jim MacLeod, Group Leader, National Research Council Canada

2 – 6 pm
Thursday Technical Sessions:

- 8A – Grease III
- 8B – Contact Mechanics II
- 8C – Engine & Drivetrain IV
- 8D – Lubrication Fundamentals V: Viscosity
- 8E –Tribochemistry – Materials Tribology & Nanotribology Joint Session III
- 8F – Additive Manufacturing II: Special Symposium
- 8G – Rolling Element Bearings VI
- 8H –Surface Engineering II

3 – 3:30 pm
Networking Break & Special Programming

2021 STLE Virtual Annual Meeting & Exhibition

KEYNOTE & PLENARY SPEAKERS

The 2021 STLE Virtual Annual Meeting program features eight world-renowned thought-leaders, each presenting their perspectives on the latest emerging trends and technologies impacting the tribology and lubrication industry.

Monday, May 17, 2021 | 8:30 – 10 am EDT

DR. SAID JAHANMIR

Assistant Director of Federal Partnerships, The National Institute of Standards Technology (NIST) Office of Advanced Manufacturing

Dr. Said Jahanmir is assistant director for federal partnerships at the National Institute of Standards Technology (NIST) Office of Advanced Manufacturing. Jahanmir received a doctorate in mechanical engineering from the Massachusetts Institute of Technology (MIT), where his work in tribology (friction, lubrication and wear) led to a new theory for wear of materials based on the fundamental mechanics and physics of contacts. Jahanmir, an STLE and ASME Fellow and Honorary Member, also served as the 2018-2019 ASME president. Jahanmir is also currently the president and CEO of Boston Tribology Associates, an engineering consulting firm and serves as Adjunct Professor of Mechanical Engineering at Texas A&M University. Jahanmir is a prominent technology leader with extensive scientific, technical, management and policy experience in the U.S. government, industry and academia.

Keynote Presentation

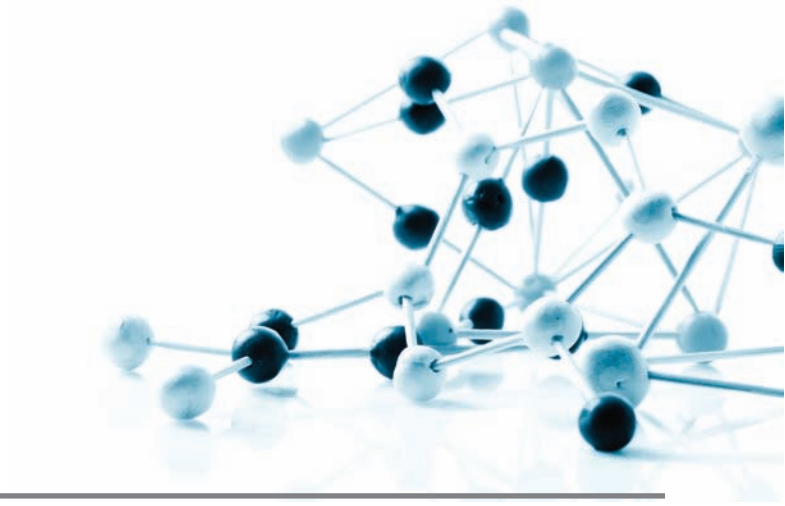
"How Tribology Benefits Technology and Society"

"We don't get no respect!" I heard this from a senior tribologist giving a keynote address at an STLE Annual Meeting many years ago. This sentiment has always resonated with me. Why is it that our work and contribution as tribologists and lubrication engineers is not recognized? So, what exactly is our contribution to technology and society? In this talk, we will discuss the impact of tribology over the past 75 to 100 years. ASLE, the predecessor of STLE, was formed 75 years ago "to foster the dissemination of lubrication knowledge and to encourage research and the exchange of ideas." This was well before the term "tribology" was coined in 1966. This was near the end of World War II, often referred to as a "mechanized" war, when planes, automobiles, and mechanical weapons all needed to be lubricated; at a time of rapid expansion of the age of automobiles and planes; with newly emerging lubricant additive technology; and with the need for longer life and higher reliability of mechanical systems. Over the years, our work as tribologists and lubrication engineers has transformed technology and has made our lives much more comfortable and safer. We have made a huge impact through the development of advanced oil refining and treatment processes, new synthetic lubricants, lubricant additives, green lubricants, new materials, high-performance bearings, reliable seals and gears, and solid lubricants, just to name a few. All of us must be proud of what we have accomplished and deserve much respect and accolades.

DR. MIKE LOVELL

President, Marquette University

Dr. Michael R. Lovell has served as the 24th president of Marquette University since July 2014. President Lovell holds three degrees in mechanical engineering, including a Ph.D. from the University of Pittsburgh. Prior to joining Marquette, Lovell served as chancellor at the University of Wisconsin-Milwaukee and held faculty positions at the University of Pittsburgh and the University of Kentucky. As a renowned scholar, Lovell has published more than 100 articles in leading engineering journals, has written a dozen book chapters, and co-authored the book Tribology for Scientists and Engineers. President Lovell has received numerous recognitions including a CAREER award from the National Science Foundation, an Outstanding Young Manufacturing Engineer from the Society of Manufacturing Engineers (SME), and the Burt L Newkirk Award from the American Society of Manufacturing Engineers (ASME). Lovell holds several U.S. and world patents and is a fellow of ASME and the National Academy of Inventors.



Keynote Presentation

"Inflection Point: A New Paradigm for Tribology Education"

Even before the COVID-19 pandemic, the higher education sector was struggling to address a growing financial crisis. With years of shrinking public support, concerns about the value of a degree in today's job market, increasing tuition, and the national student debt crisis, universities were ripe for disruption and needed to restructure. The pandemic accelerated this need for change; students and families have fewer resources to pay for college and universities across the country have lost more than $120 billion in revenue since March 2020. Higher education is at an inflection point. The disruption in higher education comes at a time when the tribology and lubrication engineering workforce will face necessary turnover. Developing a talent pipeline in the field of tribology represents both a challenge and opportunity. With limited academic programs available and the higher education sector on its head, we must reimagine how tribology education is delivered and how professionals in the field are developed. In this talk, we will examine what this new era of tribology education could look like. New instructional models, many of which are from the private sector, are emerging to replace traditional college education. Their credentials are faster, cheaper, and highly focused on skills and job placement. The field of tribology, with its practical nature and its natural link to the transportation, energy, and manufacturing sectors, can be on the leading edge in a new paradigm for higher education.

DR. KATHY WAHL

Head of Molecular Interfaces and Tribology Section, Naval Research Laboratory

Dr. Kathryn J. Wahl is Head of the Molecular Interfaces and Tribology Section at the Naval Research Laboratory. Wahl received a bachelor's degree in physics and mathematics from St. Olaf College, and a doctorate in materials science and engineering from Northwestern University. Wahl came to the NRL as a National Research Council postdoctoral fellow in the Tribology Section and studied friction, wear and transfer film formation of model solid lubricant coatings. Since joining the NRL research staff, Wahl's research has focused on fundamental physics and chemistry of sliding and adhesive surfaces for contacts ranging from macroscopic to nanometer-scale. Wahl has served on the Editorial Advisory Board of Review of Scientific Instruments, and currently serves on the editorial boards of Tribology Letters and Wear. Wahl is a fellow of STLE and American Vacuum Society (AVS), and a member of the Materials Research Society (MRS) and American Chemical Society (ACS).

Keynote Presentation

"Advancing Tribology – How Will We Tackle The Next 75 Years?"

Tribology has had a great ride over the past 75 years – becoming a named field and as a science and engineering discipline that can be fairly credited with truly transformational contributions to modern life. So where will we go from here? What challenges will we tackle? One of the most critical aspects of these questions involves time and money: How should we invest our research and development funds and efforts, given an ever-expanding set of technical challenges? Even considering purely tribology-related aspects, it's a complex problem. On one hand we need and want to improve mature engineered systems and, on the other hand, emerging technologies demand solutions from advanced materials and engineering. Further, we simultaneously have unprecedented ability to apply highly advanced analytical tools, models and software to understand mechanics and chemistry of contact phenomena at scales from atoms to geological. How will we as tribologists support and enable the legacy engineered systems that have dominated 20th century life, while embracing science and technology advances to address emerging 21st century opportunities? Should we embrace machine learning, and if so what aspects of our field are best served by this approach? How can we project how advanced manufacturing approaches will influence wear and durability? The future is rich with opportunity, and tribology expertise remains a key science and technology area essential to a majority of modern and emerging technologies.

2021 STLE Virtual Annual Meeting & Exhibition

KEYNOTE & PLENARY SPEAKERS

Tuesday, May 18, 2021 | 8:30 – 10 am EDT

DR. MELISSA ORME

Vice President, Boeing Additive Manufacturing Aerospace Applications

Dr. Melissa Orme belongs to that small group of engineers who have participated 'hands-on' in the field of additive manufacturing before the term or even the industry of "additive manufacturing" existed. Her career has been divided between academia and small business. On the academic front, she worked as a professor at University of California, Irvine for 12 years, where she rose to the rank of full professor. She was an early pioneer in the field of 3D printing of metallic parts, resulting in 15 U.S. patents relevant to 3D printing, which are concerned with novel AM methods with molten metal micro-droplets, novel methods of customizing the size distribution of metallic powders, and high-speed direct circuit board printing. Prior to her current position, she served as chief technology officer of Morf3D for four years. Morf3D is a company that is focused on additive manufacturing of metallic components, primarily for the aerospace and defense industry. In that capacity, she oversaw the company's AM development programs for small lot production, which includes new material parameter development, novel AM design implementation, component validation and qualification. Currently serving as vice president of Boeing Additive Manufacturing, Orme continues to grow and scale additive manufacturing capabilities and help to rapidly expand understanding of the unique features that 3D printing can bring to our factories and production lines while improving safety and quality. She helps to drive application scalability for existing products, and mature technology for future franchise platforms across Boeing Commercial Airplanes, Boeing Defense, Space and Security and Boeing Global Services.

Keynote Presentation

"Recent Advancements in Additive Manufacturing at Boeing"

Additive Manufacturing (AM) is a technology that is more than three decades old, and Boeing has been a leader in researching and implementing AM in the aerospace industry since 1997. Metal powder-bed AM technology, however, has only recently begun to demonstrate value for application into critical aerospace products that require high quality and rigorous process and manufacturing control. This presentation will discuss advancements in the AM modality of powder-bed laser fusion and will present two case studies where we have realized added value in converting traditionally manufactured parts to additively manufactured parts. Added value associated with Additive Manufacturing is distinguished into three major categories: part level, product level, and program level. On the part level, we discuss the added value of reduction of cost, lead time, weight, buy-to-fly ratio, and an increase in quality. On the product level, we discuss the ability of AM to enable the fabrication of differentiating products, or vehicles, in the case of Boeing. On a program level, we discuss the ability to enable rapid product development and the sustainable aspects of AM. For production at scale, repeatable and reliable printing and traceability are essential and, hence, a great deal of our background work is focused on establishing repeatable and reliable material properties across machines while enabling strict traceability through the integration of the digital thread.

Wednesday, May 19, 2021 8:30 – 10 am EDT

DR. AMIT PARIKH

Research Manager, Smith & Nephew, Inc.

Amit Parikh is a research manager at Smith and Nephew, Inc., a leading portfolio medical technology company. Parikh has global tribology responsibility for the hip and knee business and has worked in the orthopaedic industry for over 17 years. During that time, he has performed failure analysis, designed new test methods, and conducted coupon and device testing to evaluate novel bearing materials and implant technologies. He has also played a key role in obtaining regulatory clearances and commercializing numerous hip and knee replacement products. In addition, he has been involved in technical marketing and sales training activities in support of new product launches. He is an active member of ASTM and the Orthopedic Research Society and has authored over 35 abstracts and journal articles.

Keynote Presentation

"Implant Materials in Arthroplasty"

Osteoarthritis is a degenerative joint disease that can cause chronic pain and significantly impact daily life. While initial treatment involves conservative, non-surgical options, arthroplasty has increasingly been performed to restore patient mobility. Over the last several decades, innovations related to material and design have significantly improved the performance and longevity of joint replacement devices. Nonetheless, opportunities to improve patient outcomes remain. Greater patient expectations and an increase in the number of young, active patients may also create new challenges in the future. This presentation will discuss materials used in arthroplasty and also highlight current challenges and opportunities.

1 – 2 pm EDT

DR. JACK ZAKARIAN

Consultant, JAZTech Consulting LLC

Jack Zakarian went to work for the Chevron Research Company in 1979 after graduating with a Ph.D. in chemical engineering from the University of California, Berkeley. He spent 37 years working for Chevron's Lubricants Business in the areas of base oil & lubricants product research & development. He retired from Chevron in 2016 and now works as an independent consultant. In 2019, he was named an STLE Fellow.

Plenary Presentation

"Hit the Right Notes With Your Technical Presentation"

This plenary talk will give valuable advice from a technical expert and STLE Fellow who, throughout his 42 years in the industry, has been known for taking a lighthearted and unconventional approach to teaching people about tribology and lubricants. Zakarian will illustrate techniques for helping people learn, understand, and retain technical information. This presentation will amuse you with song and inspire your thinking about how to make a positive impression with every technical presentation. You can get an advance preview of Jack's songs by visiting his YouTube channel: https://www.youtube.com/channel/UCKMwi6ZeiCgloJVD9DfDa3g?view_as=subscriber

Thursday, May 20, 2021
8:30 – 10 am EDT

DR. CHRISTOPHER WILLIAMS

Professor of Mechanical Engineering, Virginia Tech

Dr. Christopher Williams is the L.S. Randolph Professor and the Electro-Mechanical Corporation Senior Faculty Fellow in the department of mechanical engineering at Virginia Tech, and is the director of the Design, Research, and Education for Additive Manufacturing Systems (DREAMS) Laboratory. The lab has published over 185 peer-reviewed articles on topics spanning innovations in additive manufacturing processes and materials, design for additive manufacturing methodologies, and cyber-physical security for AM. Williams is a recipient of a National Science Foundation CAREER Award (2013) and the 2012 International Outstanding Young Researcher in Freeform and Additive Manufacturing Award. He currently serves as the vice chair of the Additive Manufacturing Community Advisors for SME. Dr. Williams holds a Ph.D. and M.S. in mechanical engineering from the Georgia Institute of Technology and a B.S., with high honors in mechanical engineering, from the University of Florida.

Keynote Presentation

"Tribology, Surface Science and Additive Manufacturing: Opportunities for a Symbiotic Relationship"

The core function of additive manufacturing (AM) technologies – forming layers by the selective placement (or forming) of solid material – provides unsurpassed design freedom in both the geometric topology and the material composition of a product. Using AM, engineers have the power to selectively place multiple materials only where they are needed, and thus are afforded the opportunity to realize products that satisfy multiple functions and design objectives. However, broad industrial adoption of AM has been constrained by many open research challenges, many of which are related to topics of relevance to the STLE community. In this talk, we will provide an overview of the current status, present challenges, and future opportunities of additive manufacturing technologies. The presentation will include a range of opportunities for STLE expertise to engage and improve AM technologies and applications – spanning from characterizing and improving surface finish of printed metals to tuning the tribological performance of printed medical implants. In addition, we will discuss opportunities where the unique traits of AM (e.g., tailored geometries and materials) might find unique use in fields driven by STLE expertise, including offshore oil and gas drilling and self-lubricating components.

1 – 2 pm EDT

DR. JIM MACLEOD

Group Leader, National Research Council Canada

Jim MacLeod is a NRC Fellow specializing in engine icing and environmental certification at the Gas Turbine Laboratory of the Aerospace Research Centre at the National Research Council of Canada. He joined NRC in 1982 as a researcher in the Propulsion Group. He has a master of engineering degree in aeronautical engineering from Carleton University, and has been extensively involved in turbine engine icing certification projects for all the major engine manufacturers. He was awarded a Queen Elizabeth II Diamond Jubilee Medal and was the 2015 recipient of the NATO Science and Technology Organization von Karman Medal. He is currently the chairman of the Aircraft Icing Research Alliance (AIRA).

Plenary Presentation

"Engine Icing Certification: Past, Present and Future"

Icing is one of the most difficult certification requirements that a modern gas turbine engine has to pass to obtain a Type Certificate. This presentation will cover the history of engine icing, the airworthiness requirements and the damage that icing can inflict on gas turbine components and engine operability. Issues related to engine design and ice protection will be discussed.

(All times listed are US Eastern Daylight Time)

2021 STLE Virtual Annual Meeting & Exhibition
EDUCATION COURSES

New for this year, five education courses are being offered virtually before and after the STLE Annual Meeting. Each course will be offered for one week between **May 3 and June 11, 2021.** No courses will overlap, so for the first time, participants can attend the virtual annual meeting, trade show and sign up for any and all courses they wish to take. Participants can still sign up to reserve a seat to attend any course before the scheduled dates. To register, visit **www.stle.org/annualmeeting**. Course attendance is not included in the general annual meeting fee.

Basic Lubrication 101

Day 1 (May 4) – 11 am – 3 pm EDT
Day 2 (May 5) – 11 am – 3 pm EDT

STLE Course Instructors:

Yvette Trzcinski (Course Chair), Jake Finn, Ken Hope, Gabe Kirsch, David Turner, Jason Papacek

Basic Lubrication 101 is primarily for the person entering the lubrication field who needs a broad introduction to the field of lubrication, lubrication principles and lubricating materials. This course is also for individuals not directly involved but who need a broad overview of lubricants and basic lubricating components. Basic Lubrication 101 does not require a formal scientific degree or background, although many technical terms and concepts are covered. Experienced people attend the course to be kept up to date on the latest developments, especially in those areas not directly related to their job function or area of expertise. Thus, Basic Lubrication 101 is usually attended by a broad cross section of people such as technical, technical services, sales, marketing, manufacturing, maintenance, and managers who in some way are involved in the industry.

Basic Lubrication 102

Day 1 (May 11) – 11 am – 3 pm EDT
Day 2 (May 12) – 11 am – 3 pm EDT

STLE Course Instructors:

Yvette Trzcinski (Course Chair), Frank Uherek, Nathan Knotts, Gareth Fish, Matthew Hoeffner, Paul Shiller, Hamed Eksiri, Ron LeBlanc

Basic Lubrication 102 is an overview of equipment systems (gears, bearings, seals, compressors, and engines) and their lubrication requirements, including a module on grease. Like Basic Lubrication 101, this course does not require a formal scientific degree or background, although many technical terms and concepts related to the use of lubricants in various mechanical devices are covered. Basic Lubrication 102 is intended for a diverse group, including people involved in technical services, sales, marketing, manufacturing, maintenance, and managers who want to know more about how lubricants work in service. This course assumes fundamental knowledge of lubricants and lubrication principles, as presented in the Basic Lubrication 101 course.

Metalworking Fluids 105

Day 1 (May 25) – 11 am – 3 pm EDT
Day 2 (May 26) – 11 am – 3 pm EDT

STLE Course Instructors:

Brian Hovik (Course Chair), Richard Butler, Neil Canter, Ted McClure, Jennifer Lunn, Fred Passman, John Burke

Metalworking Fluids 105 is designed for those involved in developing, working with and using metal forming fluids in the manufacturing environment. This course is very useful for formulators, technical service representatives, shop floor personnel and coolant service managers who need to know more about the fundamental concepts of metal forming fluids. This course is divided into modules covering metal forming operations, metal forming fluid chemistry, metal forming fluid failure mechanisms, controlling contamination and microbial growth, waste treatment and operator acceptance. Participants will gain a good understanding of metal forming operations, formulation of metal forming fluids, tools for identifying and correcting metal forming fluid failures and waste treatment of metal forming fluids.

Advanced Lubrication 301

Day 1 (June 1) – Noon – 4 pm EDT
Day 2 (June 2) – Noon – 4 pm EDT

STLE Course Instructors:

Alexander Mannion (Course Chair), Kevin De Santis, Anil Agiral, Gene Scanlon, Sona Sivakova

Advanced Lubrication 301 covers the molecular structures and chemistries of lubricant additive types. Additives examined will include antioxidants, rust inhibitors, detergents, dispersants, antiwear additives, extreme pressure additives, friction modifiers and rheology and viscosity modifiers.

Advanced Lubrication 302

Day 1 (June 8) – 11 am – 3 pm EDT
Day 2 (June 9) 2021 – 11 am – 3 pm EDT

STLE Course Instructors:

Babak Lofti (Course Chair), Brendan Miller, Ramoun Mourhatch, Weixue Tian, Vasilios Bakolas, Tim Krantz, Stephen Berkebile, Arup Gangopadhyay, Hamed Ghaednia

Advanced Lubrication 302 goes more in-depth on lubrication regimes, wear, and wear mechanisms, as well as lubricant failure analysis. This course includes a series of lubricant failure analysis case studies on automotive engines, gears and bearings.

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2021 STLE Virtual Annual Meeting & Exhibition
AWARD RECIPIENTS

STLE would like to congratulate the following individuals who will be recognized for their outstanding technical achievements in the field of tribology and lubrication at the 2021 STLE Virtual Annual Meeting & Exhibition.

PUBLISHING AWARDS

Given in recognition of outstanding achievement in the field of tribology and lubrication. All publishing awards are for papers printed in *Tribology Transactions,* STLE's peer-reviewed journal.

Edmond E. Bisson Award

The Bisson Award was named in honor of Edmond E. Bisson, a former STLE editor-in-chief who was instrumental in establishing the society's reputation as a technical publisher. Established in 1991, the award is given to STLE members or non-members for the best written contribution published by the society in the year preceding the Annual Meeting. The contribution must deal with tribology, lubrication engineering or allied disciplines.

- **Steven J. Thrush,** U.S. Army CCDC GVSC (USA)
- **Allen S. Comfort,** U.S. TARDEC (USA)
- **James S. Dusenbury,** U.S. Army CCDC GVSC (USA)
- **Yuzan Xiong,** Oakland University (USA)
- **Hongwei Qu,** Oakland University (USA)
- **Xue Han,** Oakland University (USA)
- **J. David Schall,** Oakland University (USA)
- **Gary C. Barber,** Oakland University (USA)
- **Xia Wang,** Oakland University (USA)

"Stability, Thermal Conductivity, Viscosity, and Tribological Characterization of Zirconia Nanofluids as a Function of Nanoparticle Concentration"

Frank P. Bussick Award

The Bussick Award is presented for the most outstanding technical paper written on sealing systems technology and materials. The award is sponsored by the STLE Seals Technical Committee and honors a former committee chair and STLE board member.

- **Jinbo Jiang,** Zhejiang University of Technology (P.R. China)
- **Xudong Peng,** Zhejiang University of Technology (P.R. China)
- **Cong Zong,** Zhejiang University of Technology (P.R. China)
- **Wenjing Zhao,** Zhejiang University of Technology (P.R. China)
- **Yuan Chen,** Zhejiang University of Technology (P.R. China)
- J**iyun Li,** Zhejiang University of Technology (P.R. China)

"Enhancing Film Stiffness of Spiral Groove Dry Gas Seal via Shape Modification at Low Speed: Numerical Results and Experiment"

Walter D. Hodson Award

The Hodson Award was established in 1950 and is given to the lead author of the best paper written by an STLE member 35 years of age or younger and published by the society in the year preceding the Annual Meeting. The purpose of the award is to stimulate the interest of young engineers in the science of tribology and lubrication and the activities of STLE.

- **Benjamin M. Fry** (*lead author), **Hugh Spikes, Janet S. Wong,** Imperial College London (United Kingdom)
- **Gareth Moody,** Croda Europe Ltd. (United Kingdom)

"Effect of Surface Cleaning on Performance of Organic Friction Modifiers"

Wilbur Deutsch Memorial Award

The Deutsch Award is named for a former STLE president and recognizes the most outstanding technical paper written on the practical aspects of lubrication published by the society in the year preceding the Annual Meeting.

- **Jens E. Johansson,** Luleå University of Technology (Sweden)
- **Mark T. Devlin,** Afton Chemical Corporation (USA)
- **Jeffrey M. Guevremont,** Afton Chemical Corporation (USA)
- **Braham Prakash,** Luleå University of Technology (Sweden)

"Improving Hypoid Gear Oil Pitting Performance Through Friction Reduction"

Captain Alfred E. Hunt Award

Named for ALCOA's first president, this award is given annually to the STLE member or members authoring the best technical paper dealing with the field of lubrication or an allied field.

- **Alexis Bonetto, Daniel Nélias, Thibaut Chaise, Laurent Zampon,** Univ. Lyon, INSA-Lyon (France)

"A Coupled Euler-Lagrange Model for More Realistic Simulation of Debris Denting in Rolling Element Bearings"

Al Sonntag Award

The Sonntag Award was established in 1983 and is given to an STLE member or members authoring the best technical paper on solid lubricants published by the society in the year preceding the Annual Meeting.

- **Charles Miller, Dipankar Choudhury, Min Zou,** University of Arkansas (USA)

"The Effects of Surface Roughness on the Durability of Polydopamine/PTFE Solid Lubricant Coatings on NiTiNOL 60"

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2021 STLE Virtual Annual Meeting & Exhibition
AWARD RECIPIENTS

INDUSTRY SERVICE AWARDS

STLE International Award

Dr. Ali Erdemir, Texas A&M University (USA)

The International Award, which was established in 1948, is STLE's highest technical honor and bestows lifetime honorary membership on the recipient, who need not have been a member of STLE. It is given in recognition of the recipient's outstanding contributions in tribology, lubrication engineering or allied fields.

P.M. Ku Meritorious Award

Dr. Martin Webster, ExxonMobil Research and Engineering (retired) (USA)

The Ku Award was established in 1978 and is given to the STLE member who most typifies the dedicated spirit of the late P.M. Ku, who worked tirelessly to promote and advance the mission of STLE. The award has been established to recognize outstanding and selfless achievement on behalf of STLE. To qualify for the honor, the recipient must have been a member of the society for at least 15 consecutive years and performed extensive active, dedicated service.

Vic Joll Award

Ken Brown, Eco Fluid Center Ltd. (Canada) – STLE Toronto Section

The Vic Joll Award recognizes outstanding and selfless contributions by a member of an STLE local section. It is given to a section member who has worked tirelessly and continuously for the benefit of the section, devoting numerous hours in the performance of many tasks necessary to promote and advance the mission of the section and of STLE. The award is named in honor of the late Vic Joll, 1978-79 STLE president who championed local sections.

Raymond L. Thibault Excellence in Education Award

Daniel Holdmeyer, Chevron Lubricants (retired) (USA)

The Raymond L. Thibault Excellence in Education Award was established in 2020 and is given to an STLE member who has demonstrated dedication to passionate and influential work as an educator in practical aspects of tribology & lubrication engineering which benefits the STLE community.

LOCAL SECTION AWARDS

Outstanding STLE Local Section Awards:

- STLE Detroit, STLE Hamilton, STLE Lower Ohio River Valley

STLE Local Section Achievement Awards:

- STLE Houston, STLE Philadelphia, STLE Toronto

STLE FELLOWS

2021 STLE Fellows

STLE Fellows are persons of outstanding personal achievement in the field of tribology or lubrication engineering who have 20 years of active practice in the science and/or engineering professions and have been an STLE member for 10 years. They are nominated by the Fellows Committee and approved by the STLE board of directors.

- **Dr. David Burris,** University of Delaware (USA)
- **Dr. Daniele Dini,** Imperial College London (United Kingdom)
- **Dr. Mathias Woydt,** MATRILUB (Germany)

2020 STLE Fellows

- **Dr. Vasilios Bakolas,** Schaeffler Technologies AG & Co. KG (Germany)
- **Dr. Seong Kim,** The Pennsylvania State University (USA)
- **Dr. Ashlie Martini,** University of California, Merced (USA)

STUDENT SCHOLARSHIPS

Presidential Awards Program

STLE grants three academic awards through its Presidential Awards Program: The Elmer E. Klaus Fellowship (graduate students), The E. Richard Booser Scholarship (undergraduate students) and The Jeanie S. McCoy Scholarship (female undergraduate or graduate students). These awards are administered by the STLE Presidential Council and are meant to encourage students to pursue an advanced degree or a career in tribology or lubrication engineering by subsidizing a research project related to the field.

The Elmer E. Klaus Fellowship
Eliane Gendreau, Imperial College London (United Kingdom)

The E. Richard Booser Scholarship
Brenden Miller, Gonzaga University (USA)

The Jeanie S. McCoy Scholarship
Jamie Benson, University of Delaware (USA)

EARLY CAREER AWARDS

The Early Career Awards recognize the technical achievements of STLE student members, postdoctoral researchers, junior-level academic faculty and industry professionals and provides financial support for attendance to the STLE Annual Meeting.

Student
Kazi Istiaque Alam, University of Delaware (USA)

Postdoctoral Researcher
Dr. Xin He, Oak Ridge National Laboratory (USA)

Academic Professional
Dr. Filippo Mangolini, University of Texas at Austin (USA)

Industry Professional
Dr. Suvrat Bhargava, TE Connectivity (USA)

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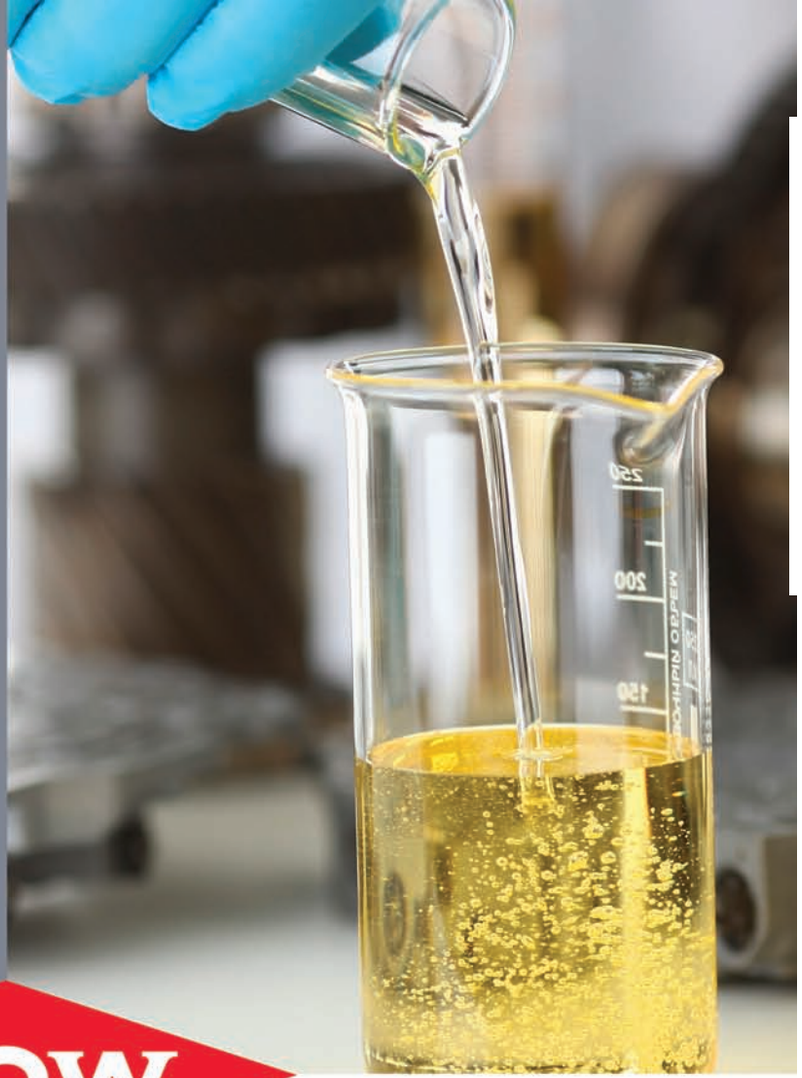

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Overview

Monday, May 17, 2021

8:30 – 10 am
Opening Welcome and Monday Keynote Session

Keynote Speakers:

- Dr. Said Jahanmir, Assistant Director of Federal Partnerships, National Institute of Standards and Technology (NIST) Office of Advanced Manufacturing
- Dr. Mike Lovell, President, Marquette University
- Dr. Kathy Wahl, Head of Molecular Interfaces and Tribology Section, Naval Research Laboratory

10 – 10:30 am
Networking Break & Special Programming

10 am – 4 pm
Virtual Exhibits and Student Posters

10:30 am – 1 pm
Monday Technical Sessions:

- 1A – Seals I
- 1B – Environmentally Friendly Fluids I
- 1C – Fluid Film Bearings I
- 1D – Gears I
- 1E – Metalworking Fluids I
- 1F – Nanotribology I
- 1G – Power Generation and Wind Turbine Tribology I
- 1H – Commercial Marketing Forum I
- 1I – Synthetic Lubricants and Hydraulics I

1 – 2 pm
Networking Break & Special Programming

2 – 6 pm
Monday Technical Sessions:

- 2A – Engine & Drivetrain Session on Electric Vehicles I
- 2B – Environmentally Friendly Fluids II
- 2D – Materials Tribology I
- 2E – Metalworking Fluids II
- 2F – Nanotribology II
- 2G – Power Generation and Wind Turbine Tribology II
- 2I – Commercial Marketing Forum II
- 2J – Synthetic Lubricants and Hydraulics II

3 – 4 pm – Exhibitor Appreciation Hour & Networking Break

6:30 – 8 pm
Virtual Networking Reception

Trade Show Hours:

- Monday, May 17: 10 am – 4 pm
- Tuesday, May 18: 10 am – 3:30 pm
- Wednesday, May 19: 10 am – 3:30 pm
- Thursday, May 20: 10 am – 3:30 pm

(All times listed are Eastern Daylight Time)

TIME	SESSION 1A Seals I Virtual Meeting Room 1	SESSION 1B Environmentally Friendly Fluids I Virtual Meeting Room 2	SESSION 1C Fluid Film Bearings I Virtual Meeting Room 3
10:30 – 11 am	On Surface Energy and Friction of Hydraulic Rod Seals, O. Feuchtmüller, p. 24	Global Fluid Trends, E. Jones, p. 24	Influence of Journal Surface Scratch Characteristics on the Performance of a Two-Lobe Journal Bearing – Comparison Between Experimental Data and Numerical Results, A. Vo, p. 24
11 – 11:30 am	Advanced Sealing Concepts for Redox Flow Batteries, D. Jannes, p. 24	EU Ecolabel for Lubricants – European Approach to Evaluate EALs, S. Rea, p. 24	Effect of Pad Fixations on the Tribological Performance of Parallel-Surface Fixed-Pad Thrust Bearings, A. Charitopoulos, p. 24
11:30 – Noon	A Method of Direct Measurement of Mechanical Seal Wear In Pumps and Compressors, M. Slivinski, p. 24	Sustainability in the Lubricants Industry, I. Herrmann, p. 24	Experimental Characterization of Hydrodynamic Bearing During Oil Flow Interruption Event, L. Naldi, p. 24
Noon – 12:30 pm	Computational Fluid Dynamics Analysis & Experimental Results for the Dynamic Performance of Two Long Smooth Surface Annular Seals Operating with a Liquid in Air Mixture, J. Yang, p. 24	New Hydrolytic Stability Testing on Biobased Lubricants and Base Fluids, M. Miller, p. 24	A Study of the Dynamic Properties of the Elastic Supports of an Air Journal Bearing, A. Paridie, p. 24
12:30 – 1 pm	Seals Business Meeting	Bio-Based and Biodegradable Base Oils for Environmentally Acceptable Lubricants (EALs), Z. Hunt, p. 24	Fluid Film Bearings Business Meeting
1 – 2 pm	**Networking Break**	**Networking Break**	**Networking Break**
	SESSION 2A **Engine & Drivetrain on Electric Vehicles I** **Virtual Meeting Room 1**	**SESSION 2B** **Environmentally Friendly Fluids II** **Virtual Meeting Room 2**	
2 – 2:30 pm	Test Rig to Investigate Function and Efficiency of the Speed 4E Hyper-High-Speed Electromechanical Powertrain, L. Pointner-Gabriel, p. 26	Latest in Biosynthetic Base Oils – Evaluating Estolide Performance Characteristics in Expanding Viscosity Ranges, M. Kriech, p. 26	
2:30 – 3 pm	Fluid Cooling Performance Understanding for Electric Drivetrain Applications, Y. Kwak, p. 26	Lubricity Behavior of HVOs, D. Halenahally p. 26	
3 – 4 pm	**Exhibitor Appreciation Hour**	**Exhibitor Appreciation Hour**	**Exhibitor Appreciation Hour**
4 – 4:30 pm	Lubricant & Greases Solutions for the Whole Electrical Vehicle Drivetrain Including the Thermal Management of Batteries, T. Murr, p. 26		
4:30 – 5 pm	Thermal Properties of Group V Base Fluids for Fast Charge Battery Cooling Applications, B. Warren, p. 26	EALs for Marine Vessel Stern Tubes – Not All Esters Are Equal, K. Duncan, p. 26	
5 – 5:30 pm	Prediction of Power Losses in Electric Vehicle Transmissions, A. Kadiric, p. 26	How Polyalkylene Glycols Save Energy in Industrial Gear Application – A Sustainability Case Study, T. Meyers, p. 28	
5:30 – 6 pm	Ultra-Low Viscosity Synthetic Fluids to Enhance Performance and Durability for Electric Vehicles (EVs), B. Lotfi, p. 26	Soy-Based Lubricants: Performance and Sustainability, R. Brentin, p. 28	
6 – 6:30 pm		Environmentally Friendly Fluids Business Meeting	

SESSION 1D Gears I Virtual Meeting Room 4	SESSION 1E Metalworking Fluids I Virtual Meeting Room 5	SESSION 1F Nanotribology I Virtual Meeting Room 6	
Permissible Water Content of Gear Lubricants Regarding the Pitting Performance of Case-Carburized Gears, N. Sagraloff, p. 24	IW5000, Oil-Free Aqueous AF/AW/EP Additive Based on IF-WS_2 Technology: Extending the Frontiers of Water-Based Lubrication Fluid Technologies, H. Kim, p. 25	Polymer Brushes on Gels: Imitating the Lubricious Properties of Cartilage, N. Spencer, p. 25	**10:30 – 11 am**
Approach for the Development of an Alternative Classification Method for Gear Oils for High-Loaded Hypoid Gears Comparable to API GL-5, A. Drechsel, p. 24	Cross-Functional Benefits of Metalworking Fluid Additives, M. Stapels, p. 25		**11 – 11:30 am**
The Effect of Surface Roughness and the Ratio on the Initiation and Progression of Micropitting Damage, B. Wainwright, p. 25	Improving and Expanding the Applicability of the ASTM D3233 Pin & Vee Block Method for Cutting Fluid Evaluation: Correlation with a Real Cutting Operation, D. Drees, p. 25	Formulation of Lubricant Additives Using AB Initio Computational Methods, C. Gattinoni, p. 25	**11:30 – Noon**
Gears Business Meeting	New Seal Compatibility Test Method for Metalworking Fluids, S. Baumgaertel, p. 25	Molecular Dynamics Simulations of Nanofluidics, M. Elewa, p. 25	**Noon – 12:30 pm**
	Consistently Beating the Odds – How to Build Successful Products, E. Schnellbacher, p. 25	Rheo-Tribological Analysis of Cellulose Nano-Crystalline (CNC) Aqueous Suspensions, B. Zakani, p. 25	**12:30 – 1 pm**
Networking Break	**Networking Break**	**Networking Break**	**1 – 2 pm**
SESSION 2D **Materials Tribology I** **Virtual Meeting Room 4**	**SESSION 2E** **Metalworking Fluids II** **Virtual Meeting Room 5**	**SESSION 2F** **Nanotribology II** **Virtual Meeting Room 6**	
The Effect of Hot Compaction on the Tribological Performance of the PDA+PTFE Nanocomposite Coatings, S. Ghosh, p. 28	Foam Control & Formulation Techniques to Minimize Foam in Water Dilutable MWFs, M. Miller, p. 28	Nanotribology and Nanorheology of Confined Ionic Liquids, R. Espinosa-Marzal, p. 28	**2 – 2:30 pm**
The Effect of Environmental Factors on the Tribological Behavior of PDA/PTFE + Graphite Particles Coating on 60NiTi, D. Choudhury, p. 28	Adenylate Energy Charge – New Tool for Determining Metalworking Fluid Microbial Population's Sublethal Response to Microbicide Treatment, F. Passman, p. 28	Eco-Friendly Aqueous EP Additive Based on IF-WS_2 / Polyalkylene Oxides Combi Technology: Structure-Property-Performance Relationship Beyond the Horizon in Lubricant Industry, H. Kim, p. 28	**2:30 – 3 pm**
Exhibitor Appreciation Hour	**Exhibitor Appreciation Hour**	**Exhibitor Appreciation Hour**	**3 – 4 pm**
Effect of Filler Mechanical Properties on Fluoropolymer Composite Wear, M. Sidebottom, p. 28	Reserving Metalworking Formulation Space for the Impossibilities, H. Potnis, p. 28	Reviewing the Performance of Permanently Suspended Nanocarbons in Lubricants, A. Darnell, p. 28	**4 – 4:30 pm**
Effect of Counterface and Filler Particle Properties on Wear Performance of Fluoropolymer Composites, S. Ullah, p. 28	Panel Discussion: Metalworking Fluids Hot Topics, N. Canter, Chemical Solutions, Willow Grove, PA, p. 28	The Electrical and Tribological Performance of Silver Nanoparticle Laden Lubricants in Comparison to a Conventional Product, L. Crilly, p. 30	**4:30 – 5 pm**
Ultralow Wear Self-Mated PTFE Composites, K. Van Meter, p. 28		High Temperature Nanomechanical & Nanotribological Behavior of Sub-5 nm Nitrogen-Doped Carbon Overcoat Films, A. Shakil, p. 30	**5 – 5:30 pm**
Leveraging Trace Nanofillers to Stabilize & Discretize Already Low Wear Polymer Interfaces, I. Alam, p. 28	Metalworking Fluids Business Meeting	PEO-Chameleon as a Potential Protective Coating for High-Temperature Applications, A. Shirani, p.30	**5:30 – 6 pm**
			6 – 6:30 pm

MONDAY >>

TIME	SESSION 1G Power Generation/Wind Turbine Tribology I Virtual Meeting Room 7	SESSION 1H Commercial Marketing Forum I Virtual Meeting Room 8	SESSION 1I Synthetic Lubricants & Hydraulics I Virtual Meeting Room 9
10:30 – 11 am	Environmentally Acceptable Lubricant (EAL) Novel Esters That Are Extremely Hydrolytic and Oxidation Stable, R. Navaratnam, p. 25	Latest Advances in **Bruker** TriboLab Lubricant Testing Platform, S. Papanicolaou, p. 26	Novel Base Oil Technologies for Industrial Gear Oils, J. Langston, p. 26
11 – 11:30 am	Efficiency and Lifetime Improvement for Wind Turbines by Using Silicon-Based Additive Technology, S. Bill, p. 25	**Pilot Chemical** Will FLIP The Way You Think About Metalworking Fluids, R. Harpum, p. 26	Could the Latest Oil Technology Give You Cleaner, Longer-Lasting and More Productive Hydraulic Systems?, S. Gullapalli, p. 26
11:30 – Noon	Bio-Based Ionic Liquid Lubricants for Wind Turbine Applications, Md H. Rahman, p. 25	**ExxonMobil Chemical** Next Generation PAOs to Improve Fuel Economy and Automotive Fluids Performance, M. Sheehan, p. 26	New Hydrolytic Stability Testing on Biobased Lubricants and Base Fluids, M. Lutz, p. 26
Noon – 12:30 pm	Developing Accelerated Benchtop Testing Methodologies for Grease Lubricated Main Bearing Contacts in Wind Turbines, B. Gould, p. 25	**Kao Chemicals** Performance Highlights and Regional Formulations, C. Broer, p. 26	
12:30 – 1 pm	Power Generation Business Meeting	**LANXESS** New Mobility – Additive Solutions for Gear Oils in Electric Vehicle Drivetrains, S. Sandhoefner, p. 26	
1 – 2 pm	Networking Break	Networking Break	Networking Break
	SESSION 2G **Power Generation/Wind Turbine Tribology II** **Virtual Meeting Room 7**	**SESSION 2I** **Commercial Marketing Forum II** **Virtual Meeting Room 8**	**SESSION 2J** **Synthetic Lubricants & Hydraulics II** **Virtual Meeting Room 9**
2 – 2:30 pm	Salvaging Poorly Stored Turbine Oil, N. Achebe, p. 30	**Biosynthetic Technologies:** Estolides, High Performance Sustainable Base Oils for Lubricant and Metalworking Formulations, M. Kriech, p. 30	Tribological Performance of Used and Artificially Altered Hydraulic Oils, N. Döerr, p. 30
2:30 – 3 pm	Ksp and Thermodynamic Considerations Relevant to Effective Varnish-Removal, M. Hobbs, p. 30	**The Lubrizol Corporation:** PIBSA Emulsifier Developments for Metalworking, G. Kirsch, p. 30	Critical Shear Rate of Polymer-Enhanced Hydraulic Fluids, P. Panwar, p. 30
3 – 4 pm	Exhibitor Appreciation Hour	Exhibitor Appreciation Hour	Exhibitor Appreciation Hour
4 – 4:30 pm	Wind Turbine Business Meeting	**Evonik Oil Additives:** Get Electrified with Evonik VISCOPLEX® and VISCOBASE® for E-Fluids, J. Mills, p. 30	Dynamometer Testing of Energy Efficient Hydraulic Fluids and Fuel Savings Analysis for US Army Construction and Material Handling Equipment, P. Michael, p. 30
4:30 – 5 pm		**BASF Corporation:** Emgard 7103 XFE Gear Lubricant – Fuel Economy Improvement Technology, D. Mosher, p. 30	Fluid Effects on Stick-Slip Friction in Hydraulic Cylinder Rod Seals, P. Michael, p. 30
5 – 5:30 pm		**LANXESS:** Thermal Fluids for EV Battery Immersion Cooling, T. Benanti, p. 30	Synthetic Lubricants and Hydraulics Business Meeting
5:30 – 6 pm			
6 – 6:30 pm			

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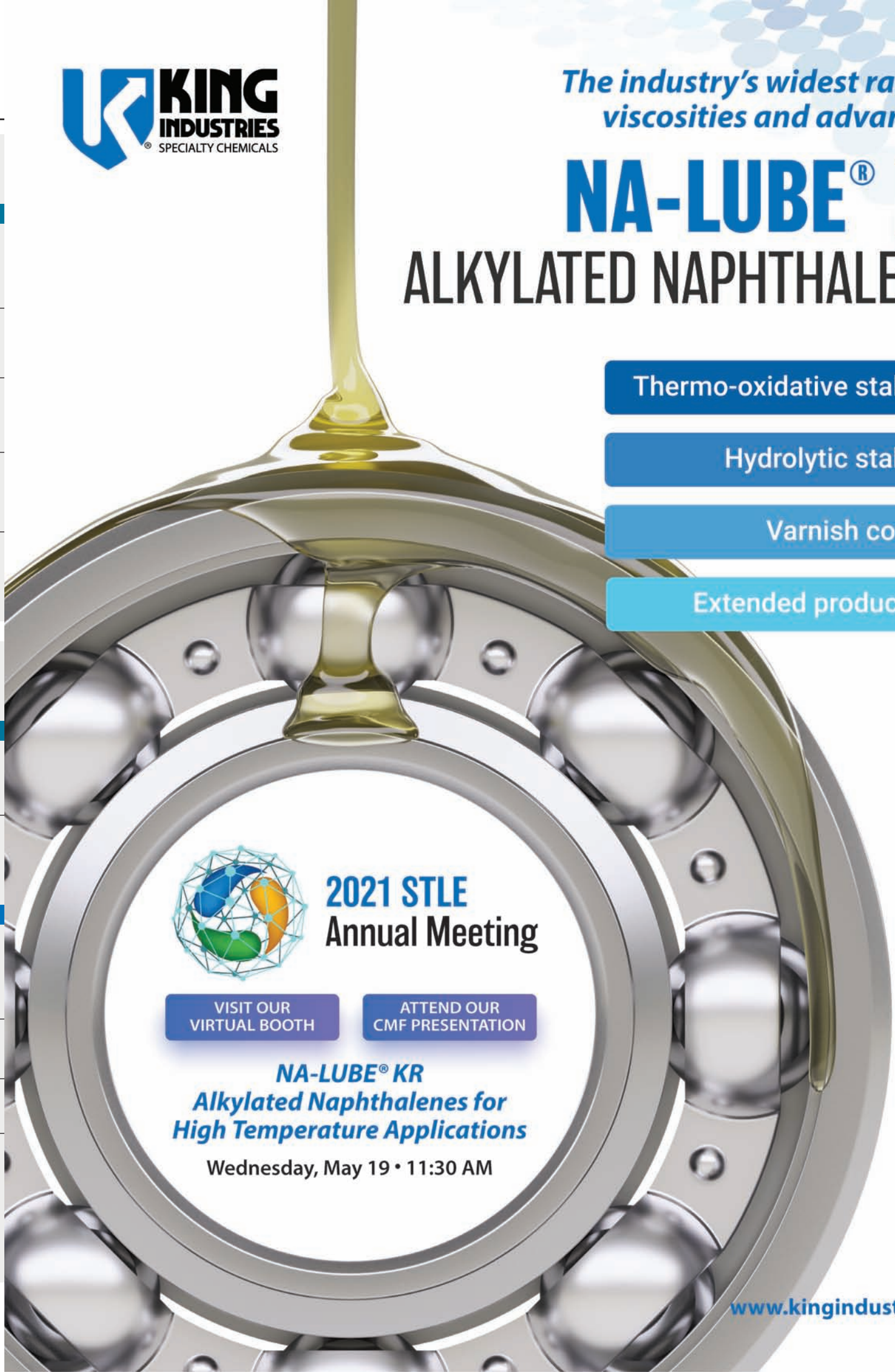

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1A • Virtual Meeting Room 1

SEALS I

Session Chair: Bo Tan, University of Kentucky, Lexington, KY

Session Vice Chair: Khalid Malik, Ontario Power Generation, Ajax, Ontario, Canada

10:30 – 11 am

3492008: On Surface Energy and Friction of Hydraulic Rod Seals

Oliver Feuchtmüller, Frank Bauer, Lothar Hörl, Universitat Stuttgart, Stuttgart, Germany

11 – 11:30 am

3499704: Advanced Sealing Concepts for Redox Flow Batteries

Detlef Jannes, Lothar Hörl, Frank Bauer, University of Stuttgart, Stuttgart, Germany

11:30 am – Noon

3476014: A Method of Direct Measurement of Mechanical Seal Wear In Pumps and Compressors

Mark Slivinski, Carbide Derivative Technologies, Tucson, AZ

Noon – 12:30 pm

3497118: Computational Fluid Dynamics Analysis and Experimental Results for the Dynamic Performance of Two Long Smooth Surface Annular Seals Operating with a Liquid in Air Mixture

Jing Yang, Dung Tran, Luis San Andres, Texas A&M University, College Station, TX

12:30 – 1 pm – Seals Business Meeting

1B • Virtual Meeting Room 2

ENVIRONMENTALLY FRIENDLY FLUIDS I

Session Chair: Brajendra Sharma, University of Illinois, Champaign, IL

Session Vice Chair: Selim Erhan, Oil Process Industries, Decatur, IL

10:30 – 11 am

3492300: Global Fluid Trends

Edward Jones, Hangsterfer's Labs. Inc., Mantua, NJ

11 – 11:30 am

3472961: EU Ecolabel for Lubricants – European Approach to Evaluate EALs

Salvatore Rea, Thomas Klein, Lanxess Solutions US, Inc., Shelton, CT

11:30 am – Noon

3499043: Sustainability in the Lubricants Industry

Inga Herrmann, VSI Verband Schmierstoff-Industrie e.V., Hamburg, Germany

Noon – 12:30 pm

3480821: New Hydrolytic Stability Testing on Biobased Lubricants and Base Fluids

Mark Miller, Biosynthetic Technologies, Indianapolis, IN

12:30 – 1 pm

3500611: Bio-Based and Biodegradable Base Oils for Environmentally Acceptable Lubricants (EALs)

Zach Hunt, Tetramer Technologies LLC, Pendleton, SC

1C • Virtual Meeting Room 3

FLUID FILM BEARINGS I

Session Chair: Bruce Fabijonas, Kingsbury, Inc., Philadelphia, PA

10:30 – 11 am

3559597: Influence of Journal Surface Scratch Characteristics on the Performance of a Two-Lobe Journal Bearing – Comparison Between Experimental Data and Numerical Results

Anh Vo, Jean Bouyer, Michel Fillon, Universite de Poitiers, Poitiers, Poitou-Charentes, France

11 – 11:30 am

3519704: Effect of Pad Fixations on the Tribological Performance of Parallel-Surface Fixed-Pad Thrust Bearings

Anastassios Charitopoulos, Michel Fillon, Institut Pprime, CNRS – University of Poitiers –ISAE- ENSMA, Chasseneuil, Nouvelle Aquitain, France; Christos Papadopoulos, Ethniko Metsobio Polytechneio, Zografou, Attica, Greece

11:30 am – Noon

3488092: Experimental Characterization of Hydrodynamic Bearing During Oil Flow Interruption Event

Lorenzo Naldi, Riccardo Ferraro, Baker Hughes Company, Firenze, Italy

Noon – 12:30 pm

3498814: A Study of the Dynamic Properties of the Elastic Supports of an Air Journal Bearing

Ahmed Paridie, Nicoleta Ene, The University of Toledo, Toledo, OH; Florin Dimofte, DiWave Technologies, Cleveland, OH

12:30 – 1 pm – Fluid Film Bearings Business Meeting

1D • Virtual Meeting Room 4

GEARS I

Session Chair: Jeffrey Ewin, NAVAIR, Patuxent River, MD

Session Vice Chair: Weixue Tian, ExxonMobil Research & Engineering, Annandale, NJ

10:30 – 11 am

3484437: Permissible Water Content of Gear Lubricants Regarding the Pitting Performance of Case-Carburized Gears

Nadine Sagraloff, Karsten Stahl, Gear Research Centre (FZG), Technical University of Munich (TUM), Garching, Germany; Christian Engelhardt, Patentanwälte von Bezold, Munich, Germany; Thomas Tobie

11 – 11:30 am

3484786: Approach for the Development of an Alternative Classification Method for Gear Oils for High-Loaded Hypoid Gears Comparable to API GL-5

Alexander Drechsel, Josef Pellkofer, Michael Hein, Karsten Stahl, Technische Universitat Munchen, Garching bei München, Germany

11:30 am – Noon

3498786: The Effect of Surface Roughness and the Λ Ratio on the Initiation and Progression of Micropitting Damage

Benjamin Wainwright, Amir Kadiric, Imperial College London, London, United Kingdom

Noon – 12:30 pm – Gears Technical Committee Business Meeting

1E • Virtual Meeting Room 5

METALWORKING FLUIDS I

Session Chair: Clayton Cooper, ANGUS Chemical Co, Buffalo Grove, IL

Session Vice Chair: Jennifer Lunn, JTM Products, Solon, OH

10:30 – 11 am

3480913: IW5000, Oil-Free Aqueous AF/AW/EP Additive Based on IF-WS_2 Technology: Extending the Frontiers of Water-Based Lubrication Fluid Technologies

Hoon Kim, George Diloyan, Rui Wu, Vasya Ignatyshyun, Nanotech Industrial Solutions, Avenel, NJ

11 – 11:30 am

3482901: Cross-Functional Benefits of Metalworking Fluid Additives

Michael Stapels, Kao Chemicals GmbH, Emmerich, Germany; Clayton Cooper, ANGUS Chemical Co., Buffalo Grove, IL

11:30 am – Noon

3484653: Improving and Expanding the Applicability of the ASTM D3233 Pin & Vee Block Method for Cutting Fluid Evaluation: Correlation with a Real Cutting Operation

Dirk Drees, Michel De Bilde, Emmanuel Georgiou, Falex Tribology NV, Rotselaar, Belgium

Noon – 12:30 pm

3493012: New Seal Compatibility Test Method for Metalworking Fluids

Stephan Baumgaertel, VSI Association German Lubricant Industry, Hamburg, Germany

12:30 – 1 pm

3499803: Consistently Beating the Odds – How to Build Successful Products

Emil Schnellbacher, Formulas & Solutions, LLC, Sterling Heights, MI

1F • Virtual Meeting Room 6

NANOTRIBOLOGY I

Session Chair: Nikolay Garabedian, University of Delaware, Newark, DE

Session Vice Chair: Prathima Nalam, SUNY University at Buffalo, Buffalo, NY

10:30 am – 11:30 am

INVITED TALK:

Polymer Brushes on Gels: Imitating the Lubricious Properties of Cartilage

Nicholas Spencer, ETH Zurich, Zurich, Switzerland

11:30 am – Noon

3499904: Formulation of Lubricant Additives Using AB Initio Computational Methods

Chiara Gattinoni, Eidgenossische Technische Hochschule Zurich, Zurich, Switzerland

Noon – 12:30 pm

3490400: Molecular Dynamics Simulations of Nanofluidics

Mohamed Elewa, Hannes Holey, Karlsruhe Institute of Technology, Karlsruhe, Germany; Lars Pastewka, University of Freiburg, Freiburg, Germany; Peter Gumbsch, Karlsruhe Institute of Technology, Karlsruhe, Germany

12:30 – 1 pm

3484404: Rheo-Tribological Analysis of Cellulose Nano-Crystalline (CNC) Aqueous Suspensions

Behzad Zakani, Sohrab Entezami, Dana Grecov, University of British Columbia, Vancouver, British Columbia, Canada

1G • Virtual Meeting Room 7

POWER GENERATION AND WIND TURBINE TRIBOLOGY I

Session Chair: Salvatore Rea, Lanxess Corp., Perkasie, PA

10:30 – 11 am

3483809: Environmentally Acceptable Lubricant (EAL) Novel Esters That Are Extremely Hydrolytic and Oxidation Stable

Ramesh Navaratnam, Patech Fine Chemical, Dublin, OH

11 – 11:30 am

3484486: Efficiency and Lifetime Improvement for Wind Turbines by Using Silicon-Based Additive Technology

Stefan Bill, Croda International PLC, Goole, East Yorkshire, United Kingdom

11:30 am – Noon

3485238: Bio-Based Ionic Liquid Lubricants for Wind Turbine Applications

Md Hafizur Rahman, Pradeep Menezes, University of Nevada Reno, Reno, NV; Manish Patel, NanoTech Industrial Solutions, Lake Charles, LA; Ashlie Martini, University of California, Merced, Merced, CA

Noon – 12:30 pm

3491278: Developing Accelerated Benchtop Testing Methodologies for Grease Lubricated Main Bearing Contacts in Wind Turbines

Benjamin Gould, Nicholaos Demas, Robert Erck, Aaron Greco, Argonne National Laboratory, Lemont, IL

12:30 – 1 pm – Power Generation Business Meeting

1H • Virtual Meeting Room 8

COMMERCIAL MARKETING FORUM I

10:30 – 11 am – Bruker
3578865: Latest Advances in Bruker TriboLab Lubricant Testing Platform
Steve Papanicolaou

11 – 11:30 am – Pilot Chemical
3566002: Pilot Chemical Will FLIP The Way You Think About Metalworking Fluids
Rob Harpum

11:30 am – Noon – ExxonMobil Chemical
3577801: Next Generation PAOs to Improve Fuel Economy and Automotive Fluids Performance
Michael Sheehan

Noon – 12:30 pm – Kao Chemicals
3577917: Performance Highlights and Regional Formulations
Cor Broer

12:30 – 1 pm – LANXESS
3578521: New Mobility – Additive Solutions for Gear Oils in Electric Vehicle Drivetrains
Steffen Sandhoefner

1I • Virtual Meeting Room 9

SYNTHETIC LUBRICANTS AND HYDRAULICS I

Session Chair: Ryan Fenton, BASF Corp., Tarrytown, NY

Session Vice Chair: Rob Davidson, Afton Chemical, Richmond, VA

10:30 – 11 am
3488536: Novel Base Oil Technologies for Industrial Gear Oils
Justin Langston, Gabriela Fedor, Thomas Schimmel, Evonik Oil Additives, Horsham, PA

11 – 11:30 am
3485682: Could the Latest Oil Technology Give You Cleaner, Longer-Lasting and More Productive Hydraulic Systems?
Sravani Gullapalli, Sameer Sathaye, Shell Global Solutions USA Inc., Houston, TX

11:30 am – Noon
3480820: New Hydrolytic Stability Testing on Biobased Lubricants and Base Fluids
Marlon Lutz, Biosynthetic Technologies, Indianapolis, IN

2A • Virtual Meeting Room 1

ENGINE AND DRIVETRAIN SESSION ON ELECTRIC VEHICLES I

Session Chair: Babak Lotfi, ExxonMobil, Houston, TX

2 – 2:30 pm
3480287: Test Rig to Investigate Function and Efficiency of the Speed 4E Hyper-High-Speed Electromechanical Powertrain
Lukas Pointner-Gabriel, Hermann Pflaum, Karsten Stahl, Technical University of Munich, Garching, Bavaria, Germany

2:30 – 3 pm
3505568: Fluid Cooling Performance Understanding for Electric Drivetrain Applications
Yungwan Kwak, Kun Liu, Afton Chemical Corp., Richmond, VA; Adam Banks, Afton Chemical Ltd., Bracknell, Bracknell Forest, United Kingdom

3 – 4 pm – Exhibitor Appreciation Hour

4 – 4:30 pm
3483132: Lubricant & Greases Solutions for the Whole Electrical Vehicle Drivetrain Including the Thermal Management of Batteries
Torsten Murr, Shell Global Solutions Germany, Hamburg, Hamburg, Germany

4:30 – 5 pm
3485393: Thermal Properties of Group V Base Fluids for Fast Charge Battery Cooling Applications
Bethan Warren, Croda International PLC, Goole, East Yorkshire, United Kingdom

5 – 5:30 pm
3517639: Prediction of Power Losses in Electric Vehicle Transmissions
Amir Kadiric, Joseph Shore, Imperial College London, London, United Kingdom

5:30 – 6 pm
3490846: Ultra-Low Viscosity Synthetic Fluids to Enhance Performance and Durability for Electric Vehicles (EVs)
Babak Lotfi, ExxonMobil, Houston, TX

2B • Virtual Meeting Room 2

ENVIRONMENTALLY FRIENDLY FLUIDS II

Session Chair: Daniel Garbark, Battelle, Columbus, OH

Session Vice Chair: Brajendra Sharma, University of Illinois, Champaign, IL

2 – 2:30 pm
3480823: Latest in Biosynthetic Base Oils – Evaluating Estolide Performance Characteristics in Expanding Viscosity Ranges
Matthew Kriech, Biosynthetic Technologies, Indianapolis, IN

2:30 – 3 pm
3497856: Lubricity Behavior of HVOs
Deepak Halenahally Veeregowda, Angela Maria Tortora, Ducom Instruments, Groningen, Netherlands

3 – 4 pm – Exhibitor Appreciation Hour

4:30 – 5 pm
3484497: EALs for Marine Vessel Stern Tubes – Not All Esters Are Equal
Kevin Duncan, Croda International PLC, Goole, East Yorkshire, United Kingdom

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2B | Friendly Fluids II (con't)

5 – 5:30 pm
3485148: How Polyalkylene Glycols Save Energy in Industrial Gear Application – A Sustainability Case Study
Tiffany Meyers, Andy Michael, Clariant, Mount Holly, NC

5:30 – 6 pm
3484505: Soy-Based Lubricants: Performance and Sustainability
Robert Brentin, Omni Tech International, Midland, MI

6 – 6:30 pm – Environmentally Friendly Fluids Business Meeting

2D • Virtual Meeting Room 4
MATERIALS TRIBOLOGY I: POLYMERS

Session Chair: Istiaque Alam, University of Delaware, Newark, DE

Session Vice Chair: Sifat Ullah, Miami University, Oxford, OH

2 – 2:30 pm
3499517: The Effect of Hot Compaction on the Tribological Performance of the PDA+PTFE Nanocomposite Coatings
Sujan Ghosh, Min Zou, Nathaniel Harris, University of Arkansas, Fayetteville, AR; Samuel Beckford, Neda Mahmoudi, SurfTec LLC, Fayetteville, AR

2:30 – 3 pm
3499239: The Effect of Environmental Factors on the Tribological Behavior of PDA/PTFE + Graphite Particles Coating on 60NiTi
Dipankar Choudhury, Min Zou, University of Arkansas, Fayetteville, AR

3 – 4 pm – Exhibitor Appreciation Hour

4 – 4:30 pm
3522263: Effect of Filler Mechanical Properties on Fluoropolymer Composite Wear
Mark Sidebottom, Sifat Ullah, Miami University, Oxford, OH; Nathan Heckman, Brad Boyce, Los Alamos National Labs, Albuquerque, NM; Tomas Babuska, Lehigh University, Bethlehem, PA; Brandon Krick, Florida State University, Tallahassee, FL

4:30 – 5 pm
3522247: Effect of Counterface and Filler Particle Properties on Wear Performance of Fluoropolymer Composites
Sifat Ullah, Mark Sidebottom, Miami University, Oxford, OH

5 – 5:30 pm
3501523: Ultralow Wear Self-Mated PTFE Composites
Kylie Van Meter, Tomas Babuska, Brandon Krick, Florida State University, Tallahassee, FL; Kasey Campbell, Lehigh University, Bethlehem, PA

5:30 – 6 pm
3501937: Leveraging Trace Nanofillers to Stabilize & Discretize Already Low Wear Polymer Interfaces
Istiaque Alam, David Burris, University of Delaware, Newark, DE

2E • Virtual Meeting Room 5
METALWORKING FLUIDS II

Session Chair: Alexes Morgan, Sea-Land Chemical Co., Westlake, OH

Session Vice Chair: Ron Lemke, Italmatch Chemicals, Custer Park, IL

2 – 2:30 pm
3475838: Foam Control & Formulation Techniques to Minimize Foam in Water Dilutable MWFs
Michael Miller, Univar Solutions, Houston, TX

2:30 – 3 pm
3473238: Adenylate Energy Charge – New Tool for Determining Metalworking Fluid Microbial Population's Sublethal Response to Microbicide Treatment
Frederick Passman, Biodeterioration Control Associates, Inc., Princeton, NJ; Peter Küenzi, Blaser Swisslube AG, Hasle-Ruegsau, Bern, Switzerland; Jordan Schmidt, LuminUltra Technologies, Ltd., Fredericton, New Brunswick, Canada

3 – 4 pm – Exhibitor Appreciation Hour

4 – 4:30 pm
3481361: Reserving Metalworking Formulation Space for the Impossibilities
Harish Potnis, Angus Chemical Company, Mumbai, Mahararashtra, India

4:30 – 5:30 pm
PANEL DISCUSSION:
3575513: Metalworking Fluids Hot Topics
Neil Canter, Chemical Solutions, Willow Grove, PA

5:30 – 6 pm – Metalworking Fluids Business Meeting

2F • Virtual Meeting Room 6
NANOTRIBOLOGY II

Session Chair: Mehmet Baykara, UC Merced, Merced, CA

2 – 2:30 pm
3507286: Nanotribology and Nanorheology of Confined Ionic Liquids
Rosa Espinosa-Marzal, Mengwei Han, University of Illinois at Urbana-Champaign, Urbana, IL

2:30 – 3 pm
3484465: Eco-Friendly Aqueous EP Additive Based on IF-WS_2 / Polyalkylene Oxides Combi Technology: Structure-Property-Performance Relationship Beyond the Horizon in Lubricant Industry
Hoon Kim, George Diloyan, Rui Wu, Vasya Ignatyshyun, Nanotech Industrial Solutions, Avenel, NJ

3 – 4 pm – Exhibitor Appreciation Hour

4 – 4:30 pm
3485187: Reviewing the Performance of Permanently Suspended Nanocarbons in Lubricants
Aaron Darnell, Lubrication Specialties, Inc., Mount Gilead, OH

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Session: Metalworking Fluids I
Title: Cross Functional Benefits of Metalworking Fluid Additives
From 10:30 to 11:00 AM (EST)

Session: Commercial Marketing Forum
Title: Kao performance highlights and regional formulations
From 12:00 to 12:30 PM (EST)

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INDUSTRIAL FLUIDS & LUBRICANT

2F | Nanotribology II (con't)

4:30 – 5 pm
3485307: The Electrical and Tribological Performance of Silver Nanoparticle Laden Lubricants in Comparison to a Conventional Product
Larkin Crilly, Robert Jackson, Samuel Bond, German Mills, Auburn University, Auburn, AL; Suvrat Bhargava, TE Connectivity Ltd Berwyn, Middletown, PA

5 – 5:30 pm
3485451: High Temperature Nanomechanical and Nanotribological Behavior of Sub-5 nm Nitrogen-Doped Carbon Overcoat Films
Ahmad Shakil, Andreas Polycarpou, Texas A&M University College Station, College Station, TX

5:30 – 6 pm
3498186: PEO-Chameleon as a Potential Protective Coating for High-Temperature Applications
Asghar Shirani, Samir Aouadi, Andrey Voevodin, Diana Berman, University of North Texas, Denton, TX; Aleksey Yerokhin, University of Manchester, Manchester, United Kingdom; Andras Korenyi-Both, Tribologix Inc., Golden, CO

2G • Virtual Meeting Room 7
POWER GENERATION AND WIND TURBINE TRIBOLOGY II

Session Chair: Salvatore Rea, Lanxess Corp, Perkasie, PA

2 – 2:30 pm
3474239: Salvaging Poorly Stored Turbine Oil
Nnamdi Achebe, Petrosave Integrated Services Ltd., Amuwo-Odofi, Nigeria

2:30 – 3 pm
3491891: Ksp and Thermodynamic Considerations Relevant to Effective Varnish-Removal
Matthew Hobbs, Peter Dufresne, EPT, Calgary, Alberta, Canada

3 – 4 pm – Exhibitor Appreciation Hour

4 – 4:30 pm – Wind Turbine Business Meeting

2I • Virtual Meeting Room 8
COMMERCIAL MARKETING FORUM II

2 – 2:30 pm – Biosynthetic Technologies
3566322: Estolides, High Performance Sustainable Base Oils for Lubricant and Metalworking Formulations
Matthew Kriech

2:30 – 3 pm – The Lubrizol Corporation
3578465: Lubrizol's PIBSA Emulsifier Developments for Metalworking
Gabriel Kirsch

3 – 4 pm – Exhibitor Appreciation Hour

4 – 4:30 pm – Evonik Oil Additives
3572948: Get Electrified with Evonik VISCOPLEX® and VISCOBASE® for E-Fluids
Justin Mills

4:30 – 5 pm – BASF Corporation
3578953: BASF Emgard 7103 XFE Gear Lubricant – Fuel Economy Improvement Technology
Donna Mosher

5 – 5:30 pm – LANXESS
3576222: Thermal Fluids for EV Battery Immersion Cooling
Travis Benanti

2J • Virtual Meeting Room 9
SYNTHETIC LUBRICANTS AND HYDRAULICS II

Session Chair: Ryan Fenton, BASF Corp., Tarrytown, NY

Session Vice Chair: Rob Davidson, Afton Chemical, Richmond, VA

2 – 2:30 pm
3485572: Tribological Performance of Used and Artificially Altered Hydraulic Oils
Nicole Döerr, Serhiy Budnyk, AC2T research GmbH, Wiener Neustadt, Austria; Daria Kolbas, Oksana Elagina, Gubkin Russian State University of Oil and Gas, Moscow, Russian Federation; Ameneh Schneider, Optimol Instruments Prueftechnik GmbH, Munich, Germany; Franz Novotny-Farkas, Ingenieurbuero fuer Erdoelwesen, Schwechat, Austria

2:30 – 3 pm
3490868: Critical Shear Rate of Polymer-Enhanced Hydraulic Fluids
Pawan Panwar, Ashlie Martini, University of California Merced, Merced, CA; Paul Michael, Milwaukee School of Engineering, Milwaukee, WI; Mark Devlin, Afton Chemical Corp, Richmond, VA

3 – 4 pm – Exhibitor Appreciation Hour

4 – 4:30 pm
3498720: Dynamometer Testing of Energy Efficient Hydraulic Fluids and Fuel Savings Analysis for US Army Construction and Material Handling Equipment
Paul Michael, Milwaukee School of Engineering, Milwaukee, WI; Jill Bramer, Eric Sattler, US Army CCDC Ground Vehicle Systems Center, Warren, MI

4:30 – 5 pm
3483443: Fluid Effects on Stick-Slip Friction in Hydraulic Cylinder Rod Seals
Paul Michael, Milwaukee School of Engineering, Milwaukee, WI; Oluwaseyi Ogunsola, Shell Technology Center, Houston, TX

5 – 5:30 pm – Synthetic Lubricants and Hydraulics Business Meeting

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For the first time, the trend-setting event in Europe in the fields of lubrication, maintenance and condition monitoring is taking place in June 8-10, 2021, summer-time in the Bavarian mountains!

OilDoc hopes to welcome as many visitors as possible face-to-face in our venue in Rosenheim (near Munich), but you will also get the possibility to take part virtual: We will digitally stream all live presentations and the event atmosphere directly to your workplace!

However and regardless of the type of participation: The programme committee has compiled an outstanding program with 60+ presentations, workshops and excursions.

Check out the program, register now & safe your Early Bird Discount!

Please note: It is possible to transfer a in-person registration into a virtual registration at any time (and reverse). The difference in the fee will be refunded. A substitute participant can also be named at any time.

Topics

- Condition Monitoring & Maintenance 4.0
- Fluid Condition Monitoring – Online • On-Site • Offline
- Asset & Fluid Management – Innovative & Sustainable
- Lubricants – (Bio) Base oils • Additives • Engine & Hydraulic
- E-Drive Lubrication – Developments & opportunities
- Metal working and forming lubrication
- Oil Care & Filtration

Excellent networking opportunities
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Conference language: English

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Overview

Tuesday, May 18, 2021

8:30 – 10 am
Tuesday Keynote Session

Keynote Speaker:

- Dr. Melissa Orme, Vice President, Boeing Additive Manufacturing

10 – 10:30 am
Networking Break & Special Programming

10 am – 3:30 pm
Virtual Exhibits and Student Posters

10:30 am – 1 pm
Tuesday Technical Sessions:

- 3A – Condition Monitoring I
- 3B – Lab to Field: Bridging the Gap Between Bench and Engine: Engine & Drivetrain & Lubrication Fundamentals Joint Session I
- 3C – Nonferrous Metals I
- 3D – Materials Tribology II
- 3E – Metalworking Fluids III
- 3F – Nanotribology III
- 3G – Rolling Element Bearings I
- 3H – Lubrication Fundamentals I: Non-Tribological Oil Properties
- 3I – Commercial Marketing Forum III

1 – 2 pm
STLE Virtual Business Meeting

2 – 6 pm
Tuesday Technical Sessions:

- 4A – Condition Monitoring II
- 4B – Additive Manufacturing I: Special Symposium
- 4C – Nonferrous Metals II: Tribology and Biobased Session in Memory of Dr. Girma Biresaw
- 4D – Materials Tribology III
- 4E – Metalworking Fluids IV
- 4F – Nanotribology IV
- 4G – Rolling Element Bearings II
- 4H – 2D Materials/Superlubricity: Material Tribology & Nanotribology Joint Session I
- 4I – Commercial Marketing Forum IV

3 – 3:30 pm
Networking Break & Exhibitor Appreciation

Trade Show Hours:

- Monday, May 17: 10 am – 4 pm
- Tuesday, May 18: 10 am – 3:30 pm
- Wednesday, May 19: 10 am – 3:30 pm
- Thursday, May 20: 10 am – 3:30 pm

(All times listed are Eastern Daylight Time)

TIME	SESSION 3A Condition Monitoring I Virtual Meeting Room 1	SESSION 3B Engine/Drivetrain/Lubrication Fundamentals Virtual Meeting Room 2	SESSION 3C Nonferrous Metals I Virtual Meeting Room 3
10:30 – 11 am	Monitoring of EGR Diesel Engines Lubricant: Should the Nitration be Considered?, J. Fotue, p. 36	Correlation of Engine Oil Degradation in Large Scale Alteration Device and Engine Test Rig, N. Doerr, p. 36	A Non-Ferrous Study Investigating the Lubricity and Film Thickness Behavior of Rolling Oils Containing Mixed Ester Packages on Varying Grades of Aluminum, E. Pates, p. 36
11 – 11:30 am	Laboratory Aging of Ester Oils and Its Effect on Friction and Wear, D. Patro, p. 36	Piston Ring Coating Development – From Bench to Vehicle, P. Lee, p. 36	Metal Corrosion: Looking Farther Than the Eye Can See, C. Cooper, p. 36
11:30 – Noon	Diagnosing the Root Cause of an Overheated Gearbox, E. Zabawski, p. 36	Cavitation Initiation and Patterns in Engine Lubricants as a Result of Different Operating Conditions and Lubricant Properties, P. Dellis, p. 36	Nuclear Magnetic Resonance Spectroscopy as a Useful Tool for Routinely Analyzing the Composition of Aluminum Hot Rolling Emulsions, J. Leimhofer, p. 36
Noon – 12:30 pm	Product Quality Maintenance & Reliability in the Lubricant Supply Chain, M. Roe, p. 36	Low Friction Powertrains: Current Advances in Lubricants and Coatings, B. Zhmud, p. 36	Lubricant Additive Response Comparisons in a Commercial Post Lubricant on 3104 Aluminum D&I Can Stock Using Twist Compression Tests (TCT), T. McClure, p. 36
12:30 – 1 pm		Cooperativity Between Zirconium Dioxide Nanoparticles and Extreme Pressure Additives in Forming Protective Tribofilms: Toward Enabling Low Viscosity Lubricants, R. Carpick, p. 36	Tramp Oils – What Are They and How Do They Effect a Hot Rolling Emulsion?, A. Knopp, p. 36
1 – 2 pm	STLE Virtual Business Meeting	STLE Virtual Business Meeting	STLE Virtual Business Meeting
	SESSION 4A **Condition Monitoring II** **Virtual Meeting Room 1**	**SESSION 4B** **Additive Manufacturing I** **Virtual Meeting Room 2**	**SESSION 4C** **Nonferrous Metals II** **Virtual Meeting Room 3**
2 – 2:30 pm	Fluid Analysis in Condition-Based Monitoring and Reliability, J. Acosta, p. 42	Wear and Friction of Additively Manufactured Stainless Steel Materials, R. Jackson, p. 42	Correlation Between Microscopic Surface Damage and Frictional Behavior of Lubricants for Stamping Automotive Aluminum Sheet Products, M. Shafiei, p. 42
2:30 – 3 pm	Fast and Reliable Quality Control of Fresh and In-Service Lubricants by FT-MidIR Spectrometry, A. Mendez, p. 42	Tribological and Mechanical Properties of High Entropy Alloys, M. Jones, p. 42	Filtration of Rolling Fluids, C. Thomas, p. 42
3 – 3:30 pm	Networking Break	Networking Break	Networking Break
3:30 – 4 pm	Analysis of Metal Additives and Wear Metals in Lubricants by High-Resolution ICP-OES, O. Buettel, p. 42	Surface Texture Characterization of Metal Selective Laser Melted Part with Varying Surface Inclinations, S. Lou, p. 42	Biobased Disulfide Additive Based on Soybean Oil, G. Bantchev, p. 42
4 – 4:30 pm	Diagnosing Improper Bearing Lubrication Using Oil Analysis, E. Zabawski, p. 42	Tribological Effects of Surface Textures on the Sliding Behavior of Short Carbon Fiber Reinforced Nylon Composites Fabricated by 3D Printing Techniques, L. Chang, p. 42	Vegetable Oils for Metalworking Lubricants: Physico-Chemical and Stability Aspects of Different Options, J. Pattathilchira Varghese, p. 42
4:30 – 5 pm	Condition Monitoring Business Meeting	Fabrication and Testing of Bioinspired Surface Designs for Friction Reduction at the Piston Ring and Liner Interface, S. Maddox, p. 42	Nonferrous Metals Business Meeting
5 – 5:30 pm		Designing a Bioinspired Surface for Improved Wear Resistance and Friction Reduction, J. Hoskins, p. 42	

SESSION 3D Materials Tribology II	SESSION 3E Metalworking Fluids III	SESSION 3F Nanotribology III	
Virtual Meeting Room 4	**Virtual Meeting Room 5**	**Virtual Meeting Room 6**	
Data Science Techniques Applied to In Situ XRD Measurements of Copper Under Tribological Load, N. Garabedian, p. 38	Model MWFs Based on Naphthenic Base Oils – Straight Cut or Blend?, T. Norrby, p. 38	Mechanical Dissipation of Energy: From Breaking of Bonds to the Release of Adhesive Contacts, L. Pastewka, p. 38	**10:30 – 11 am**
Extreme Environment Tribological Study of Advanced Bearing Polymers for Space Applications, K. Bashandeh, p. 38	Novel Self Emulsifiable Esters for High Lubricity and Low Foam MWFs, R. Hoogendoorn, p. 38		**11 – 11:30 am**
Reduced Cost NiTi-Alloy Bearings Made via Near Net Shape Powder Metallurgy Processes, C. DellaCorte, p. 38	A New Method to Simulate Strip Drawing Tests on the Lab-Scale, D. Drees, p. 38	Tribological Experiments in the Age of Big Data, N. Garabedian, p. 38	**11:30 – Noon**
Ultralow Wear Plasma Enhanced Atomic Layer Deposited Nitrides: Exploring Processing, Structure, Properties and Mechanisms at Multiple Scales, T. Grejtak, p. 38	Surface Behavior and Lubricative Properties of Hydroxyproline Rich, Natural Proteins in Metalworking Fluids, E. Yezdimer, p. 38	Isopropanol Vapor Phase Lubrication of Multi-Asperity Interfaces: The Role of Capillarity and Boundary Lubrication, B. Weber, p. 38	**Noon – 12:30 pm**
Origin of Self-Healing in Dynamic Crosslinked Polymers: Experiments and Simulations, Z. Ye, p. 38	Tribological Study of Materials for Effective Cutting Tool Life, C. Sanchez, p. 38	Tribological Performance of Piston Compression Ring in Artificial Intelligence-Based Design Green Lubricant During Cold Start-up, S. Imran, p. 38	**12:30 – 1 pm**
STLE Virtual Business Meeting	**STLE Virtual Business Meeting**	**STLE Virtual Business Meeting**	**1 – 2 pm**

SESSION 4D Materials Tribology III	SESSION 4E Metalworking Fluids IV	SESSION 4F Nanotribology IV	
Virtual Meeting Room 4	**Virtual Meeting Room 5**	**Virtual Meeting Room 6**	
Method for Tribological Experiment to Study Scuffing Instigation on AISI 52100 Steel and Hard Ceramic Coatings, K. Jacques, p.44	The Future of Metalworking Fluids: It's Biobased!, J. Mackey, p. 44	MD Study of Adhesion Between a Si Tip and Si Substrate During Indentation and Sliding, J. Harrison, p. 44	**2 – 2:30 pm**
Tribological Behavior of Textured Polymer Surfaces, M. Hossain, p. 44	New Solution for Aluminum Machining with Synthetic Fluids, M. Ponsardin, p. 44	Interfacial Interactions and Tribological Behavior of Metal-Oxide/2D-Material Contacts, T. Filleter, p. 44	**2:30 – 3 pm**
Networking Break	**Networking Break**	**Networking Break**	**3 – 3:30 pm**
Determination of Scuffing and Wear of Materials in Low-Lubricity Fuels, S. Berkebile, p. 44	Measuring Tapping Performance Parameters – Using Tapping Torque to Evaluate Coolants and Coolant Additives, M. Miller, p. 44	Structure, Solvation and Friction of Cyclic-Hydrocarbons Confined at Graphitic Interface, B. Sattari Baboukani, p. 44	**3:30 – 4 pm**
Paleo-Tribology: Inspiration from Fossil Grinding Dentitions – From Wear Models to Damage Tolerant Composites, T. Grejtak, p. 44	Polyglykol as Performance Wear Lubricant and Synergism with Extreme Pressure Additives on Net Oil Metalworking Fluid, E. Lima, p. 44	Nanoparticle Sintered Tribofilm Removal Study: An Experimental Approach, S. Thrush, p. 46	**4 – 4:30 pm**
A Novel Method to Assess Conventional Tribological Properties of Hard Coatings by Pin-On-Disc Testing, E. Goti, p. 44	Multiple Light Scattering for Physical Stability Analysis of Concentrated Dispersions, G. Irvine, p. 44	In Situ SEM Nanomechanical Characterization of Tribofilms Derived from Inorganic Nanoparticles, K. Farokhzadeh, p. 46	**4:30 – 5 pm**
Materials Tribology Business Meeting	Preview of the Metalworking Fluids (MWF) 105 Education Course, P. Kuenzi, p. 44	Nanotribology Business Meeting	**5 – 5:30 pm**

TUESDAY >>

TIME	SESSION 3G Rolling Element Bearings I Virtual Meeting Room 7	SESSION 3H Lubrication Fundamentals I Virtual Meeting Room 8	SESSION 3I Commercial Marketing Forum III Virtual Meeting Room 9
10:30 – 11 am	Contact Protection by Grease in Aeronautical Heavily Charged Oscillating Bearings, L. Frache, p. 40	Analytical Approaches to Chemical Structure and Physical Property Measurements of Lubricant Oils, E. Riches, p. 40	**BASF Corporation:** IRGAPAC® T 1668 M – New Premium Turbine Package Meeting MP Specifications, A. Mannion, p. 40
11 – 11:30 am	Film Thickness and Starvation in Grease Lubricated Bearings, P. Lugt, p. 40	Practical Considerations for the Development of Amine and Phenol Synergies, J. Dong, p. 40	**Evonik Oil Additives:** Life Cycle Analysis of an Efficient Hydraulic Fluid, T. Krapfl, p. 40
11:30 – Noon	Friction-Based Calibration of Raceway and Flange Lubrication Models for Railway Bearing Performance Prediction, A. Ruellan, p. 40	Oxidative Stability of Estolides, T. Thompson, p. 40	**Münzing:** Effects of Filtration on Münzing Defoamer Performance in Aqueous Metal Removal Fluids, J. Sullivan, p. 40
Noon – 12:30 pm	Wear Development Due to Oscillating Movement Operating Conditions as Employed in Rotor Blade Bearings in Wind Turbines, S. Wandel, p. 40	Modeling Thermal Conductivity of Lubricants, J. Ahmed, p. 40	**Colonial Chemical:** High-performance Corrosion Inhibitors for Aluminum and Its Alloys, S. Tang, p. 40
12:30 – 1 pm	Transient Finite Element Simulation of Bearing Surface Damage Due to Oscillating Motion with Consideration of Mixed Lubrication Conditions, J. Hwang, p. 40	Mechanistic Insights into Lubricant Foaming and Foam Control Utilizing Single Bubble Techniques, V. Chandran Suja, p. 40	**Evonik Oil Additives:** High VI 0W-16 and 0W-20 Engine Oils using Evonik's VISCOPLEX® Viscosity Index Improvers – The Optimal Choice for Hybrid Electric Vehicles, P. Moore, p. 40
1 – 2 pm	**STLE Virtual Business Meeting**	**STLE Virtual Business Meeting**	**STLE Virtual Business Meeting**
	SESSION 4G **Rolling Element Bearings II** **Virtual Meeting Room 7**	**SESSION 4H** **2D Materials/Superlubricity I** **Virtual Meeting Room 8**	**SESSION 4I** **Commercial Marketing Forum IV** **Virtual Meeting Room 9**
2 – 2:30 pm	The Next Generation Aircraft Engine High Speed Bearing, P. Glöckner, p. 46	Mechanical and Tribological Properties of MXene Nano-Sheets, B. Zhang, p. 46	**Afton Chemical's** Key Driver Seminar IIoT Technologies Leading to Engaged, Optimized and Profitable Customer Relationships, S. Steen, p. 46
2:30 – 3 pm	Innovative Bearing Solutions for E-Mobility Applications, J. Modi, p. 46	Wear Life of Ni-doped MoS_2 Dry Film Lubricants for Space Applications, A. Vellore, p. 46	
3 – 3:30 pm	**Networking Break**	**Networking Break**	**Networking Break**
3:30 – 4 pm	An Investigation of the Effects of Surface Roughness on Rolling Contact Fatigue, S. Lorenz, p. 46	Probing the Influence of Water and Oxygen on the Friction and Wear of MoS_2, T. Babuska, p. 46	**Sea-Land Chemical** Company Update, P. Pendergast, p. 46
4 – 4:30 pm	Tribological and Tribochemical Evaluation of Various Lubricants on Steel as well as WC-DLC Coating under Extreme-Pressure Boundary Lubrication Conditions: Rig Test, K. Mistry, p. 46	Robust Solid Lubricant Operable in Multifarious Environments, A. Ayyagari, p. 46	**The Lubrizol Corporation:** Reduce, Renew, Regenerate: Sustainability of Industrial Lubricants, S. Basu, p. 46
4:30 – 5 pm		Achieving Direct Macroscale Liquid Superlubricity Under Boundary and Mixed Lubrication, Q. Ma, p. 46	
5 – 5:30 pm		Super Lubricity of Solids from Quantum Mechanics, B. Zhang, p. 46	**TestOil:** Visual Cues of Lubrication & Reliability Programs with TestOil PRO, H. Vercillo, p. 46

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2021 STLE Virtual Annual Meeting & Exhibition

TECHNICAL SESSIONS | Tuesday, May 18, 2021

3A • Virtual Meeting Room 1

CONDITION MONITORING I

Session Chair: Michael Plumley, U.S. Coast Guard Academy, New London, CT

10:30 – 11 am

3533615: Monitoring of EGR Diesel Engines Lubricant: Should the Nitration be Considered?

Joseph Fotue, TOTAL Cameroon, Douala, Cameroon

11 – 11:30 am

3499071: Laboratory Aging of Ester Oils and Its Effect on Friction and Wear

Debdutt Patro, Fabio Alemanno, Deepak Halenahally Veeregowda, Ducom Instruments, Groningen, Netherlands

11:30 am – Noon

3500168: Diagnosing the Root Cause of an Overheated Gearbox

Evan Zabawski, TestOil, Strongsville, OH

Noon – 12:30 pm

3472067: Product Quality Maintenance & Reliability in the Lubricant Supply Chain

Michael Roe, MJR Lubricant Distribution Consulting & Auditing, Cypress, TX

3B • Virtual Meeting Room 2

LAB TO FIELD: BRIDGING THE GAP BETWEEN BENCH AND ENGINE

Engine and Drivetrain and Lubrication Fundamentals Joint Session I

Session Chair: Babak Lotfi, ExxonMobil, Houston, TX

10:30 – 11 am

3485580: Correlation of Engine Oil Degradation in Large Scale Alteration Device and Engine Test Rig

Nicole Doerr, Adam Agocs, Serhiy Budnyk, Andjelka Ristic, Marcella Frauscher, AC2T research GmbH, Wiener Neustadt, Austria

11 – 11:30 am

3498159: Piston Ring Coating Development – From Bench to Vehicle

Peter Lee, Southwest Research Institute, San Antonio, TX

11:30 am – Noon

3471731: Cavitation Initiation and Patterns in Engine Lubricants as a Result of Different Operating Conditions and Lubricant Properties

Polychronis Dellis, ASPETE, Athens, Attiki, Greece

Noon – 12:30 pm

3495414: Low Friction Powertrains: Current Advances in Lubricants and Coatings

Boris Zhmud, BIZOL Germany GmbH, Berlin, Germany; Peter Lee, Southwest Research Institute, San Antonio, TX

12:30 – 1 pm

3499242: Cooperativity Between Zirconium Dioxide Nanoparticles and Extreme Pressure Additives in Forming Protective Tribofilms: Toward Enabling Low Viscosity Lubricants

Robert Carpick, Meagan Elinski, Parker LaMascus, Andrew Jackson, University of Pennsylvania, Philadelphia, PA; Lei Zhang, Robert Wiacek, Pixelligent, Baltimore, MD

3C • Virtual Meeting Room 3

NONFERROUS METALS I

Session Chair: Ariane Viat, Constellium Technology Center, Saint Egreve, France

10:30 – 11 am

3484255: A Non-Ferrous Study Investigating the Lubricity and Film Thickness Behavior of Rolling Oils Containing Mixed Ester Packages on Varying Grades of Aluminum

Emma Pates, Stephen Chestnutt, Total UK Ltd., Manchester, United Kingdom; Annie King, Total Specialties USA, Inc., Houston, TX

11 – 11:30 am

3480774: Metal Corrosion: Looking Farther Than the Eye Can See

Clayton Cooper, ANGUS Chemical Co., Buffalo Grove, IL

11:30 am – Noon

3489606: Nuclear Magnetic Resonance Spectroscopy as a Useful Tool for Routinely Analyzing the Composition of Aluminum Hot Rolling Emulsions

Josef Leimhofer, AMAG Rolling GmbH, Ranshofen, Austria

Noon – 12:30 pm

3499533: Lubricant Additive Response Comparisons in a Commercial Post Lubricant on 3104 Aluminum D&I Can Stock Using Twist Compression Tests (TCT)

Ted McClure, Sea-Land Chemical Co./SLC Testing Services, Westlake, OH

12:30 – 1 pm

3497932: Tramp Oils – What Are They and How Do They Effect a Hot Rolling Emulsion?

Andrea Knopp, Constellium, Ravenswood, WV

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3D • Virtual Meeting Room 4
MATERIALS TRIBOLOGY II

Session Chair: Morgan Jones, Sandia National Laboratories Albuquerque, NM

Session Vice Chair: Kylie Van Meter, Florida State University, Tallahassee, FL

10:30 – 11 am
3499636: Data Science Techniques Applied to In Situ XRD Measurements of Copper Under Tribological Load
Nikolay Garabedian, Patric Gruber, Christian Greiner, Karlsruhe Institute of Technology, Karlsruhe, Germany

11 – 11:30 am
3484803: Extreme Environment Tribological Study of Advanced Bearing Polymers for Space Applications
Kian Bashandeh, Vasilis Tsigkis, Texas A&M University, College Station, TX; Pixiang Lan, ATSP Innovations, Champaign, IL; Andreas Polycarpou, Texas A&M University, College Station, TX

11:30 am – Noon
3483431: Reduced Cost NiTi-Alloy Bearings Made via Near Net Shape Powder Metallurgy Processes
Christopher DellaCorte, NASA, Cleveland, OH

Noon – 12:30 pm
3503429: Ultralow Wear Plasma Enhanced Atomic Layer Deposited Nitrides: Exploring Processing, Structure, Properties and Mechanisms at Multiple Scales
Tomas Grejtak, Tomas Babuska, Jewel Haik, Istiaque Chowdhury, Nicholas Strandwitz, Lehigh University, Bethlehem, PA; Kylie Van Meter, Brandon Krick, Florida State University, Tallahassee, FL; Mark Sowa, Veeco, Waltham, MA; Alexander Kozen, University of Maryland, College Park, MD

12:30 – 1 pm
3485898: Origin of Self-Healing in Dynamic Crosslinked Polymers: Experiments and Simulations
Zhijiang Ye, Nethmi De Alwis Watuthanthrige, Ballal Ahammed, Madison Dolan, Mehdi Zanjani, Dominik Konkolewicz, Miami University, Oxford, OH; Jian Wu, Harbin Institute of Technology, Weihai, Shandong, China

3E • Virtual Meeting Room 5
METALWORKING FLUIDS III

Session Chair: Jeffrey Mackey, Biosynthetic Technologies, Indianapolis, IN

Session Vice Chair: Chad Crocker, S&S Chemical, Northport, NY

10:30 – 11:00 am
3485651: Model MWFs Based on Naphthenic Base Oils – Straight Cut or Blend?
Thomas Norrby, Linda Visuri, Jinxia Li, Nynas AB, Nynashamn, Sweden

11 – 11:30 am
3492540: Novel Self Emulsifiable Esters for High Lubricity and Low Foam MWFs
Ronald Hoogendoorn, Patech, Moordrecht, Nederland, Netherlands

11:30 am – Noon
3484684: A New Method to Simulate Strip Drawing Tests on the Lab-Scale
Dirk Drees, Emmanuel Georgiou, Falex Tribology NV, Rotselaar, Belgium; Mark Veldhuis, Philips, Drachten, Netherlands; Javad Hazrati, Universiteit Twente, Enschede, Overijssel, Netherlands

Noon – 12:30 pm
3485050: Surface Behavior and Lubricative Properties of Hydroxyproline Rich, Natural Proteins in Metalworking Fluids
Eric Yezdimer, Gelita USA, Sergeant Bluff, IA; Matthias Reihmann, Gelita AG, Eberbach, Germany

12:30 – 1 pm
3499841: Tribological Study of Materials for Effective Cutting Tool Life
Carlos Sanchez, Peter Lee, Michael Moneer, Southwest Research Institute, San Antonio, TX

3F • Virtual Meeting Room 6
NANOTRIBOLOGY III

Session Chair: Suvrat Bhargava, TE Connectivity, Middletown, PA

Session Vice Chair: Arnab Bhattacharjee, University of Delaware, Newark, DE

10:30 – 11:30 am
INVITED TALK:
3565571: Mechanical Dissipation of Energy: From Breaking of Bonds to the Release of Adhesive Contacts
Lars Pastewka, Antoine Sanner, Albert-Ludwigs-Universitat Freiburg, Freiburg im Breisgau, Germany; Richard Jana, Aalto-yliopisto, Aalto, Finland

11:30 am – Noon
3499664: Tribological Experiments in the Age of Big Data
Nikolay Garabedian, Paul Schreiber, Christian Greiner, Karlsruhe Institute of Technology, Karlsruhe, Germany

Noon – 12:30 pm
3483709: Isopropanol Vapor Phase Lubrication of Multi-Asperity Interfaces: The Role of Capillarity and Boundary Lubrication
Bart Weber, Feng-Chun Hsia, Advanced Research Center for Nanolithography, Amsterdam, Netherlands

12:30 – 1 pm
3476540: Tribological Performance of Piston Compression Ring in Artificial Intelligence-Based Design Green Lubricant During Cold Start-up
Shahid Imran, HITEC University, Taxila, Pakistan

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3G • Virtual Meeting Room 7

ROLLING ELEMENT BEARINGS I

Session Chair: Trevor Slack, American Roller Bearing, Morganton, NC

Session Vice Chair: Hannes Grillenberger, Schaeffler Technologies AG and Co. KG, Herzogenaurach, Germany

10:30 – 11 am

3485603: Contact Protection by Grease in Aeronautical Heavily Charged Oscillating Bearings

Lucas Frache, David Philippon, LaMCoS Laboratory, Villeurbanne, Rhône Alpes, France; Francesco Massi, DIMA – University of Rome "La Sapienza", Rome, Italy

11 – 11:30 am

3483102: Film Thickness and Starvation in Grease Lubricated Bearings

Piet Lugt, SKF Research and Technology Development, Houten, Utrecht, Netherlands; Hui Cen, Xuchang University, Xuchang, Henan, China

11:30 am – Noon

3499278: Friction-Based Calibration of Raceway and Flange Lubrication Models for Railway Bearing Performance Prediction

Arnaud Ruellan, Pietro Tesini, Lieuwe de Vries, Armin Schlereth, Giuseppe Guala, SKF Group, Vilar Perosa, Italy

Noon – 12:30 pm

3484440: Wear Development Due to Oscillating Movement Operating Conditions as Employed in Rotor Blade Bearings in Wind Turbines

Sebastian Wandel, Gerhard Poll, Leibniz Universitat Hannover, Hannover, Niedersachsen, Germany; Arne Bartschat, Fraunhofer-Institut fur Windenergiesysteme IWES, Bremerhaven, Bremen, Germany

12:30 – 1 pm

3482687: Transient Finite Element Simulation of Bearing Surface Damage Due to Oscillating Motion with Consideration of Mixed Lubrication Conditions

Jae-Il Hwang, Josephine Kelley, Qiongdan Hu, Gerhard Poll, Institute of Machine Design and Tribology, Garbsen, Germany

3H • Virtual Meeting Room 8

LUBRICATION FUNDAMENTALS I: NON-TRIBOLOGICAL OIL PROPERTIES

Session Chair: Jodie Nelson, American Refining Group, Bradford, PA

Session Vice Chair: Q. Jane Wang, Northwestern University, Evanston, IL

10:30 – 11 am

3496577: Analytical Approaches to Chemical Structure and Physical Property Measurements of Lubricant Oils

Eleanor Riches, Caitlyn Da Costa, Jeff Goshawk, Michael Jones, Gordon Jones, Waters Corporation, Wilmslow, Cheshire, United Kingdom; James Browne, TA Instruments, New Castle, DE

11 – 11:30 am

3481748: Practical Considerations for the Development of Amine and Phenol Synergies

Jun Dong, SONGWON Industrial Group, Glen Allen, VA

11:30 am – Noon

3480826: Oxidative Stability of Estolides

Travis Thompson, Biosynthetic Technologies, Indianapolis, IN

Noon – 12:30 pm

3485249: Modeling Thermal Conductivity of Lubricants

Jannat Ahmed, Q. Jane Wang, Northwestern University, Evanston, IL; Ning Ren, Frances Lockwood, Valvoline Inc., Lexington, KY

12:30 – 1 pm

3497278: Mechanistic Insights into Lubricant Foaming and Foam Control Utilizing Single Bubble Techniques

Vineeth Chandran Suja, Gerald Fuller, Stanford University, Stanford, CA

3I • Virtual Meeting Room 9

COMMERCIAL MARKETING FORUM III

10:30 – 11 am – BASF Corporation

3578660: IRGAPAC® T 1668 M: New Premium Turbine Package Meeting MP Specifications

Alex Mannion

11 – 11:30 am – Evonik Oil Additives

3576684: Life Cycle Analysis of an Efficient Hydraulic Fluid

Thilo Krapfl

11:30 am – Noon – Münzing

3568227: Effects of Filtration on Münzing Defoamer Performance in Aqueous Metal Removal Fluids

James Sullivan

Noon – 12:30 pm – Colonial Chemical

3578734: High-performance Corrosion Inhibitors for Aluminum and Its Alloys

Steven Tang

12:30 – 1 pm – Evonik Oil Additives

3573199: High VI 0W-16 and 0W-20 Engine Oils using Evonik's VISCOPLEX® Viscosity Index Improvers – The Optimal Choice for Hybrid Electric Vehicles

Peter Moore

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4A • Virtual Meeting Room 1

CONDITION MONITORING II

Session Chair: Jatin Mehta, Fluitec International, Bayonne, NJ

2 – 2:30 pm
3498173: Fluid Analysis in Condition-Based Monitoring and Reliability
Julio Acosta, POLARIS Laboratories, Richmond, TX

2:30 – 3 pm
3531472: Fast and Reliable Quality Control of Fresh and In-Service Lubricants by FT-MidIR Spectrometry
Aaron Mendez, Ayalytical Instruments Inc., Houston, TX

3 – 3:30 pm – Break

3:30 – 4 pm
3559470: Analysis of Metal Additives and Wear Metals in Lubricants by High-Resolution ICP-OES
Oliver Buettel, Analytik Jena US LLC, Beverly, MA

4 – 4:30 pm
3500173: Diagnosing Improper Bearing Lubrication Using Oil Analysis
Evan Zabawski, TestOil, Strongsville, OH

4:30 – 5 pm – Condition Monitoring Business Meeting

4B • Virtual Meeting Room 2

ADDITIVE MANUFACTURING I: SPECIAL SYMPOSIUM

Session Chair: Michael Khonsari, Louisiana State University, Baton Rouge, LA

2 – 2:30 pm
3551361: Wear and Friction of Additively Manufactured Stainless Steel Materials
Robert Jackson, Sanjeev KC, Pooriya Nezhadfar, Collin Phillips, Nima Shamsaei, Auburn University, Auburn, AL; Marian Kennedy, Clemson University College of Engineering Computing and Applied Sciences, Clemson, SC

2:30 – 3 pm
3482009: Tribological and Mechanical Properties of High Entropy Alloys
Morgan Jones, Andrew Kustas, Ping Lu, Michael Chandross, Nicolas Argibay, Sandia National Laboratory, Albuquerque, NM

3 – 3:30 pm – Break

3:30 – 4 pm
3580636: Surface Texture Characterization of Metal Selective Laser Melted Part with Varying Surface Inclinations
Shan Lou, Shubhavardhan Huddersfield, Weidong Liu, Wenhan Zeng, Paul Scott, Xiangqian Jiang, University of Huddersfield School of Computing and Engineering, Huddersfield, Kirklees, United Kingdom; Tian long See, The Manufacturing Technology Centre, Coventry, United Kingdom

4 – 4:30 pm
3581203: Tribological Effects of Surface Textures on the Sliding Behavior of Short Carbon Fiber Reinforced Nylon Composites Fabricated by 3D Printing Techniques
Li Chang, The University of Sydney, Sydney, New South Wales, Australia

4:30 – 5 pm
3582267: Fabrication and Testing of Bioinspired Surface Designs for Friction Reduction at the Piston Ring and Liner Interface
Shelby Maddox, Jiyu Cai, Xiaoxiao Han, Xiangbo Meng, Josué Goss, Min Zou, University of Arkansas, Fayetteville, AR; Arup Gangopadhyay, Ford Motor Company, Dearborn, MI; Hamed Ghaednia, Gehring Group, Farmington Hills, MI

5 – 5:30 pm
3581773: Designing a Bioinspired Surface for Improved Wear Resistance and Friction Reduction
Julia Hoskins, University of Arkansas Fayetteville, Fayetteville, AR

4C • Virtual Meeting Room 3

NONFERROUS METALS II

Tribology and Biobased Session in Memory of Dr. Girma Birresaw

Session Chair: Annie King, Houston, TX

2 – 2:30 pm
3476874: Correlation Between Microscopic Surface Damage and Frictional Behavior of Lubricants for Stamping Automotive Aluminum Sheet Products
Mehdi Shafiei, Shania Polson, Novelis, Novi, MI

2:30 – 3 pm
3479424: Filtration of Rolling Fluids
Craig Thomas, JR Schneider Co., Inc., Benicia, CA

3 – 3:30 pm – Break

3:30 – 4 pm
3482772: Biobased Disulfide Additive Based on Soybean Oil
Grigor Bantchev, Girma Biresaw, James Lansing, Rogers Harry-O'Kuru, Yunzhi Chen, USDA-ARS National Center for Agricultural Utilization Research, Peoria, IL

4 – 4:30 pm
3484628: Vegetable Oils for Metalworking Lubricants: Physico-Chemical and Stability Aspects of Different Options
Joseph Pattathilchira Varghese, Formerly Indian Oil R&D Center, Faridabad, Haryana, India

4:30 – 5 pm – Nonferrous Metals Business Meeting

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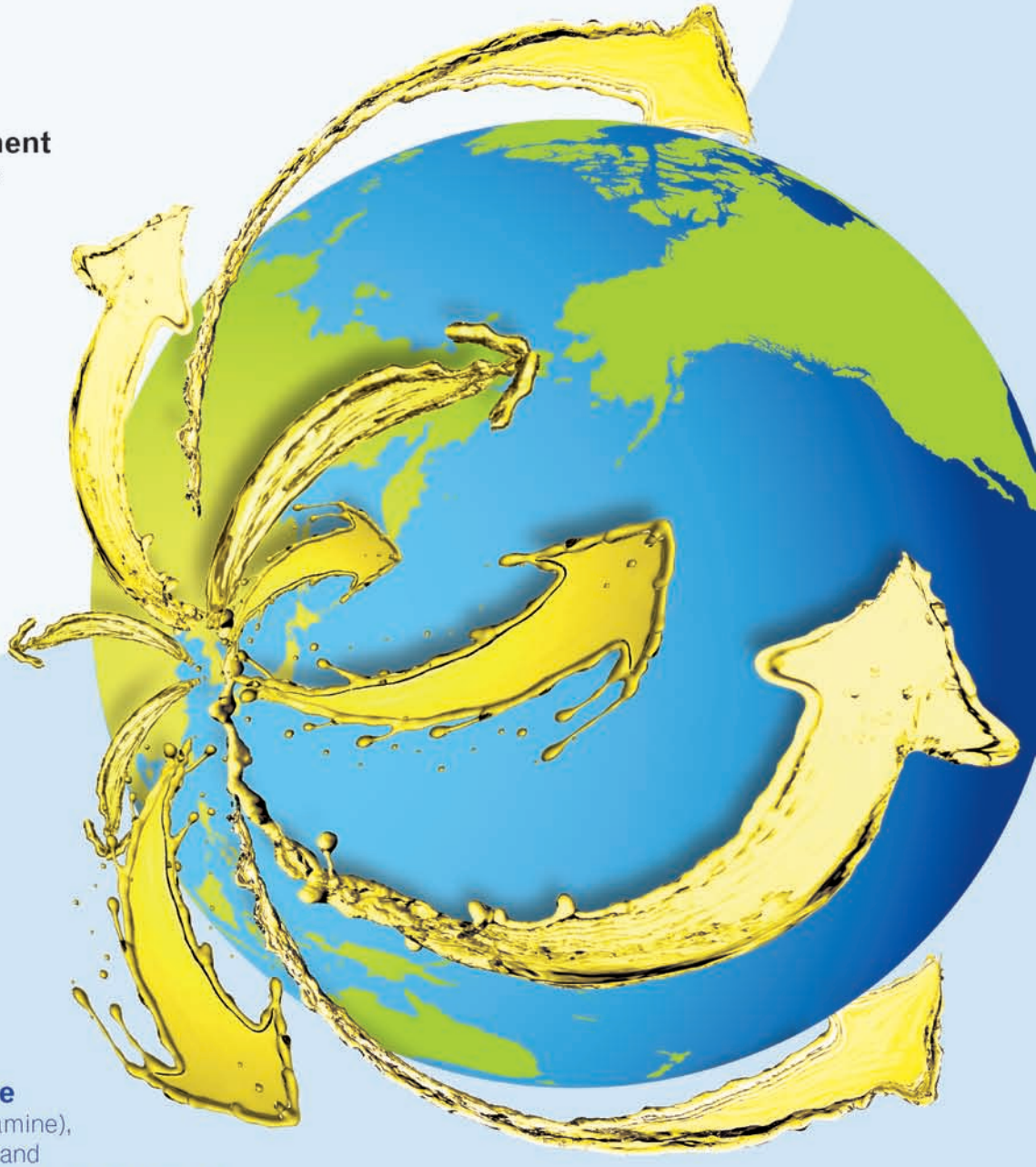

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4D • Virtual Meeting Room 4
MATERIALS TRIBOLOGY III

Session Chair: Nikhil Murthy, U.S. Army Research Lab, Aberdeen Proving Ground, MD

2 – 2:30 pm
3485503: Method for Tribological Experiment to Study Scuffing Instigation on AISI 52100 Steel and Hard Ceramic Coatings
Kelly Jacques, Diana Berman, University of North Texas, Burleson, TX; Stephen Berkebile, Nikhil Murthy, Army Research Laboratory, Aberdeen Proving Ground, MD

2:30 – 3 pm
3484132: Tribological Behavior of Textured Polymer Surfaces
Mohammad Hossain, Emeka Chukwuonu, Texas A&M University-Kingsville, Kingsville, TX; Hung-Jue Sue, Texas A&M University, College Station, TX

3 – 3:30 pm – Break

3:30 – 4 pm
3482506: Determination of Scuffing and Wear of Materials in Low-Lubricity Fuels
Stephen Berkebile, Nikhil Murthy, CCDC Army Research Laboratory, Aberdeen Proving Ground, MD; Kelly Jacques, Diana Berman, University of North Texas, Denton, TX; Caleb Matzke, Maharshi Dey, Surojit Gupta, University of North Dakota, Grand Forks, ND; Auezhan Amanov, Ruslan Karimbaev, Sun Moon University, Asan, Republic of Korea

4 – 4:30 pm
3500772: Paleo-Tribology: Inspiration from Fossil Grinding Dentitions – From Wear Models to Damage Tolerant Composites
Tomas Grejtak, Tomas Babuska, Lehigh University, Bethlehem, PA; Soumya Varma, Siddhartha Pathak, Iowa State University, Ames, IA; Tyler Hunt, Stephen Kuhn-Hendricks, Gregory Erickson, Brandon Krick, Florida State University, Tallahassee, FL; Mark Norell, American Museum of Natural History, New York, NY

4:30 – 5 pm
3565111: A Novel Method to Assess Conventional Tribological Properties of Hard Coatings by Pin-On-Disc Testing
Edoardo Goti, Luigi Mazza, Andrea Mura, Politecnico di Torino, Torino, Italy; Jiri Nohava, Pavel Sedmak, Anton Paar TriTec SA, Corcelles, Neuchâtel, Switzerland

5 – 5:30 pm – Materials Tribology Business Meeting

4E • Virtual Meeting Room 5
METALWORKING FLUIDS IV

Session Chair: Eric Yezdimer, Gelita, Sergeant Bluff, IA

Session Vice Chair: Robert Golden, Pilot Chemical, Cincinnati, OH

2 – 2:30 pm
3484869: The Future of Metalworking Fluids: It's Biobased!
Jeffrey Mackey, Biosynthetic Technologies, Indianapolis, IN

2:30 – 3 pm
3478594: New Solution for Aluminum Machining with Synthetic Fluids
Mickael Ponsardin, TOTAL Lubricants, Pindamonhangaba, SP, Brazil

3 – 3:30 pm – Break

3:30 – 4 pm
3475839: Measuring Tapping Performance Parameters – Using Tapping Torque to Evaluate Coolants and Coolant Additives
Michael Miller, Univar Solutions, Houston, TX

4 – 4:30 pm
3479656: Polyglykol as Performance Wear Lubricant and Synergism with Extreme Pressure Additives on Net Oil Metalworking Fluid
Eduardo Lima, Dow Chemical Brazil, Jundiai, Sao Paulo, Brazil

4:30 – 5 pm
3500883: Multiple Light Scattering for Physical Stability Analysis of Concentrated Dispersions
Gordon Irvine, Charles Nider, Pascal Bru, Formulaction, Inc, Worthington, OH; Christelle Tisserand, Yoann Lefeuvre, Gerard Meunier, Formulaction, Dallas, TX

5 – 5:30 pm
3580511: Preview of the Metalworking Fluids (MWF) 105 Education Course
Peter Küenzi, Blaser Swisslube AG, Hasle-Ruegsau, Bern, Switzerland; Brian Hovik, Viking Engineering, Leavenworth, WA; Michael Stapels, KAO Chemicals GmbH, Emmerich am Rhein, Nordrhein-Westfalen, Germany

4F • Virtual Meeting Room 6
NANOTRIBOLOGY IV

Session Chair: Filippo Mangolini, The University of Texas at Austin, Austin, TX

2 – 2:30 pm
3529206: MD Study of Adhesion Between a Si Tip and Si Substrate During Indentation and Sliding
Judith Harrison, US Naval Academy, Annapolis, MD; Zachary Milne, Sandia National Laboratories, Albuquerque, NM; Robert Carpick, University of Pennsylvania, Philadelphia, PA; J. David Schall, North Carolina AT&T University, Greensboro, NC

2:30 – 30 pm
3484691: Interfacial Interactions and Tribological Behavior of Metal-Oxide/2D-Material Contacts
Tobin Filleter, Shwetank Yadav, Taib Arif, Guorui Wang, Rana Sodhi, Yu Hui Cheng, Chandra Veer Singh, University of Toronto, Toronto, Ontario, Canada; Guillaume Colas, 4Univ. Bourgogne Franche-Comté FEMTO-ST Institute, Besançon, France

3 – 3:30 pm – Break

3:30 – 4 pm
3499774: Structure, Solvation and Friction of Cyclic-Hydrocarbons Confined at Graphitic Interface
Behnoosh Sattari Baboukani, Prathima Nalam, SUNY University at Buffalo, Buffalo, NY; Zhijiang Ye, Miami University, Oxford, OH

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4F | Nanotribology IV (con't)

4 – 4:30 pm
3500077: Nanoparticle Sintered Tribofilm Removal Study: An Experimental Approach
Steven Thrush, US Army CCDC GVSC, Warren, MI

4:30 – 5 pm
3516653: In Situ SEM Nano - mechanical Characterization of Tribofilms Derived from Inorganic Nanoparticles
Kora Farokhzadeh, Praveena Manimunda, Bruker Nano Surfaces, San Jose, CA; Steve Shaffer, Shaffer Tribology Consulting, San Jose, CA

5 – 5:30 pm – Nanotribology Business Meeting

4G • Virtual Meeting Room 7
ROLLING ELEMENT BEARINGS II

Session Chair: Daulton Isaac, Air Force Research Laboratory, Wright Patterson AFB, OH

2 – 2:30 pm
3482402: The Next Generation Aircraft Engine High Speed Bearing
Peter Glöckner, Schaeffler Aerospace Germany GmbH & Co.KG, Schweinfurt, Bavaria, Germany

2:30 – 3 pm
3477365: Innovative Bearing Solutions for E-Mobility Applications
Jitesh Modi, Schaeffler Group USA, Troy, MI

3 – 3:30 pm – Break

3:30 – 4 pm
3499371: An Investigation of the Effects of Surface Roughness on Rolling Contact Fatigue
Steven Lorenz, Farshid Sadeghi, Purdue University, West Lafayette, IN

4 – 4:30 pm
3493327: Tribological and Tribochemical Evaluation of Various Lubricants on Steel as well as WC-DLC Coating under Extreme-Pressure Boundary Lubrication Conditions: Rig Test
Kuldeep Mistry, The Timken Company, North Canton, OH

4H • Virtual Meeting Room 8
2D MATERIALS/ SUPERLUBRICITY

Materials Tribology & Nanotribology Joint Session I

Session Chair: Arzu Çolak, Clarkson University, Potsdam, NY

2 – 2:30 pm
3504641: Mechanical and Tribological Properties of MXene Nano-Sheets
Bo Zhang, Saga Daigaku Riko Gakubu Daigakuin Kogakukei Kenkyuka, Saga, Japan

2:30 – 3 pm
3492372: Wear Life of Ni-doped MoS_2 Dry Film Lubricants for Space Applications
Azhar Vellore, Sergio Romero Garcia, University of California, Merced, Merced, CA; Duval Johnson, NASA Jet Propulsion Laboratory, Pasadena, CA; Ashlie Martini, University of California, Merced, Merced, CA

3 – 3:30 pm – Break

3:30 – 4 pm
3504161: Probing the Influence of Water and Oxygen on the Friction and Wear of MoS_2
Tomas Babuska, Tomas Grejtak, Lehigh University, Bethlehem, PA; John Curry, Sandia National Laboratory, Albuquerque, NM; Brandon Krick, Florida State University, Tallahassee, FL

4 – 4:30 pm
3503112: Robust Solid Lubricant Operable in Multifarious Environments
Aditya Ayyagari, Kalyan Mutyala, Anirudha Sumant, Argonne National Laboratory, Lemont, IL

4:30 – 5 pm
3484970: Achieving Direct Macroscale Liquid Superlubricity Under Boundary and Mixed Lubrication
Qiang Ma, Arman Mohammad Khan, Q. Jane Wang, Yip-Wah Chung, Northwestern University, Evanston, IL

5 – 5:30 pm
3482121: Super Lubricity of Solids from Quantum Mechanics
Bo Zhang, Saga Daigaku Riko Gakubu Daigakuin Kogakukei Kenkyuka, Saga, Japan

4I • Virtual Meeting Room 9
COMMERCIAL MARKETING FORUM IV

2 – 3 pm – Afton Chemical
3576688: Afton Chemical's Key Driver Seminar IIoT Technologies Leading to Engaged, Optimized and Profitable Customer Relationships
Stephen Steen

3 – 3:30 pm – Break

3:30 – 4 pm – Sea-Land Chemical
Company Update
Pete Pendergast

4 – 5 pm – The Lubrizol Corporation
3578685: Reduce, Renew, Regenerate: Sustainability of Industrial Lubricants
Shubhamita Basu

5 – 5:30 pm – TestOil
3578799: Visual Cues of Lubrication & Reliability Programs with TestOil PRO
Heather Vercillo

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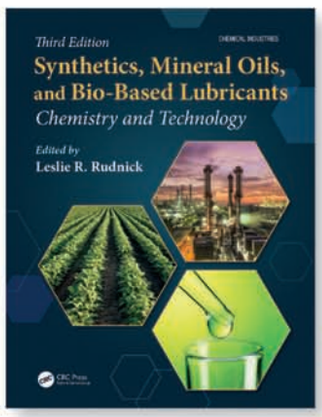

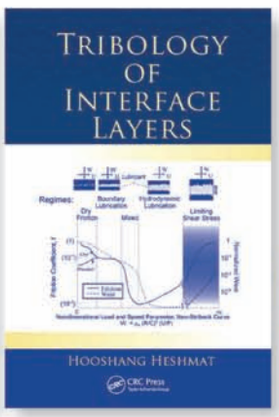

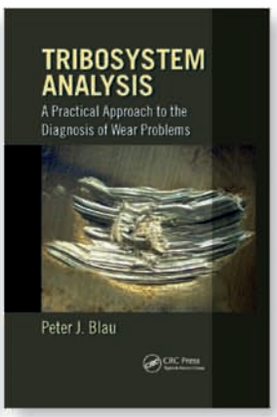

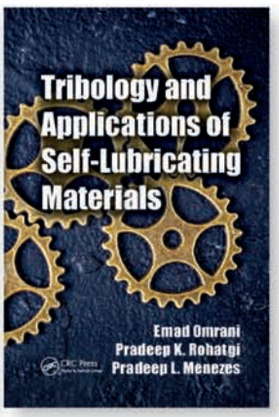

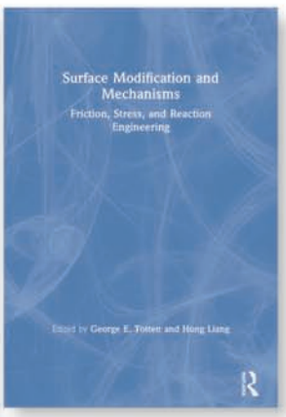

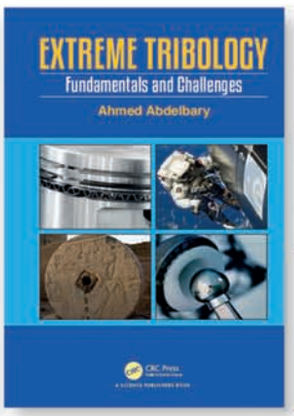

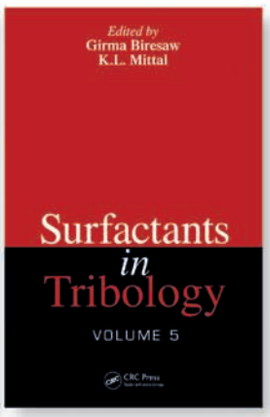

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WEDNESDAY

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Overview

Wednesday, May 19, 2021

8:30 – 10 am
Wednesday Keynote Session

Keynote Speaker:

- Dr. Armit Parikh, Research Manager, Smith & Nephew, Inc.

10 – 10:30 am
Networking Break & Special Programming

10 am – 3:30 pm
Virtual Exhibits and Student Posters

10:30 am – 1 pm
Wednesday Technical Sessions:

- 5A – Biotribology I
- 5B – 2D Materials/Superlubricity: Material Tribology & Nanotribology Joint Session II
- 5C – Engine & Drivetrain I
- 5D – Lubrication Fundamentals II: Additives I
- 5E – Wear I
- 5F – Tribotesting I
- 5G – Rolling Element Bearings III
- 5H – Nonferrous Metals III
- 5I – Commercial Marketing Forum V

1 – 2 pm
Plenary Program – Session #1

Plenary Speaker:

- Dr. Jack Zakarian, Consultant, JAZTech Consulting LLC

2 – 6 pm
Wednesday Technical Sessions:

- 6A – Biotribology II
- 6B – 2D Materials/Superlubricity: Material Tribology & Nanotribology Joint Session II
- 6C – Engine & Drivetrain II
- 6D – Lubrication Fundamentals III: Additives II
- 6E – Wear II
- 6F – Tribotesting II
- 6G – Rolling Element Bearings IV
- 6H – Tribochemistry – Materials Tribology & Nanotribology Joint Session I
- 6I – Grease I
- 6J – Commercial Marketing Forum V1

3 – 3:30 pm
Networking Break & Special Programming

Trade Show Hours:

- Monday, May 17: 10 am – 4 pm
- Tuesday, May 18: 10 am – 3:30 pm
- Wednesday, May 19: 10 am – 3:30 pm
- Thursday, May 20: 10 am – 3:30 pm

(All times listed are Eastern Daylight Time)

TIME	SESSION 5A Biotribology I Virtual Meeting Room 1	SESSION 5B 2D Materials/Superlubricity II Virtual Meeting Room 2	SESSION 5C Engine & Drivetrain I Virtual Meeting Room 3
10:30 – 11 am	Impact of Metal Release on Chondrocytes Due to Biotribocorrosion in CoCrMo Sliding Against Articular Cartilage, M. Rodriguez Ripoll, p. 52	The Fascinating Frictional Properties of Layered Materials, M. Urbakh, p. 52	Component Wear in Diesel Engine High Pressure Fuel Pumps Operating with Heavy Fuel, N. Murthy, p. 52
11 – 11:30 am	Experimental Biotribological Testing of Hydrogels and Articular Cartilage for Medical Engineering Applications, P. Staudinger, p. 52		The Measurement of Wear in a GDI Engine Using Radioactive Wear Measurements – Phase II, P. Lee, p. 52
11:30 – Noon	The Mechanics of Single Cross-Links which Mediate Cell Attachment at a Hydrogel Surface, A. Çolak, p. 52	Robust Vibration Induced Lubricity, A. Bhattacharjee, p. 52	Development and Testing of a Low Viscosity, Fuel Efficient, Heavy-Duty Diesel Engine Oil for Severe Service, A. Comfort, p. 52
Noon – 12:30 pm	A New Method to Evaluate Compression, Adhesion and Thread Formation (Tackiness) in Biomedical and Healthcare Products, E. Georgiou, p. 52	2D Materials as Solid Lubricants: Ab Initio Comparative Study of Tribochemical, and (Super)Lubric Properties, M. Clelia Righi, p. 52	Development and Demonstration of a Prototype 0W-20 Heavy Duty Diesel Engine Oil, J. Pettingill, p. 52
12:30 – 1 pm			Engine Efficiency Testing on Aggregated Textured Components, S. Hsu, p. 52
1 – 2 pm	**Plenary Program #1**	**Plenary Program #1**	**Plenary Program #1**
	SESSION 6A **Biotribology II** **Virtual Meeting Room 1**	**SESSION 6B** **2D Materials/Superlubricity III** **Virtual Meeting Room 2**	**SESSION 6C** **Engine & Drivetrain II** **Virtual Meeting Room 3**
2 – 2:30 pm	Acoustic Emission Signals as a Diagnostic Tool for Joint Wear, K. Olorunlambe, p. 56	Phase Transitions in Alkanes Confined at Graphitic Interface, P. Nalam, p. 56	The Effect of Engine Oil and Lubrication System Design on Engine Friction as Demonstrated in a Motored Engine, W. Anderson, p. 58
2:30 – 3 pm	Wear of Antibacterial Coatings on CoCrMo Under Butterfly Motion and Dynamic Loads in a Biotribometer, D. Halenahally Veeregowda, p. 56	Nanotribology of 2D Transition Metal Dichalcogenides: The Effect of Chalcogen Variation on Frictional Behavior of MoS_2, $MoSe_2$ and $MoTe_2$, M. Vazirisereshk, p. 56	Friction and Wear of Thermal Spray Coatings for Cylinder Bores, A. Gangopadhyay, p. 58
3 – 3:30 pm	**Networking Break**	**Networking Break**	**Networking Break**
3:30 – 4 pm	Oral Tribology, Lubrication and Adsorption of Alternative Food Proteins, B. Kew, p. 56		Benchtop Test for Screening Wet Clutch Materials, C. Sanchez, p. 58
4 – 4:30 pm	Soft Matter Tribology in Biology, A. Pitenis, p. 56	Contact Aging in Structural Superlubricity, W. Oo, p. 56	Road to Ultra-Low Viscosity 0W Oils: Quantifying Frictional Benefits on the Journal Bearing Machine, P. Desai, p. 58
4:30 – 5 pm	Biotribology Business Meeting	Inverse Layer Dependence of Friction on Chemically Doped MoS_2, M. Baykara, p. 58	Engine and Drivetrain Business Meeting
5 – 5:30 pm		Why is Friction at the Graphene Step Edge So High While Friction on the Basal Plane is So Low?, Z. Chen p. 58	
5:30 – 6 pm			
6 – 6:30 pm			

SESSION 5D Lubrication Fundamentals II: Additives I	SESSION 5E Wear I	SESSION 5F Tribotesting I	
Virtual Meeting Room 4	**Virtual Meeting Room 5**	**Virtual Meeting Room 6**	
Tribochemistry – Past, Present, and Future, S. Hsu, p. 52	The Effect of Friction on Micropitting, M. Ueda, p. 54	Fretting Wear in Contacts Representative of Wire Rope Internal Interfaces: The Influence of Key Lubrication Parameters, C. Dyson, p. 54	**10:30 – 11 am**
Torque Tightening of Threaded Fasteners: The Influence of Lubrication on Friction, C. Dyson, p. 52	Wear Characterization and Mitigation for Knife Mills Used in Biomass Size Reduction, K. Lee, p. 54	Comparing Afton's Bespoke Stick Slip Rig with the Former Cincinnati Milacron Rig, R. Lumby, p. 54	**11 – 11:30 am**
Graphite: a New Reinforcing Filler to Polymer, H. Liu, p. 54	Effect of Nitriding and Carbonitriding on the Scuffing Resistance of Aerospace Bearing Steels, D. Isaac, p. 54	Depletion of MoDTC and Synergism with OFM in Boundary Lubricated Tribological Contacts, A. Morina, p. 54	**11:30 – Noon**
Using Oil-Soluble Ionic Liquids Together with Other Additives in a Lubricant, J. Qu, p. 54	Developing an Innovative Next Generation Anti-Wear, C. Chretien, p. 54	Reconditioning Lubricating Oils: The Tribological Performance Perspective, A. Ruellan, p. 54	**Noon – 12:30 pm**
Research on Durable Organic Friction Modifiers for PCMO and HDDEO Applications, B. Casey, p. 54	Suppressed Triboluminescence Attributed to Electron Structure Changes in the Doped Surface, C. Song, p. 54	Electric Current Effects on Wind Turbine Bearing Steel: Test Rig and Results, R. Erck, p. 54	**12:30 – 1 pm**
Plenary Program #1	**Plenary Program #1**	**Plenary Program #1**	**1 – 2 pm**

SESSION 6D Lubrication Fundamentals III: Additives II	SESSION 6E Wear II	SESSION 6F Tribotesting II	
Virtual Meeting Room 4	**Virtual Meeting Room 5**	**Virtual Meeting Room 6**	
Engine Test of Microencapsulated Friction Modifier Additives for Fuel Economy Enhancement, S. Hsu, p. 58	Effects of Lubricant Additives on Fretting Wear, A. Kontou, p. 60	Repeatability of Friction and Wear of Different Material Pairs at 1000°C under Unidirectional Sliding Motion, D. Patro, p. 60	**2 – 2:30 pm**
Fuel Economy Improvement Using Ultralow Viscosity Lubricants, S. Hsu, p. 58	Friction and Surface Interaction Analysis of PDC on Granite and Carbonate Rocks, J. Bomidi, p. 60	Testing for Friction Differences Between Oils, K. Budinski, p. 60	**2:30 – 3 pm**
Networking Break	**Networking Break**	**Networking Break**	**3 – 3:30 pm**
Tuned Polar Methacrylate Viscosity Index Improvers for Enhanced Shear Stability and Wear Prevention, L. Cosimbescu, p. 58	A Review of Tribological and Surface Behavior of MAX Phase-Based Composites, S. Gupta, p. 60	Wear and Viscosity Effects of Mineral Oil Dilution by Biodiesels and their Methyl Esters, G. Molina, p. 60	**3:30 – 4 pm**
Exploring New and Innovative Additives for Extreme Tribological (ET) Performance, L. Wei, p. 58	The Surface Effects of Nanofluid Action on Heat-Exchanger Materials: Testing and Assessment, G. Molina, p. 60	Extracting More Value From Tribofilm Images, O. Ogunsola, p. 60	**4 – 4:30 pm**
Investigation on the Superlubricity and Nanomechanics of Liposome Adsorption on Titanium Alloys, Y. Liu, p. 58	Elevated Temperature Fretting Wear Study of Additively Manufactured Inconel 625 with Varying Process Parameters, M. Tripathy, p. 60	Advanced Capacitance Sensors for Tribological Characterization of Superlubricity Conditions, T. Khosla, p. 60	**4:30 – 5 pm**
The Importance of Tribology in Climate Discussions and for Sustainability Goals, M. Woydt, p. 58	Statistical Considerations in Wear Scar Measurement in Antifriction Coatings, M. Mushrush, p. 60	Synergistic Action of Friction Modifier (MoDTC) with PTFE NPs as an Additive, V. Saini, p. 60	**5 – 5:30 pm**
Lubrication Fundamentals Business Meeting	Wear Business Meeting	Tribotesting Business Meeting	**5:30 – 6 pm**
			6 – 6:30 pm

WEDNESDAY >>

TIME	SESSION 5G Rolling Element Bearings III Virtual Meeting Room 7	SESSION 5H Nonferrous Metals III Virtual Meeting Room 8	SESSION 5I Commercial Marketing Forum V Virtual Meeting Room 9
10:30 – 11 am		Structure-Performance Evaluation of Synthetic Metalworking Fluid Additives, T. Meyers, p. 56	**Functional Products:** Introducing V-705, a New and Unique Synthetic Basestock for Automotive and Industrial Applications, G. Duckworth, p. 56
11 – 11:30 am	A Mechanistic Approach to Understand Rolling Contact Fatigue (RCF) Induced Microstructural Alterations, M. Abdullah, p. 54	Chemistry Behind Settling Metal Fines in Aqueous Metalworking Fluids, S. Velez, p. 56	**ANGUS Chemical Co.:** Benefits of CORRGUARD™ Additives in Metalworking Fluid Formulations and Beyond, M. Chen, p. 56
11:30 – Noon	Mechanistic Study of White Etching Bands Formation in Bearing Steel Due to RCF, M. El Laithy, p. 54	Gas-to-Liquids (GTL) Technology Offers Advances in Metalworking and Aluminum Rolling Fluids while Enhancing Safety, Performance, and Environmental Sustainability, G. Wehr, p. 56	**King Industries:** NA-LUBE KR Alkylated Naphthalenes for High Temperature Application, A. Harris, p. 56
Noon – 12:30 pm	Fracture-Mechanical Evaluation of Inclusions – Comparison with Test Results, J. Binderszewsky, p. 54		**TestOil:** Should I Change My Lubricant When the Color Changes?, H. Vercillo, p. 56
12:30 – 1 pm	Rolling Element Bearings Business Meeting		**Chevron Phillips Chemical Company:** PAOs and Electric Applications, K. Hope, p. 56
1 – 2 pm	**Plenary Program #1**	**Plenary Program #1**	**Plenary Program #1**
	SESSION 6G **Rolling Element Bearings IV** **Virtual Meeting Room 7**	**SESSION 6H** **Tribochemistry I** **Virtual Meeting Room 8**	**SESSION 6I** **Grease I** **Virtual Meeting Room 9**
2 – 2:30 pm	Influence of Vibration Induced Standstill Marks (Fretting) on Bearings of E-drives, M. Grebe, p. 62	Wear Penalty for Steel Rubbing Against Hard Coatings in Reactive Lubricants, X. He, p. 62	Fully Customizable Calcium Sulfonate Greases for Optimum Performances, M. Legatte, p. 62
2:30 – 3 pm	Numerical Modeling of Three-Dimensional Crack Propagation Under Rolling Contact Fatigue, F. Meray, p. 62	Investigation of Friction and Wear Behavior in Chloride Molten Salt for Concentrating Solar Power Pump Bearings, X. He, p. 62	Adhesion and Tackiness of Greases: From Concept to an ASTM Standard Method, E. Georgiou, p. 62
3 – 3:30 pm	**Networking Break**	**Networking Break**	**Networking Break**
3:30 – 4 pm	Experimental Investigation of Influence of Different Heat Treatments on Fracture Behavior of High Strength Bearing Steels, N. Londhe, p. 62	Tribological Behavior of PS400-Related Tribopairs for Space Exploration, V. Tsigkis, p. 62	New Method to Measure Grease Tackiness and Comparison with Water Resistance and Low-Temperature Mobility, A. Kumar, p. 62
4 – 4:30 pm	Propagation of Rolling Contact Fatigue Cracks in Ball Bearing, K. Matsumoto, p. 62	Development of Self-Adaptive Lubricating Silver Aluminum Borate Composite for Wide Temperature Range, A. Kasar, p. 62	Back to the Basics – Part II: Fundamental Building Blocks of Grease Formulation – The Next Story, J. Kaperick, p. 62
4:30 – 5 pm	The Effect of Electrical Current on Premature Fatigue and Microstructural Alterations in Bearing Steel, B. Gould, p. 62	Dependence of Tribological Performance and Tribopolymerization on the Surface Binding Strength of Selected Cycloalkane-Carboxylic Acid Additives, Q. Ma, p. 62	
5 – 5:30 pm			
5:30 – 6 pm			**SESSION 6J** **Commercial Marketing Forum VI** **Virtual Meeting Room 10**
6 – 6:30 pm			**BYK** (2 – 2:30 pm) **Clariant** (2:30 – 3 pm)

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5A • Virtual Meeting Room 1

BIOTRIBOLOGY I

Session Chair: Angela Pitenis, University of California, Santa Barbara, CA

10:30 – 11 am

3499561: Impact of Metal Release on Chondrocytes Due to Biotribocorrosion in CoCrMo Sliding Against Articular Cartilage

Manel Rodriguez Ripoll, Bojana Simlinger, Friedrich Franek, AC2T research GmbH, Wiener Neustadt, Austria; Christoph Bauer, Christoph Stotter, Thomas Klestil, Stefan Nehrer, Danube University Krems, Krems, Niederösterreich, Austria

11 – 11:30 am

3490856: Experimental Biotribological Testing of Hydrogels and Articular Cartilage for Medical Engineering Applications

Paul Staudinger, Anton-Paar GmbH, Graz, Austria; Florian Rummel, Anton Paar Germany GmbH, Ostfildern, Germany; Kartik Pondicherry, Anton Paar India, Hyderabad, India; Dominique Felk, Tuebingen University, Tuebingen, Germany

11:30 am – Noon

3499124: The Mechanics of Single Cross-Links which Mediate Cell Attachment at a Hydrogel Surface

Arzu Çolak, Clarkson University, Potsdam, NY; Bin Li, Technical University of Munich, Munchen, Germany; Johanna Blass, Aránzazu del Campo, Roland Bennewitz, Leibniz Institute for New Materials, Saarbrucken, Germany

Noon – 12:30 pm

3484432: A New Method to Evaluate Compression, Adhesion and Thread Formation (Tackiness) in Biomedical and Healthcare Products

Emmanuel Georgiou, Falex Tribology NV, Rotselaar, Belgium; Olaf Mollenhauer, Kompass Sensor GmbH, Ilmenau, Germany; Dirk Drees, Falex Tribology NV, Rotselaar, Belgium

5B • Virtual Meeting Room 2

2D MATERIALS/ SUPERLUBRICITY

Materials Tribology & Nanotribology Joint Session II

Session Chair: Kora Farokhzadeh, Bruker Nano Surfaces, San Jose, CA

Session Vice Chair: Mohammad Vaziriserehk, University of California Merced, Merced, CA

10:30 – 11:30 am

INVITED TALK

3565696: The Fascinating Frictional Properties of Layered Materials

Michael Urbakh, Tel Aviv University School of Chemistry, Tel Aviv, Israel

11:30 am – Noon

3501572: Robust Vibration Induced Lubricity

Arnab Bhattacharjee, Nikolay Garabedian, David Burris, University of Delaware, Newark, DE

Noon – 1 pm

INVITED TALK

3570304: 2D Materials as Solid Lubricants: Ab Initio Comparative Study of Tribochemical, and (Super)Lubric Properties

M. Clelia Righi, Universita di Bologna, Bologna, Emilia-Romagna, Italy

5C • Virtual Meeting Room 3

ENGINE AND DRIVETRAIN I

Session Chair: William Anderson, Afton Chemical Corp., Richmond, VA

10:30 – 11 am

3483460: Component Wear in Diesel Engine High Pressure Fuel Pumps Operating with Heavy Fuel

Nikhil Murthy, Blake Johnson, CCDC Army Research Laboratory, Aberdeen Proving Ground, MD; Caleb Matzke, University of North Dakota, Grand Forks, ND; Stephen Berkebile, Army Research Laboratory, Aberdeen Proving Ground, MD

11 – 11:30 am

3498163: The Measurement of Wear in a GDI Engine Using Radioactive Wear Measurements – Phase II

Peter Lee, Gregory Hansen, Carlos Sanchez, Southwest Research Institute, San Antonio, TX

11:30 am – Noon

3502029: Development and Testing of a Low Viscosity, Fuel Efficient, Heavy-Duty Diesel Engine Oil for Severe Service

Allen Comfort, Steven Thrush, US Army CCDC GVSC, Warren, MI

Noon – 12:30 pm

3493035: Development and Demonstration of a Prototype 0W-20 Heavy Duty Diesel Engine Oil

John Pettingill, Petro-Canada Lubricants Inc, Mississauga, Ontario, Canada

12:30 – 1 pm

3497070: Engine Efficiency Testing on Aggregated Textured Components

Stephen Hsu, Govindaiah Patakamuri, George Washington University, Germantown, MD; Timothy Cushing, General Motors Corp., Detroit, MI

5D • Virtual Meeting Room 4

LUBRICATION FUNDAMENTALS II: ADDITIVES I

Session Chair: Jun Qu, Oak Ridge National Laboratory, Oak Ridge, TN

Session Vice Chair: Nicole Döerr, AC2T Research GmbH, Wiener Neustadt, Austria

10:30 – 11 am

3497203: Tribochemistry – Past, Present, and Future

Stephen Hsu, GWU, Germantown, MD

11 – 11:30 am

3479334: Torque Tightening of Threaded Fasteners: The Influence of Lubrication on Friction

Christopher Dyson, William Hopkins, ITW ROCOL, Leeds, West Yorkshire, United Kingdom; Martin Priest, Malcolm Fox, University of Bradford, Bradford, West Yorkshire, United Kingdom

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5D | Lubrication Fundamentals II (con't)

11:30 am – Noon
3579761: Graphite: a New Reinforcing Filler to Polymer
Hong Liu, Lanzhou Jiaotong University, Lanzhou, China

Noon – 12:30 pm
3494251: Using Oil-Soluble Ionic Liquids Together with Other Additives in a Lubricant
Jun Qu, Oak Ridge National Laboratory, Oak Ridge, TN

12:30 – 1 pm
3490135: Research on Durable Organic Friction Modifiers for PCMO and HDDEO Applications
Brian Casey, Vincent Gatto, Vanderbilt Chemicals, LLC, Norwalk, CT

5E • Virtual Meeting Room 5
WEAR I

Session Chair: Yan Zhou, Houghton International, Oak Ridge, TN

Session Vice Chair: John Bomidi, Baker Hughes Company, The Woodlands, TX

10:30 – 11 am
3471693: The Effect of Friction on Micropitting
Mao Ueda, Benjamin Wainwright, Hugh Spikes, Amir Kadiric, Imperial College London, London, United Kingdom

11 – 11:30 am
3498612: Wear Characterization and Mitigation for Knife Mills Used in Biomass Size Reduction
Kyungjun Lee, Oak Ridge National Laboratory, Knoxville, TN

11:30 am – Noon
3490952: Effect of Nitriding and Carbonitriding on the Scuffing Resistance of Aerospace Bearing Steels
Daulton Isaac, Mathew Kirsch, Air Force Research Laboratory, Wright-Patterson AFB, OH; Hitesh Trivedi, UES Inc., Dayton, OH

Noon – 12:30 pm
3476697: Developing an Innovative Next Generation Anti-Wear
Christelle Chretien, SOLVAY, Bristol, PA

12:30 – 1 pm
3565800: Suppressed Triboluminescence Attributed to Electron Structure Changes in the Doped Surface
Changhui Song, Liran Ma, Jianbin Luo, Tsinghua University, Beijing, China

5F • Virtual Meeting Room 6
TRIBOTESTING I

Session Chair: Christopher DellaCorte, NASA, Cleveland, OH

Session Vice Chair: Ashish Kasar, University of Nevada Reno, Reno, NV

10:30 – 11 am
3479342: Fretting Wear in Contacts Representative of Wire Rope Internal Interfaces: The Influence of Key Lubrication Parameters
Christopher Dyson, William Hopkins, Michael Cassidy, ITW ROCOL, Leeds, West Yorkshire, United Kingdom; Richard Chittenden, University of Leeds, Leeds, West Yorkshire, United Kingdom; Martin Priest, Malcolm Fox, University of Bradford, Bradford, West Yorkshire, United Kingdom

11 – 11:30 am
3483644: Comparing Afton's Bespoke Stick Slip Rig with the Former Cincinnati Milacron Rig
Ralph Lumby, Afton Chemical Ltd., Bracknell, United Kingdom

11:30 am – Noon
3519445: Depletion of MoDTC and Synergism with OFM in Boundary Lubricated Tribological Contacts
Ardian Morina, Simon Barnes, Shahriar Kosarieh, Anne Neville, University of Leeds, Leeds, Leeds, United Kingdom; David Gillespie, Gareth Moody, Croda International, Goole, United Kingdom

Noon – 12:30 pm
3499299: Reconditioning Lubricating Oils: The Tribological Performance Perspective
Arnaud Ruellan, Aldara Naveira-Suarez, SKF Group, Goteborg, Sweden

12:30 – 1 pm
3484933: Electric Current Effects on Wind Turbine Bearing Steel: Test Rig and Results
Robert Erck, Benjamin Gould, Nicholaos Demas, Aaron Greco, Argonne National Laboratory, Lemont, IL

5G • Virtual Meeting Room 7
ROLLING ELEMENT BEARINGS III

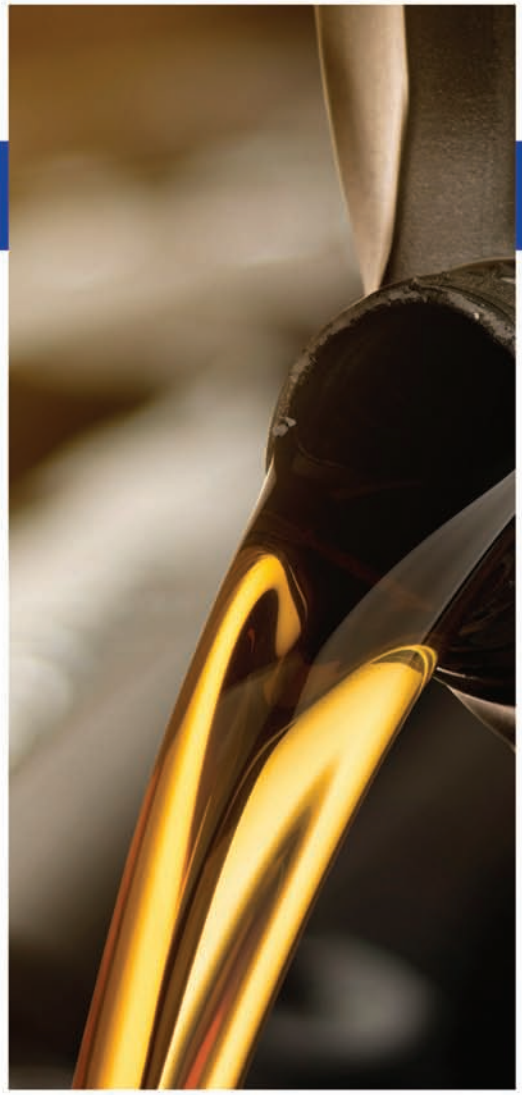
Session Chair: Hannes Grillenberger, Schaeffler Technologies AG and Co KG, Herzogenaurach, Germany

11 – 11:30 am
3483981: A Mechanistic Approach to Understand Rolling Contact Fatigue (RCF) Induced Microstructural Alterations
Muhammad Abdullah, Zulfiqar Khan, Bournemouth University, Bournemouth, Dorset, United Kingdom; Wolfram Kruhoeffer, Schaeffler Technologies AG und Co KG, Herzogenaurach, Bayern, Germany

11:30 am – Noon
3489226: Mechanistic Study of White Etching Bands Formation in Bearing Steel Due to RCF
Mostafa El Laithy, Ling Wang, Terry Harvey, University of Southampton, Southampton, Hampshire, United Kingdom; Bernd Vierneusel, Schaeffler Technologies AG and Co KG, Schweinfurt, Germany

Noon – 12:30 pm
3495122: Fracture-Mechanical Evaluation of Inclusions – Comparison with Test Results
Joerg Binderszewsky, Wolfram Kruhoeffer, Toni Blass, Schaeffler Technologies AG & Co. KG, Herzogenaurach, Germany

12:30 – 1 pm – Rolling Element Bearings Business Meeting



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5H • Virtual Meeting Room 8

NONFERROUS METALS III

Session Chair: Tom Oleksiak, Quaker Houghton, Acworth, GA

10:30 – 11 am
3485144: Structure-Performance Evaluation of Synthetic Metalworking Fluid Additives
Tiffany Meyers, Stephanie Cole, Clariant, Mount Holly, NC

11 – 11:30 am
3476767: Chemistry Behind Settling Metal Fines in Aqueous Metalworking Fluids
Stefanie Velez, Münzing Chemie GmbH, Bloomfield, NJ

11:30 am – Noon
3495372: Gas-to-Liquids (GTL) Technology Offers Advances in Metalworking and Aluminum Rolling Fluids while Enhancing Safety, Performance, and Environmental Sustainability
Gregory Wehr, ChemGroup, Inc., Louisville, KY

5I • Virtual Meeting Room 9

COMMERCIAL MARKETING FORUM V

10:30 – 11 am – Functional Products
3577954: Introducing V-705, a New and Unique Synthetic Basestock for Automotive and Industrial Applications
Gavin Duckworth

11 – 11:30 am – ANGUS Chemical Co.
3577794: Benefits of CORRGUARD™ Additives in Metalworking Fluid Formulations and Beyond
Min Chen

11:30 am – Noon – King Industries
3578764: NA-LUBE KR Alkylated Naphthalenes for High Temperature Application
Amanda Harris

Noon – 12:30 pm – TestOil
3578640: Should I Change My Lubricant When the Color Changes?
Heather Vercillo

12:30 – 1 pm – Chevron Phillips Chemical Company
3576286: PAOs and Electric Applications
Ken Hope

6A • Virtual Meeting Room 1

BIOTRIBOLOGY II

Session Chair: Alison Dunn, University of Illinois, Urbana, IL

2 – 2:30 pm
3483667: Acoustic Emission Signals as a Diagnostic Tool for Joint Wear
Khadijat Olorunlambe, Zhe Hua, Duncan Shepherd, Karl Dearn, University of Birmingham, Birmingham, United Kingdom

2:30 – 3 pm
3499235: Wear of Antibacterial Coatings on CoCrMo Under Butterfly Motion and Dynamic Loads in a Biotribometer
Deepak Halenahally Veeregowda, Angela Maria Tortora, Ducom Instruments, Groningen, Netherlands

3 – 3:30 pm – Break

3:30 – 4 pm
3515762: Oral Tribology, Lubrication and Adsorption of Alternative Food Proteins
Ben Kew, Anwesha Sarkar, Melvin Holmes, University of Leeds, Leeds, Yorkshire, United Kingdom

4 – 4:30 pm
3512880: Soft Matter Tribology in Biology
Angela Pitenis, Allison Chau, Jonah Rosas, George Degen, University of California, Santa Barbara, Santa Barbara, CA

4:30 – 5 pm – Biotribology Business Meeting

6B • Virtual Meeting Room 2

2D MATERIALS/ SUPERLUBRICITY

Materials Tribology & Nanotribology Joint Session III

Session Chair: Azhar Vellore, Martini Research Group, University of California, Merced, Merced, CA

Session Vice Chair: Mohammad Vazirisereshk, University of California, Merced, Merced, CA

2 – 2:30 pm
3499763: Phase Transitions in Alkanes Confined at Graphitic Interface
Prathima Nalam, Behnoosh Sattari Baboukani, SUNY University at Buffalo, Buffalo, NY; Zhijiang Ye, Miami University, Oxford, OH

2:30 – 3 pm
3492606: Nanotribology of 2D Transition Metal Dichalcogenides: The Effect of Chalcogen Variation on Frictional Behavior of MoS_2, $MoSe_2$ and $MoTe_2$
Mohammad Vazirisereshk, Ashlie Martini, University of California Merced, Merced, CA; Kathryn Hasz, Robert Carpick, University of Pennsylvania, Philadelphia, PA

3 – 3:30 pm – Break

(Session starts at 4 pm)

4 – 4:30 pm
3484804: Contact Aging in Structural Superlubricity
Wai Oo, Mehmet Baykara, University of California, Merced, Merced, CA

4:30 – 5 pm
3484587: Inverse Layer Dependence of Friction on Chemically Doped MoS_2
Mehmet Baykara, Ogulcan Acikgoz, University of California, Merced, Merced, CA; Alper Yanilmaz, Cem Celebi, Izmir Yuksek Teknoloji Enstitusu, Izmir, Turkey; Omur Dagdeviren, McGill University, Montreal, Quebec, Canada

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6B | 2D Materials/Superlubricity (con't)

5 – 5:30 pm
3498096: Why is Friction at the Graphene Step Edge So High While Friction on the Basal Plane is So Low?
Zhe Chen, Seong Kim, Pennsylvania State University, University Park, PA

6C • Virtual Meeting Room 3
ENGINE AND DRIVETRAIN II

Session Chair: Hamed Ghaednia, Gehring Group, Farmington Hills, MI

2 – 2:30 pm
3482399: The Effect of Engine Oil and Lubrication System Design on Engine Friction as Demonstrated in a Motored Engine
William Anderson, Kongsheng Yang, Zhang Yun, Sha Yang, Afton Chemical Corp., Richmond, VA; Yuelei Ding, Pan Asia Technical Automotive Center Co. Ltd., Pudong, Shanghai, China

2:30 – 3 pm
3484731: Friction and Wear of Thermal Spray Coatings for Cylinder Bores
Arup Gangopadhyay, Cliff Maki, Larry Elie, Robert Zdrodowski, Zhiqiang Liu, Urban Morawitz, Ford Motor Company, Dearborn, MI; Hamed Ghaednia, Gehring Group, Farmington Hills, MI; Joachim Patschull, Ford Motor Company (Retired), Cologne, Germany

3 – 3:30 pm – Break

3:30 – 4 pm
3499847: Benchtop Test for Screening Wet Clutch Materials
Carlos Sanchez, Southwest Research Institute, San Antonio, TX

4 – 4:30 pm
3484474: Road to Ultra-Low Viscosity 0W Oils: Quantifying Frictional Benefits on the Journal Bearing Machine
Priyanka Desai, Shell Global Solutions (US) Inc., Houston, TX; Konstantinos Kalogiannis, Omar Mian, MAHLE Engine Systems UK Ltd., Rugby, United Kingdom; Francesco Manieri, Tom Reddyhoff, Imperial College London, London, United Kingdom; Robert Mainwaring, Shell Global Solutions UK, London, United Kingdom

4:30 – 5 pm – Engine and Drivetrain Business Meeting

6D • Virtual Meeting Room 4
LUBRICATION FUNDAMENTALS III: ADDITIVES II

Session Chair: Brendan Miller, Chevron Oronite Co., Richmond, CA

Session Vice Chair: Stephen Hsu, George Washington University, Germantown, MD

2 – 2:30 pm
3497165: Engine Test of Microencapsulated Friction Modifier Additives for Fuel Economy Enhancement
Stephen Hsu, Govindaiah Patakamuri, George Washington University, Germantown, MD; Timothy Cushing, General Motors Corp., Detroit, MI

2:30 – 3 pm
3497186: Fuel Economy Improvement Using Ultralow Viscosity Lubricants
Stephen Hsu, Govindaiah Patakamuri, GWU, Germantown, MD; Timothy Cushing, General Motors Corp, Detroit, MI

3 – 3:30 pm – Break

3:30 – 4 pm
3478919: Tuned Polar Methacrylate Viscosity Index Improvers for Enhanced Shear Stability and Wear Prevention
Lelia Cosimbescu, Kristen Campbell, Miao Song, Dongsheng Li, Marie Swita, Pacific Northwest National Laboratory, Richland, WA; Robert Erck, Argonne National Laboratory, Lemont, IL

4 – 4:30 pm
3499618: Exploring New and Innovative Additives for Extreme Tribological (ET) Performance
Liwen Wei, Novitas Chem Solutions, Houston, TX

4:30 – 5 pm
3483942: Investigation on the Superlubricity and Nanomechanics of Liposome Adsorption on Titanium Alloys
Yuhong Liu, Tsinghua University, Beijing, China

5 – 5:30 pm
3483490: The Importance of Tribology in Climate Discussions and for Sustainability Goals
Mathias Woydt, MATRILUB, Berlin, Germany

5:30 – 6 pm – Lubrication Fundamentals Business Meeting

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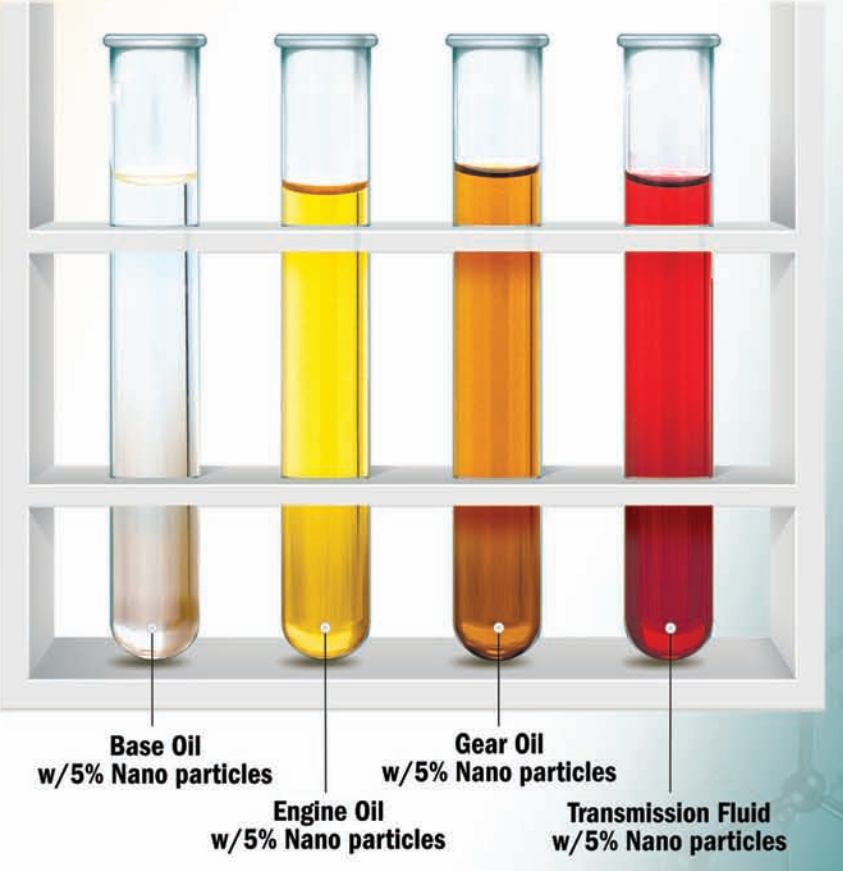
Time: 4:00pm to 4:30pm EST
Session: Nanotribology II



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6E • Virtual Meeting Room 5

WEAR II

Session Chair: Ali Beheshti, George Mason University, Fairfax, VA

2 – 2:30 pm

3541859: Effects of Lubricant Additives on Fretting Wear

Artemis Kontou, Hugh Spikes, Imperial College London, London, United Kingdom; Ian Taylor, Shell Global Solutions UK, London, Cheshire West and Chester, United Kingdom

2:30 – 3 pm

3519346: Friction and Surface Interaction Analysis of PDC on Granite and Carbonate Rocks

John Bomidi, Chengjiao Yu, Marc Bird, Baker Hughes Company, The Woodlands, TX; Maria Cinta Lorenzo Martin, Oyelayo Ajayi, Argonne National Laboratory, Lemont, IL

3 – 3:30 pm – Break

3:30 – 4 pm

3486651: A Review of Tribological and Surface Behavior of MAX Phase-Based Composites

Surojit Gupta, Maharshi Dey, Sabah Javaid, Caleb Matzke, University of North Dakota, Grand Forks, ND; Nikhil Murthy, CCDC Army Research Laboratory, Aberdeen Proving Ground, MD; Stephen Berkebile, Army Research Laboratory, Aberdeen Proving Ground, MD

4 – 4:30 pm

3496983: The Surface Effects of Nanofluid Action on Heat-Exchanger Materials: Testing and Assessment

Gustavo Molina, Fnu Aktaruzzaman, Mosfequr Rahman, Valentin Soloiu, Georgia Southern University, Statesboro, GA

4:30 – 5 pm

3498960: Elevated Temperature Fretting Wear Study of Additively Manufactured Inconel 625 with Varying Process Parameters

Manisha Tripathy, Ali Beheshti, George Mason University, Fairfax, VA; Keivan Davami, The University of Alabama, Tuscaloosa, AL

5 – 5:30 pm

3580118: Statistical Considerations in Wear Scar Measurement in Antifriction Coatings

Melissa Mushrush, DuPont de Nemours Inc, Wilmington, DE; Kevin Wier, Dow Chemical Co, Midland, MI

5:30 – 6 pm – Wear Business Meeting

6F • Virtual Meeting Room 6

TRIBOTESTING II

Session Chair: Daulton Isaac, Air Force Research Laboratory, Wright Patterson AFB, OH

Session Vice Chair: Alessandro Ralls, University of Nevada Reno, Reno, NV

2 – 2:30 pm

3499215: Repeatability of Friction and Wear of Different Material Pairs at 1000°C under Unidirectional Sliding Motion

Debdutt Patro, Harish Prasanna, Sravan Kumar Josyula, Angela Maria Tortora, Fabio Alemanno, Deepak Halenahally Veeregowda, Ducom Instruments, Groningen, Netherlands

2:30 – 3 pm

3473453: Testing for Friction Differences Between Oils

Kenneth Budinski, Bud Labs, Rochester, NY

3 – 3:30 pm – Break

3:30 – 4 pm

3481715: Wear and Viscosity Effects of Mineral Oil Dilution by Biodiesels and their Methyl Esters

Gustavo Molina, John Morrison, Emeka Onyejizu, Valentin Soloiu, Georgia Southern University, Statesboro, GA

4 – 4:30 pm

3484531: Extracting More Value From Tribofilm Images

Oluwaseyi Ogunsola, Shell Global Solutions USA Inc., Houston, TX; Chaitanya Pradan, Aarthi Thyagarajan, Vishal Ahuja, Shell India Markets Private Limited, Bengaluru, Karnataka, India

4:30 – 5 pm

3522420: Advanced Capacitance Sensors for Tribological Characterization of Superlubricity Conditions

Tushar Khosla, Jun Xiao, Nick Doe, Rtec-Instruments, San Jose, CA; Pradeep Menezes, University of Nevada Reno, Reno, NV

5 – 5:30 pm

3479016: Synergistic Action of Friction Modifier (MoDTC) with PTFE NPs as an Additive

Vinay Saini, Jayashree Bijwe, IIT Delhi, Delhi, India

5:30 – 6 pm – Tribotesting Business Meeting

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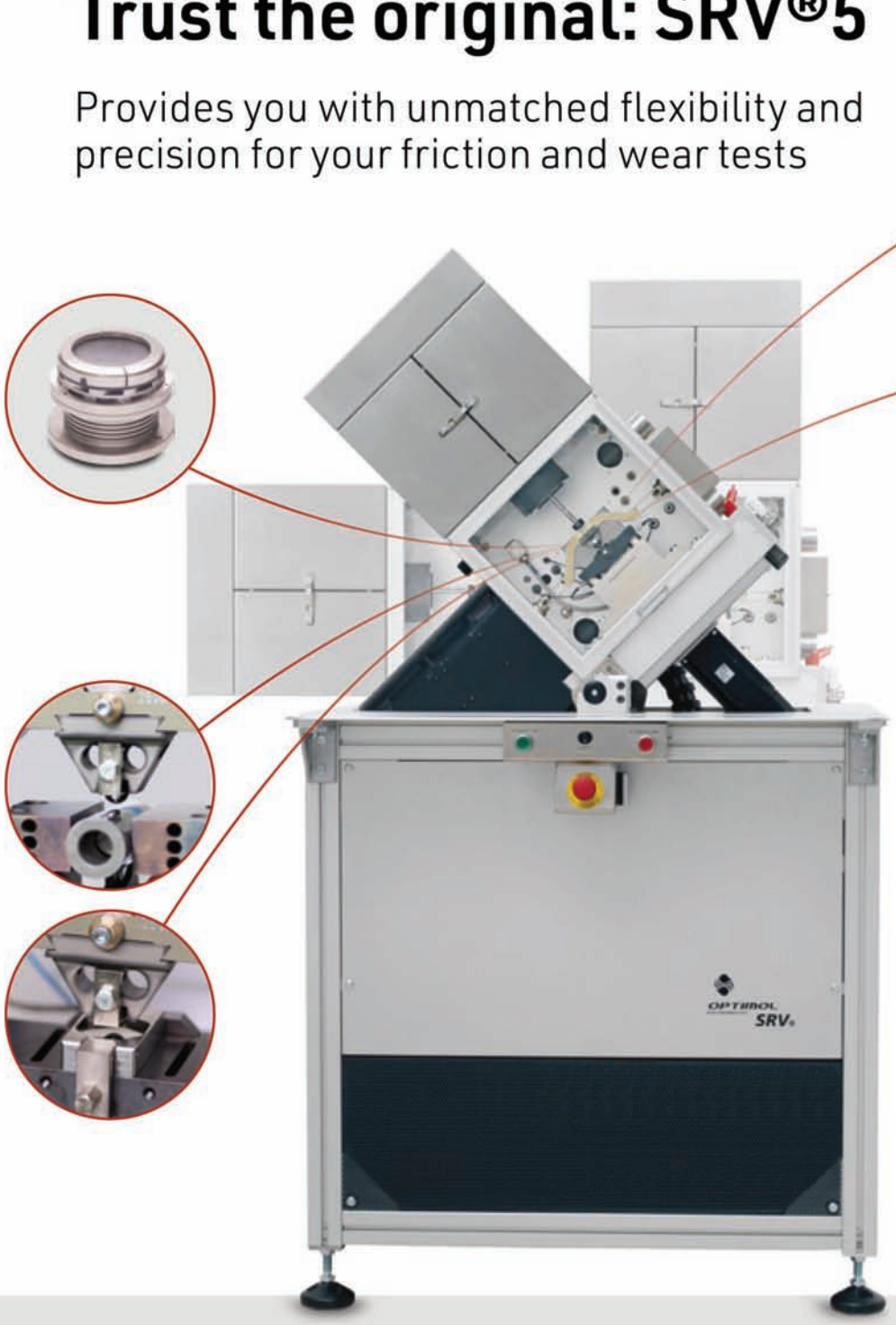

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6G • Virtual Meeting Room 7

ROLLING ELEMENT BEARINGS IV

Session Chair: Bryan Allison, SKF Aeroengine, Clymer, NY

2 – 2:30 pm

3543554: Influence of Vibration Induced Standstill Marks (Fretting) on Bearings of E-drives

Markus Grebe, Hochschule Mannheim, Mannheim, Germany

2:30 – 3 pm

3483088: Numerical Modeling of Three-Dimensional Crack Propagation Under Rolling Contact Fatigue

Florian Meray, Daniel Nelias, Anthony Gravouil, Thibaut Chaise, Univ Lyon, INSA-Lyon, CNRS, LaMCoS, Villeurbanne, France; Bruno Descharrieres, Airbus Helicopters, Aéroport International Marseille Provence, Marignane, France

3 – 3:30 pm – Break

3:30 – 4 pm

3480860: Experimental Investigation of Influence of Different Heat Treatments on Fracture Behavior of High Strength Bearing Steels

Nikhil Londhe, Scott Hyde, The Timken Company, Canton, OH

4 – 4:30 pm

3498853: Propagation of Rolling Contact Fatigue Cracks in Ball Bearing

Kenji Matsumoto, Honda Research and Development Japan Inc, Tochigi, Takanezawa, Tochigi, Japan; Naoaki Yoshida, Kyushu University, Kasuga, Fukuoka, Japan; Akira Sasaki, Maintek Consulting, Yokohama, Kanagawa, Japan

4:30 – 5 pm

3485677: The Effect of Electrical Current on Premature Fatigue and Microstructural Alterations in Bearing Steel

Benjamin Gould, Robert Erck, Nicholaos Demas, Oyelayo Ajayi, Maria Cinta Lorenzo Martin, Aaron Greco, Argonne National Laboratory, Lemont, IL

6H • Virtual Meeting Room 8

TRIBOCHEMISTRY

Materials Tribology & Nanotribology Joint Session I

Session Chair: Mark Sidebottom, Miami University, Oxford, OH

Session Vice Chair: Mary Makowiec, Pratt & Whitney, East Hartford, CT

2 – 2:30 pm

3498014: Wear Penalty for Steel Rubbing Against Hard Coatings in Reactive Lubricants

Xin He, Harry Meyer, Huimin Luo, Jun Qu, Oak Ridge National Laboratory, Oak Ridge, TN

2:30 – 3 pm

3498032: Investigation of Friction and Wear Behavior in Chloride Molten Salt for Concentrating Solar Power Pump Bearings

Xin He, Rick Wang, Dino Sulejmanovic, James Keiser, Kevin Robb, Jun Qu, Oak Ridge National Laboratory, Oak Ridge, TN

3 – 3:30 pm – Break

3:30 – 4 pm

3485147: Tribological Behavior of PS400-Related Tribopairs for Space Exploration

Vasilis Tsigkis, Kian Bashandeh, Andreas Polycarpou, Texas A&M University, College Station, TX; Pixiang Lan, ATSP Innovations, Champaign, IL

4 – 4:30 pm

3485317: Development of Self-Adaptive Lubricating Silver Aluminum Borate Composite for Wide Temperature Range

Ashish Kasar, Pradeep Menezes, University of Nevada, Reno, Reno, NV

4:30 – 5 pm

3484977: Dependence of Tribological Performance and Tribopolymerization on the Surface Binding Strength of Selected Cycloalkane-Carboxylic Acid Additives

Qiang Ma, Arman Mohammad Khan, Q. Jane Wang, Yip-Wah Chung, Northwestern University, Evanston, IL

6I • Virtual Meeting Room 9

GREASE I

Session Chair: Kuldeep Mistry, The Timken Company, North Canton, OH

Session Vice Chair: Cindy Liu, Klüber Lubrication NA, LP, Londonderry, NH

2 – 2:30 pm

3532329: Fully Customizable Calcium Sulfonate Greases for Optimum Performances

Marie Legatte, Guillaume Notheaux, SEQENS, Porcheville, France

2:30 – 3 pm

3484679: Adhesion and Tackiness of Greases: From Concept to an ASTM Standard Method

Emmanuel Georgiou, Dirk Drees, Michel De Bilde, Falex Tribology NV, Rotselaar, Belgium; Michael Anderson, Falex Corporation, Sugar Grove, IL; Satish Achanta, ASML Netherlands BV, Veldhoven, North Brabant, Netherlands; Manfred Jungk, MJ Tribology, Geisenheim, Germany

3 – 3:30 pm – Break

3:30 – 4 pm

3480662: New Method to Measure Grease Tackiness and Comparison with Water Resistance and Low-Temperature Mobility

Anoop Kumar, Chevron Lubricants, Richmond, CA

4 – 4:30 pm

3473181: Back to the Basics – Part II: Fundamental Building Blocks of Grease Formulation – The Next Story

Joseph Kaperick, Afton Chemical Corporation, Richmond, VA

6J • Virtual Meeting Room 10

COMMERCIAL MARKETING FORUM VI

2 – 2:30 pm – BYK

2:30 – 3 pm – Clariant

3 – 3:30 pm – Break

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THURSDAY

Explore the latest industry trends

New Edition of STLE Report Maps Future Trends in Tribology and Lubricants

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Overview

Thursday, May 20, 2021

8:30 – 10 am
Thursday Keynote Session

Keynote Speaker:

- Dr. Christopher Williams, Professor of Mechanical Engineering, Virginia Tech

10 – 10:30 am
Networking Break & Special Programming

10 am – 3:30 pm
Virtual Exhibits and Student Posters

10:30 am – 1 pm
Thursday Technical Sessions:

- 7A – Grease II
- 7B – Contact Mechanics I
- 7C – Engine & Drivetrain III
- 7D – Lubrication Fundamentals IV: EHL
- 7E – Tribochemistry – Materials Tribology & Nanotribology Joint Session II
- 7F – Tribotesting III
- 7G – Rolling Element Bearings V
- 7H – Surface Engineering I

1 – 2 pm
Plenary Program – Session #2

Plenary Speaker:

- Dr. Jim MacLeod, Group Leader, National Research Council Canada

2 – 6 pm
Thursday Technical Sessions:

- 8A – Grease III
- 8B – Contact Mechanics II
- 8C – Engine & Drivetrain IV
- 8D – Lubrication Fundamentals V: Viscosity
- 8E –Tribochemistry – Materials Tribology & Nanotribology Joint Session III
- 8F – Additive Manufacturing II: Special Symposium
- 8G – Rolling Element Bearings VI
- 8H –Surface Engineering II

3 – 3:30 pm
Networking Break & Special Programming

Trade Show Hours:

- Monday, May 17: 10 am – 4 pm
- Tuesday, May 18: 10 am – 3:30 pm
- Wednesday, May 19: 10 am – 3:30 pm
- Thursday, May 20: 10 am – 3:30 pm

(All times listed are Eastern Daylight Time)

TIME	SESSION 7A Grease II Virtual Meeting Room 1	SESSION 7B Contact Mechanics I Virtual Meeting Room 2	SESSION 7C Engine & Drivetrain III Virtual Meeting Room 3
10:30 – 11 am	The Effects of Addition of Zinc Carboxylate in Grease on the Tribological Properties of PA66-GF Composite in Contact with Carbon Steel, T. Kunishima, p. 68	The Origin of the Friction Coefficient for Randomly Rough Surfaces in Elastic Contact, F.-Chun Hsia, p. 68	A System Engineering Approach to Reduce Soot Wear, D. Halenahally Veeregowda, p. 68
11 – 11:30 am	Tribology Bench Tests for the Development of Next-Generation Greases with Optimized Lubrication Properties, R. McAllister, p. 68	High Temperature Contact Creep and Friction of Inconel 617 Surface Oxides, S. Salari, p. 68	Tribofilm Chemistry for Engine Oils Formulated with Organic Polymeric Friction Modifiers, D. Gillespie, p. 68
11:30 – Noon	Yielding Behavior of a Fumed Silica Lubricating Grease, B. Zakani, p. 68	Analysis of Asperity Creep of a Rough Random Surface in Contact with a Rigid Flat Surface, F. Alamos, p. 68	Enhanced Tribofilm Formation and Wear of Engine Oils under Stressed Boundary Conditions, H. Gao, p. 68
Noon – 12:30 pm		Investigating the Influence of Topography on the Magnitude and Variation of Surface Adhesion in Hard Contacts, L. Thimons, p. 68	An Integrated Approach to Measure Electrical Conductivity of Working Lubricants, Y. Chen, p. 68
12:30 – 1 pm			
1 – 2 pm	**Plenary Program #2**	**Plenary Program #2**	**Plenary Program #2**
	SESSION 8A **Grease III** **Virtual Meeting Room 1**	**SESSION 8B** **Contact Mechanics II** **Virtual Meeting Room 2**	**SESSION 8C** **Engine & Drivetrain IV** **Virtual Meeting Room 3**
2 – 2:30 pm	Grease Improvement Process for High-Speed Passenger Trains, L. de Vries, p. 70	Mechanics Models for Contacts in Lithium Metal Batteries, Q. Jane Wang, p. 70	Power Loss Measurement of Planetary Gear Stages with High Power Density, F. Siglmüller, p. 72
2:30 – 3 pm	Effect of Temperature and Surface Roughness on the Tribological Behavior of Electric Motor Greases as a Baseline for Electric Vehicle Bearing Applications, D. Sanchez Garrido, p. 70	Exact Spectral Moments and Differentiability of the Weierstrass-Mandelbrot Fractal Function, I. Green, p. 70	Correlating Viscosity to Fuel Efficiency in the Heavy-Duty Diesel Engine Fuel Efficiency Tests and the Influence of Viscosity Index Improvers, L. Camposo, p. 72
3 – 3:30 pm	**Networking Break**	**Networking Break**	**Networking Break**
3:30 – 4 pm	Oscillating Wear – A Little Back and Forth, R. Kumar, p. 70	An Investigation of the Elastic Cylindrical Line Contact Equations for Plane Strain and Stress Considering Friction, R. Jackson, p. 72	Effects of Lubricant Additives on Copper in Soaking Test, X. Fang, p. 72
4 – 4:30 pm	Using Polymers to Improve Water Resistance in H1 or Biobased Greases, E. Willett, p. 70	Contact Mechanics Simulations of Gradient Stiffness Soft Materials, A. Dunn, p. 72	Frictional Performance of Novel Eco-Friendly Organic Lubricity Additives in Passenger Car Motor Oil (PCMO) Formulations, R. Navaratnam, p. 72
4:30 – 5 pm	Grease Business Meeting	Contact Mechanics Business Meeting	Organic Polymeric Friction Modifiers Effects on Tribofilm Formation and Properties in HDDEO Formulations, A. Kurchan, p. 72
5 – 5:30 pm			Study on Polymer Colloids as a Friction Modifier, K. Yamamoto, p. 72
5:30 – 6 pm			

SESSION 7D Lubrication Fundamentals IV: EHL	SESSION 7E Tribochemistry II	SESSION 7F Tribotesting III	
Virtual Meeting Room 4	**Virtual Meeting Room 5**	**Virtual Meeting Room 6**	
Friction Increase in Starved EHL Contact, P. Sperka, p. 69	Effect of Environment on Friction Reduction Capabilities of Spin-Coated MoDTC, C. Minfray, p. 69	Effects of N-Butanol in Ultra-Low-Sulfur Diesel Mixtures on Wear, Friction and Viscosity, G. Molina, p. 69	**10:30 – 11 am**
A New Thermo-Elastohydrodynamic Lubrication Model for Journal and Sliding Bearing Systems, S. Ardah, p. 69		Improving Tool Life for Rotary Shear Biomass Comminution System, K. Lee, p. 69	**11 – 11:30 am**
Fluid-Structure Interaction Modeling of 2D Elastohydrodynamically Lubricated Contacts, K. Singh, p. 69	In Situ Tribochemical Formation of MoS_2 and WS_2 Tribofilms Using Mo and W-Containing Surfaces, M. Rodriguez Ripoll, p. 69	An Updated Method for Fuel Lubricity: Line-on-Cylinder Lubricity Evaluator (LOCLE), G. Hansen, p. 69	**11:30 – Noon**
Visco-Elastohydrodynamic Lubrication of Imperfectly Bonded Polymer Coating on Elastic Substrate, Q. Jane Wang, p. 69	Mechanisms for Decomposition of Antiwear Additives on Ferrous Surfaces: A REAXXFF Study of Phosphate Esters, C. Ayestaran Latorre, p. 69	Impact-Slide Wear Testing for Evaluation of Hard Coatings for Tooling Applications, S. Bhargava, p. 69	**Noon – 12:30 pm**
Thermal-Visco-Elastohydrodynamic Lubrication (TVEHL) of Polymer-Based Materials, Q. Jane Wang, p.69	Shear-Driven Dissociation of Organosulfur Compounds on Iron, K. Mohammadtabar, p. 69	Use of Gas-Phase-Synthesized Grapened as an Anti-Wear Lubricant Additive, G. Krauss, p. 69	**12:30 – 1 pm**
Plenary Program #2	**Plenary Program #2**	**Plenary Program #2**	**1 – 2 pm**

SESSION 8D Lubrication Fundamentals V: Viscosity	SESSION 8E Tribochemistry III	SESSION 8F Additive Manufacturing II	
Virtual Meeting Room 4	**Virtual Meeting Room 5**	**Virtual Meeting Room 6**	
Estimating the Viscosity-Pressure Response from Friction and Film Thickness Measurements under Elastohydrodynamic Conditions, E. Gendreau, p. 72	From Friction to Function, J. Felts, p. 72	Effect of a Newly Developed Laser Cladding Alloy on the Tribological Properties of Cladded Hypereutectoid Rails, P. Fasihi, p. 74	**2 – 2:30 pm**
Viscosity-Temperature Equations for Petroleum-Based Lubricating Oils, J. Zakarian, p. 72		Discussion of C\corrosion & Wear of Additively Manufactured Alloys, P. Renner, p. 74	**2:30 – 3 pm**
Networking Break	**Networking Break**	**Networking Break**	**3 – 3:30 pm**
A Novel Microfluidic Rheometer for Rapid Viscosity Measurements over Wide Shear Rate Ranges, G. Irvine, p. 72	Tribocatalysis of Lubricating Carbon Films, D. Berman, p. 72	Computation of Hydrodynamic and Capillary Phenomena in Binder Jet 3D Printing, J. Wagner, p. 74	**3:30 – 4 pm**
	Stress-Induced Mechanochemical Decomposition of Methyl Thiolate on Cu(100), A. Boscoboinik, p. 72	Investigation on the Rolling Contact Fatigue Behaviours of Different Laser Cladding Materials on the Damaged Rail, H. Ding, p. 74	**4 – 4:30 pm**
	In Situ Study of the Normal Pressure-Dependent Lubrication Mechanism of Phosphonium Phosphate Ionic Liquid in Nanoscale Single-Asperity Sliding Contacts, F. Mangolini, p. 72	Effect of Heat Treatment and Electric Discharge Alloying on the Tribological Performance of Selective Laser Melted $AlSi_{10}Mg$, B. Kuriachen, p. 74	**4:30 – 5 pm**
	Encapsulation of Lubricious Ionic Liquids within Polymer Microshells, F. Mangolini, p. 74	Realization of a Novel Morphing Surface Using Additive Manufacturing and Its Active Control in Friction, M. Murashima, p. 74	**5 – 5:30 pm**
	Effect of Halide Contaminants on the Lubricating Properties of Phosphonium Phosphate Ionic Liquid, Z. Li, p. 74		**5:30 – 6 pm**

THURSDAY >>

TIME	SESSION 7G Rolling Element Bearings V Virtual Meeting Room 7	SESSION 7H Surface Engineering I Virtual Meeting Room 8
10:30 – 11 am	Dynamics in Kinematics – Running Noise Calculation of Bearings in the Kinematic Regime, H. Grillenberger, p. 70	Evaluation Tests of MAO-Coatings in Environmentally Safe Lubricants, N. Poches, p. 70
11 – 11:30 am	Dynamic Modeling of Cage Flexibility in Ball Bearings, K. Petuya, p. 70	In Situ SEM Tribological Studies of 3D-Printed Super-hydrophobic Hierarchical Textures, M. Afshar p. 70
11:30 – Noon	Backward Whirl-Shaped Cage Instability in Rolling Bearings, F. Unterderweide, p. 70	Fabrication and Friction Characteristics of Arbitrary Biosurfaces, S. Maddox, p. 70
Noon – 12:30 pm	A First Approximation of the Global Energy Consumption of Ball Bearings, V. Bakolas, p. 70	
12:30 – 1 pm	Voltage Induced Roller Bearing Fatigue, A. Harder, p. 70	
1 – 2 pm	**Plenary Program #2**	**Plenary Program #2**
	SESSION 8G **Rolling Element Bearings VI** **Virtual Meeting Room 7**	**SESSION 8H** **Surface Engineering II** **Virtual Meeting Room 8**
2 – 2:30 pm	Experimental and Numerical Assessment of Power Loss in an Aero-Engine Cylindrical Roller Bearing, R. Kerrouche, p. 74	Friction Reduction Effect of Soft Coatings, Z. Chen, p. 74
2:30 – 3 pm	A Novel Test Rig for the Investigation of Ball Bearing Cage Friction, T. Russell, p. 74	Post-Additive Manufacturing Surface Modification Technology for Controlling Microstructure and Tribological Properties of Materials, A. Amanov, p. 74
3 – 3:30 pm	**Networking Break**	**Networking Break**
3:30 – 4 pm	CFD Investigation of Deep Groove Ball Bearing Fluid Flow, W. Peterson, p. 74	Surface Engineering Business Meeting
4 – 4:30 pm		
4:30 – 5 pm		
5 – 5:30 pm		
5:30 – 6 pm		

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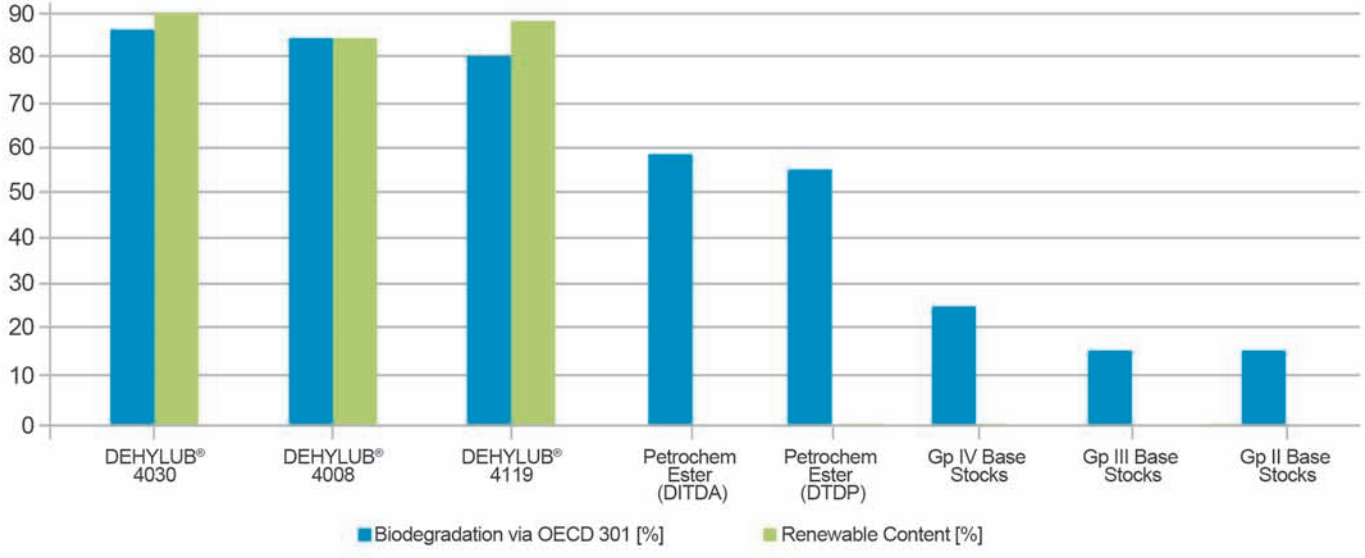

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2021 STLE Virtual Annual Meeting & Exhibition

TECHNICAL SESSIONS | Thursday, May 20, 2021

7A • Virtual Meeting Room 1

GREASE II

Session Chair: William Tuszynski, Unami Group, Quakertown, PA

Session Vice Chair: Kuldeep Mistry, The Timken Company, North Canton, OH

10:30 – 11 am

3490804: The Effects of Addition of Zinc Carboxylate in Grease on the Tribological Properties of PA66-GF Composite in Contact with Carbon Steel

Takeshi Kunishima, Jules Galipaud, Gaylord Guillonneau, Gaëtan Bouvard, Jean-Christophe Abry, Clotilde Minfray, Vincent Fridrici, Philippe Kapsa, Laboratoire de Tribologie et Dynamique des Systemes, Ecully, Auvergne-Rhône-Alpes , France

11 – 11:30 am

3499579: Tribology Bench Tests for the Development of Next-Generation Greases with Optimized Lubrication Properties

Rory McAllister, Marc Masen, Philippa Cann, Imperial College London, London, United Kingdom

11:30 am – Noon

3484425: Yielding Behavior of a Fumed Silica Lubricating Grease

Behzad Zakani, Dana Grecov, University of British Columbia, Vancouver, British Columbia, Canada

7B • Virtual Meeting Room 2

CONTACT MECHANICS I

Session Chair: Morgan Jones, Sandia National Laboratories, Albuquerque, NM

Session Vice Chair: Kylie Van Meter, Florida State University, Tallahassee, FL

10:30 – 11 am

3483691: The Origin of the Friction Coefficient for Randomly Rough Surfaces in Elastic Contact

Feng-Chun Hsia, Cyrian Leriche, Steve E. Franklin, Bart Weber, Advanced Research Center for Nanolithography, Amsterdam, Netherlands; Daniel Bonn, Universiteit van Amsterdam Faculteit der Natuurwetenschappen Wiskunde en Informatica, Amsterdam, Noord-Holland, Netherlands

11 – 11:30 am

3499189: High Temperature Contact Creep and Friction of Inconel 617 Surface Oxides

Sepehr Salari, Ali Beheshti, George Mason University, Fairfax, VA; Saifur Rahman, Andreas Polycarpou, Texas A&M University College Station, College Station, TX

11:30 am – Noon

3497896: Analysis of Asperity Creep of a Rough Random Surface in Contact with a Rigid Flat Surface

Fernando Alamos, David Go, University of Notre Dame College of Engineering, Notre Dame, IN; Martin Philo, GKN Aerospace, Santa Ana, CA; Steven Schmid, University of North Carolina at Charlotte, Charlotte, NC

Noon – 12:30 pm

3498933: Investigating the Influence of Topography on the Magnitude and Variation of Surface Adhesion in Hard Contacts

Luke Thimons, Abhijeet Gujrati, Tevis Jacobs, University of Pittsburgh, Pittsburgh, PA; Antoine Sanner, Lars Pastewka, University of Freiburg, Freiburg, Germany

7C • Virtual Meeting Room 3

ENGINE AND DRIVETRAIN III

Session Chair: Feng Dong, Borg Warner, Auburn Hills, MI

10:30 – 11 am

3499264: A System Engineering Approach to Reduce Soot Wear

Deepak Halenahally Veeregowda, Angela Maria Tortora, Edona Hyla, Ducom Instruments, Groningen, Netherlands

11 – 11:30 am

3485400: Tribofilm Chemistry for Engine Oils Formulated with Organic Polymeric Friction Modifiers

David Gillespie, John Eastwood, Croda International plc, Goole, East Yorkshire, United Kingdom

11:30 am – Noon

3483859: Enhanced Tribofilm Formation and Wear of Engine Oils under Stressed Boundary Conditions

Hong Gao, Shell Global Solutions, Houston, TX

Noon – 12:30 pm

3497315: An Integrated Approach to Measure Electrical Conductivity of Working Lubricants

Yan Chen, Hong Liang, Texas A&M University, College Station, TX

7D • Virtual Meeting Room 4

LUBRICATION FUNDAMENTALS IV: EHL

Session Chair: Daniele Dini, Imperial College of London, London, United Kingdom

Session Vice Chair: Q. Jane Wang, Northwestern University, Evanston, IL

10:30 – 11 am

3519637: Friction Increase in Starved EHL Contact

Petr Sperka, Ivan Krupka, Martin Hartl, Vysoke Uceni Technicke v Brne Fakulta Strojniho Inzenyrstvi, Brno, Czechia

11 – 11:30 am

3516692: A New Thermo-Elastohydrodynamic Lubrication Model for Journal and Sliding Bearing Systems

Suhaib Ardah, Imperial College London, London, United Kingdom; Francisco Profito, Polytechnic School of the University of São Paulo, São Paulo, Brazil; Daniele Dini, Imperial College London, London, United Kingdom

11:30 am – Noon

3493168: Fluid-Structure Interaction Modeling of 2D Elastohydrodynamically Lubricated Contacts

Kushagra Singh, Farshid Sadeghi, Purdue University, West Lafayette, IN

Noon – 12:30 pm

3520760: Visco-Elastohydrodynamic Lubrication of Imperfectly Bonded Polymer Coating on Elastic Substrate

Q. Jane Wang, Tao He, Xin Zhang, Northwestern University, Evanston, IL; Yuchuan Liu, Zhe Li, Hun June Kim, Seongchan Park, General Motors Corp, Pontiac, MI

12:30 – 1 pm

3520772: Thermal-Visco-Elastohydrodynamic Lubrication (TVEHL) of Polymer-Based Materials

Q. Jane Wang, Tao He, Xin Zhang, Northwestern University, Evanston, IL; Yuchuan Liu, Zhe Li, Hun June Kim, Seongchan Park, General Motors Corp, Pontiac, MI

7E • Virtual Meeting Room 5

TRIBOCHEMISTRY

Materials Tribology & Nanotribology Joint Session II

Session Chair: John Curry, Sandia National Laboratories, Albuquerque, NM

Session Vice Chair: Tomas Babuska, Lehigh University, Bethlehem, PA

10:30 – 11:30 am

INVITED TALK

3573521: Effect of Environment on Friction Reduction Capabilities of Spin-Coated MoDTC

Clotilde Minfray, Jules Galipaud, Mayssa Al Karboutly, Julien Fontaine, Thierry Le Mogne, Manuel Cobian, Ecole Centrale de Lyon, Ecully, Rhône-Alpes, France; Gleb Veryasov, Pooja Gaval, Alexandre Verchere, Clément Camp, Alessandra Quadrelli, Chimie Catalyse Polymeres et Procedes, Villeurbanne, Rhône-Alpes, France; Bruno Reynard, Laboratoire de Geologie de Lyon Terre Planetes Environnement, Villeurbanne, Auvergne-Rhône-Alpes, France

11:30 am – Noon

3499581: In Situ Tribochemical Formation of MoS_2 and WS_2 Tribofilms Using Mo and W-Containing Surfaces

Manel Rodriguez Ripoll, AC2T research GmbH, Wiener Neustadt, Austria; Bernhard Kohlhauser, Carsten Gachot, TU Wien, Vienna, Austria; Carmen Vladu, CEST GmbH, Wiener Neustadt, Austria

Noon – 12:30 pm

3499082: Mechanisms for Decomposition of Antiwear Additives on Ferrous Surfaces: A REAXXFF Study of Phosphate Esters

Carlos Ayestaran Latorre, James Ewen, Daniele Dini, Imperial College London, London, United Kingdom; Arash Khajeh, Ashlie Martini, University of California, Merced, Merced, CA; Joshua Moore, Joseph Remias, Afton Chemical Corp., Richmond, VA

12:30 – 1 pm

3491049: Shear-Driven Dissociation of Organosulfur Compounds on Iron

Karen Mohammadtabar, Ashlie Martini, University of California, Merced, Merced, CA; Stefan Eder, Nicole Doerr, AC2T Research GmbH, Wiener Neustadt, Austria

7F • Virtual Meeting Room 6

TRIBOTESTING III

Session Chair: Robert Jackson, Auburn University, Auburn, AL

Session Vice Chair: Md Hafizur Rahman, University of Nevada Reno, Reno, NV; Pawan Panwar, University of California Merced, Merced, CA

10:30 – 11 am

3496872: Effects of N-Butanol in Ultra-Low-Sulfur Diesel Mixtures on Wear, Friction and Viscosity

Gustavo Molina, John Morrison, Valentin Soloiu, Cesar Carapia, Georgia Southern University, Statesboro, GA

11 – 11:30 am

3498614: Improving Tool Life for Rotary Shear Biomass Comminution System

Kyungjun Lee, Oak Ridge National Laboratory, Knoxville, TN

11:30 am – Noon

3499241: An Updated Method for Fuel Lubricity: Line-on-Cylinder Lubricity Evaluator (LOCLE)

Gregory Hansen, Southwest Research Institute, San Antonio, TX

Noon – 12:30 pm

3499325: Impact-Slide Wear Testing for Evaluation of Hard Coatings for Tooling Applications

Suvrat Bhargava, Ranjan Deshmukh, Bradley Schultz, Rodney Martens, TE Connectivity, Middletown, PA

12:30 – 1 pm

3499723: Use of Gas-Phase-Synthesized Grapened as an Anti-Wear Lubricant Additive

Gordon Krauss, Albert Dato, Harvey Mudd College, Claremont, CA; Matthew Siniawski, Loyola Marymount University, Los Angeles, CA

7G • Virtual Meeting Room 7

ROLLING ELEMENT BEARINGS V

Session Chair: Daniel Merk, Schaeffler Technologies, Schweinfurt, Bavaria, Germany

10:30 – 11 am

3480732: Dynamics in Kinematics – Running Noise Calculation of Bearings in the Kinematic Regime

Hannes Grillenberger, Schaeffler Technologies AG and Co KG, Herzogenaurach, Germany

11 – 11:30 am

3481713: Dynamic Modeling of Cage Flexibility in Ball Bearings

Karine Petuya, Univ Lyon, INSA-Lyon, CNRS, LaMCoS, Safran Aircraft Engines, France, Villeurbanne, Rhône, France; Daniel Nelias, Nans Biboulet, Univ Lyon, INSA-Lyon, CNRS, LaMCoS, Villeurbanne, France

11:30 am – Noon

3485034: Backward Whirl-Shaped Cage Instability in Rolling Bearings

Florian Unterderweide, Matthias Weigold, Eberhard Abele, Technical University Darmstadt, Darmstadt, Germany

Noon – 12:30 pm

3483379: A First Approximation of the Global Energy Consumption of Ball Bearings

Vasileios Bakolas, Philipp Roedel, Oliver Koch, Michael Pausch, Schaeffler Technologies AG and Co KG, Herzogenaurach, Germany

12:30 – 1 pm

3483683: Voltage Induced Roller Bearing Fatigue

André Harder, Lukas Piske, Tobias Schirra, Eckhard Kirchner, Technical University Darmstadt, Darmstadt, Germany

7H • Virtual Meeting Room 8

SURFACE ENGINEERING I

Session Chair: Ali Beheshti, George Mason University, Fairfax, VA

Session Vice Chair: Suvrat Bhargava, TE Connectivity, Middletown, PA

11 – 11:30 am

3497576: Evaluation Tests of MAO-Coatings in Environmentally Safe Lubricants

Nikita Poches, Vladimir Malyshev, National University of Oil and Gas (Gubkin University), Moscow, Russian Federation; Nicole Döerr, AC2T research GmbH, Wiener Neustadt, Austria

11:30 am – Noon

3499607: In Situ SEM Tribological Studies of 3D-Printed Super-hydrophobic Hierarchical Textures

Mahyar Afshar Mohajer, Min Zou, University of Arkansas, Fayetteville, AR

Noon – 12:30 pm

3497892: Fabrication and Friction Characteristics of Arbitrary Biosurfaces

Shelby Maddox, Xiaoxiao Han, Xiangbo Meng, Min Zou, University of Arkansas, Fayetteville, AR

8A • Virtual Meeting Room 1

GREASE III

Session Chair: Wenyang Zhang, Tesla, Inc., Sunnyvale, CA

Session Vice Chair: William Tuszynski, Unami Group, Quakertown, PA

2 – 2:30 pm

3481391: Grease Improvement Process for High-Speed Passenger Trains

Lieuwe de Vries, Sathwik Chatra, SKF, Houten, Utrecht, Netherlands

2:30 – 3 pm

3499663: Effect of Temperature and Surface Roughness on the Tribological Behavior of Electric Motor Greases as a Baseline for Electric Vehicle Bearing Applications

Daniel Sanchez Garrido, Samuel Leventini, Ashlie Martini, University of California, Merced, Merced, CA

3 – 3:30 pm – Break

3:30 – 4 pm

3485475: Oscillating Wear – A Little Back and Forth

Rajeev Kumar, Larry Decker, ExxonMobil Research and Engineering Company Annandale, Annandale, NJ; Joseph Kaperick, Afton Chemical Corporation, Richmond, VA

4 – 4:30 pm

3499464: Using Polymers to Improve Water Resistance in H1 or Biobased Greases

Erik Willett, Functional Products Inc., Macedonia, OH

4:30 – 5 pm – Grease Business Meeting

8B • Virtual Meeting Room 2

CONTACT MECHANICS II

Session Chair: Kylie Van Meter, Florida State University, Tallahassee, FL

Session Vice Chair: Tomas Babuska, Lehigh University, Bethlehem, PA

2 – 2:30 pm

3520752: Mechanics Models for Contacts in Lithium Metal Batteries

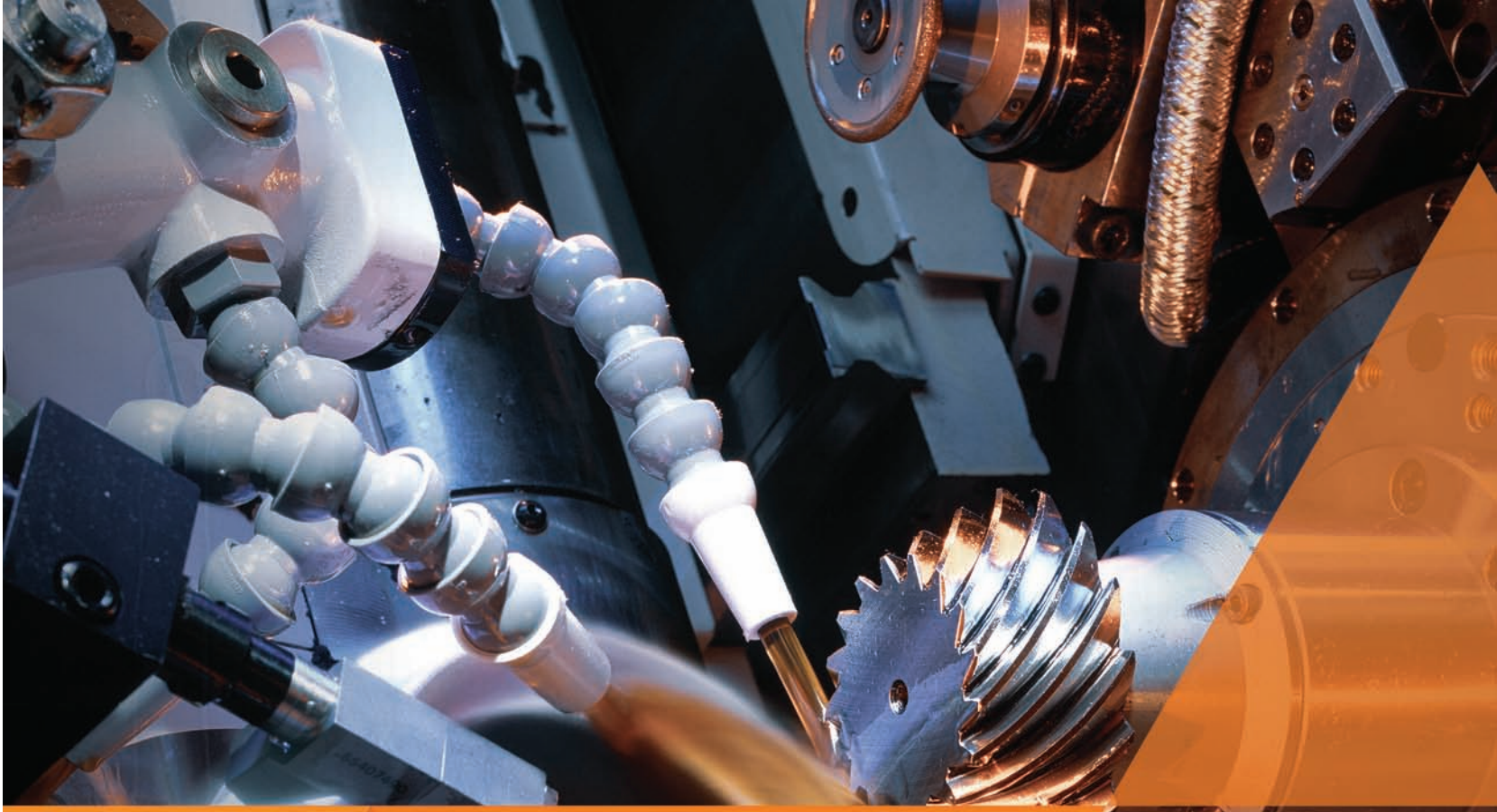
Q. Jane Wang, Xin Zhang, Northwestern University, Evanston, IL; Stephen Harris, E O Lawrence Berkeley National Laboratory, Berkeley, CA

2:30 – 3 pm

3490405: Exact Spectral Moments and Differentiability of the Weierstrass-Mandelbrot Fractal Function

Itzhak Green, Georgia Institute of Technology, Atlanta, GA

3 – 3:30 pm – Break



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8B | Contact Mechanics II (con't)

3:30 – 4 pm
3491370: An Investigation of the Elastic Cylindrical Line Contact Equations for Plane Strain and Stress Considering Friction
Robert Jackson, Kefei Xu, Nolan Chu, Auburn University, Auburn, AL

4 – 4:30 pm
3499152: Contact Mechanics Simulations of Gradient Stiffness Soft Materials
Alison Dunn, Md Mahmudul Hasan, Christopher Johnson, University of Illinois at Urbana-Champaign, Urbana, IL

4:30 – 5 pm – Contact Mechanics Business Meeting

8C • Virtual Meeting Room 3
ENGINE AND DRIVETRAIN IV

Session Chair: Carlos Sanchez, Southwest Research Institute, San Antonio, TX

2 – 2:30 pm
3485320: Power Loss Measurement of Planetary Gear Stages with High Power Density
Felix Siglmüller, Joshua Götz, Martin Sedlmair, Thomas Lohner, Karsten Stahl, Gear Research Centre (FZG), Technical University of Munich, Garching bei München, Germany

2:30 – 3 pm
3488659: Correlating Viscosity to Fuel Efficiency in the Heavy-Duty Diesel Engine Fuel Efficiency Tests and the Influence of Viscosity Index Improvers
Lucas Camposo, Phil Hutchinson, Boris Eisenberg, Julien Couet, Evonik Oil Additives, Horsham, PA

3 – 3:30 pm – Break

3:30 – 4 pm
3480558: Effects of Lubricant Additives on Copper in Soaking Test
Xinggao Fang, Afton Chemical, Richmond, VA

4 – 4:30 pm
3483835: Frictional Performance of Novel Eco-Friendly Organic Lubricity Additives in Passenger Car Motor Oil (PCMO) Formulations
Ramesh Navaratnam, Patech Fine Chemical, Dublin, OH

4:30 – 5 pm
3484509: Organic Polymeric Friction Modifiers Effects on Tribofilm Formation and Properties in HDDEO Formulations
Alexei Kurchan, Croda, New Castle, DE

5 – 5:30 pm
3484985: Study on Polymer Colloids as a Friction Modifier
Kenji Yamamoto, Kazuki Marumo, Tsuyoshi Hirmatsu, ADEKA Corporation, Arakawa-ku, Tokyo, Japan

8D • Virtual Meeting Room 4
LUBRICATION FUNDAMENTALS V: VISCOSITY

Session Chair: Ashlie Martini, University of California Merced, Merced, CA

Session Vice Chair: Nicole Döerr, AC2T research GmbH, Wiener Neustadt, Austria

2 – 2:30 pm
3486295: Estimating the Viscosity-Pressure Response from Friction and Film Thickness Measurements under Elastohydrodynamic Conditions
Eliane Gendreau, Janet Wong, Imperial College London, London, United Kingdom; Sarah Matthews, Shell Global Solutions (UK) Ltd., London, United Kingdom

2:30 – 3 pm
3473059: Viscosity-Temperature Equations for Petroleum-Based Lubricating Oils
Jack Zakarian, JAZTech Consulting, LLC, Orinda, CA; Ashlie Martini, Shaun Flannigan, Julian Gonzalez, University of California, Merced, Merced, CA

3 – 3:30 pm – Break

3:30 – 4 pm
3500906: A Novel Microfluidic Rheometer for Rapid Viscosity Measurements over Wide Shear Rate Ranges
Gordon Irvine, Charles Nider, Pascal Bru, Formulaction, Inc, Worthington, OH; Patrycja Adamska, Yoann Lefeuvre, Gerard Meunier, Formulaction, Dallas, TX

8E • Virtual Meeting Room 5
TRIBOCHEMISTRY
Materials Tribology & Nanotribology Joint Session III

Session Chair: Tomas Grejtak, Lehigh University, Bethlehem, PA

2 – 3 pm
INVITED TALK
3580562: From Friction to Function
Jonathan Felts, Texas A&M University, College Station, TX

3 – 3:30 pm – Break

3:30 – 4 pm
3496775: Tribocatalysis of Lubricating Carbon Films
Diana Berman, Asghar Shirani, Daniel Pleshek, University of North Texas, Denton, TX; Stephen Berkebile, Army Research Laboratory, Aberdeen Proving Ground, MD

4 – 4:30 pm
3499515: Stress-Induced Mechanochemical Decomposition of Methyl Thiolate on Cu(100)
Alejandro Boscoboinik, University of Pennsylvania, Philadelphia, PA; Wilfred Tysoe, University of Wisconsin-Milwaukee, Milwaukee, WI

4:30 – 5 pm
3483055: In Situ Study of the Normal Pressure-Dependent Lubrication Mechanism of Phosphonium Phosphate Ionic Liquid in Nanoscale Single-Asperity Sliding Contacts
Filippo Mangolini, Zixuan Li, Andrei Dolocan, Oscar Morales Collazo, Hugo Celio, Joan Brennecke, The University of Texas at Austin, Austin, TX; Jerzy Sadowski, Brookhaven National Laboratory, Upton, NY

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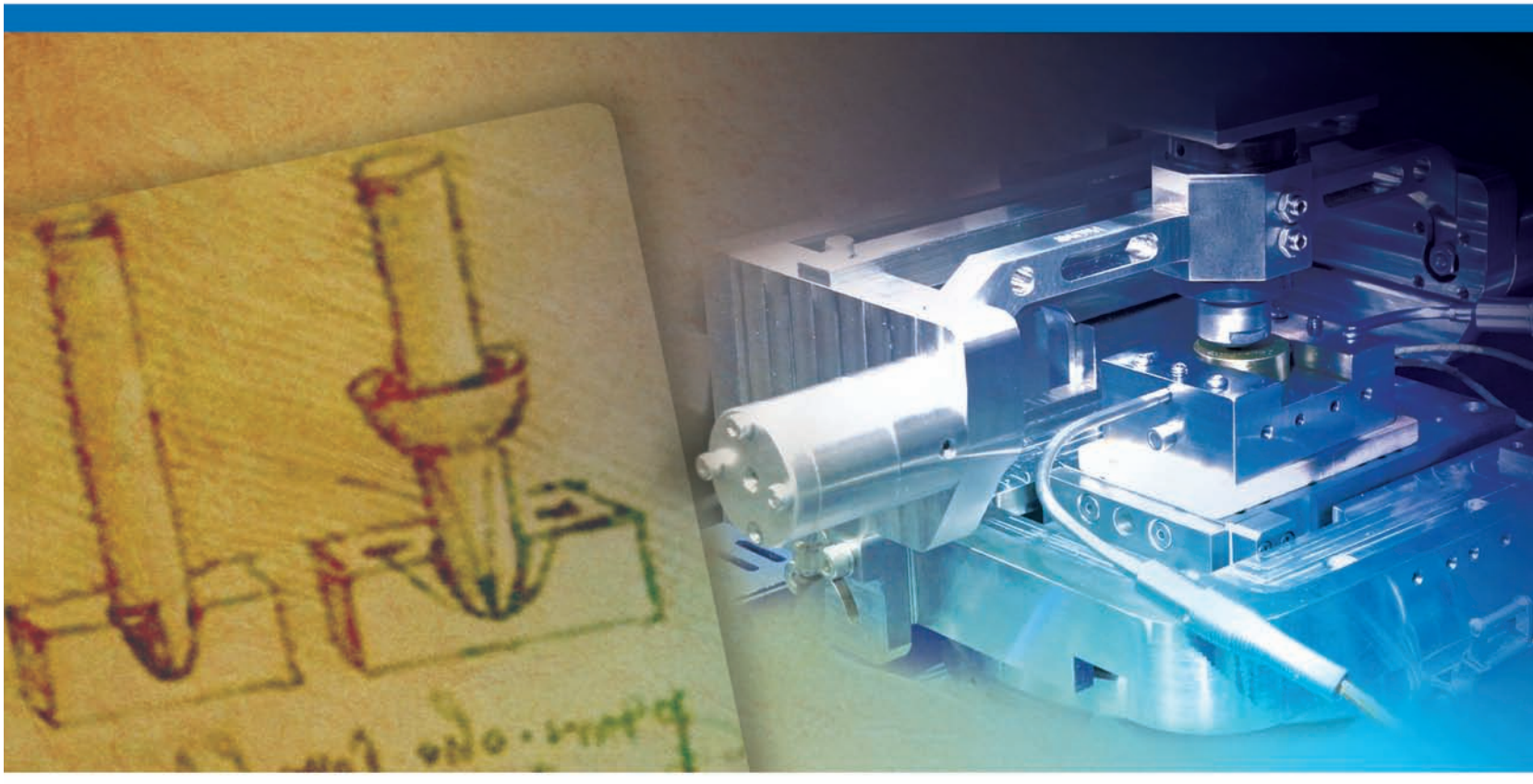

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8E | Tribochemistry (con't)

5 – 5:30 pm
3483058: Encapsulation of Lubricious Ionic Liquids within Polymer Microshells
Filippo Mangolini, Erynn Naccarelli, Jieming Yan, Ryan Misage, The University of Texas at Austin, Austin, TX

5:30 – 6 pm
3483064: Effect of Halide Contaminants on the Lubricating Properties of Phosphonium Phosphate Ionic Liquid
Zixuan Li, Filippo Mangolini, Hugo Celio, Nicolás Vergara, Jude Kershaw, Oscar Morales Collazo, Andrei Dolocan, Joan Brennecke, The University of Texas at Austin, Austin, TX

8F • Virtual Meeting Room 6
ADDITIVE MANUFACTURING II: SPECIAL SYMPOSIUM

Session Chair: Michael Khonsari, Louisiana State University, Baton Rouge, LA

2 – 2:30 pm
3580820: Effect of a Newly Developed Laser Cladding Alloy on the Tribological Properties of Cladded Hypereutectoid Rails
Panahsadat Fasihi, Ralph Abrahams, Wenyi Yan, Monash University, Clayton, Victoria, Australia; Peter Mutton, Monash University Institute of Railway Technology, Clayton, Victoria, Australia

2:30 – 3 pm
3581292: Discussion of C\corrosion & Wear of Additively Manufactured Alloys
Peter Renner, Swarn Jha, Yan Chen, Ajinkya Raut, Siddhi Mehta, Hong Liang, Texas A&M University, College Station, TX

3 – 3:30 pm – Break

3:30 – 4 pm
3583730: Computation of Hydrodynamic and Capillary Phenomena in Binder Jet 3D Printing
Joshua Wagner, C. Fred Higgs III, Rice University, Houston, TX

4 – 4:30 pm
3583888: Investigation on the Rolling Contact Fatigue Behaviours of Different Laser Cladding Materials on the Damaged Rail
Haohao Ding, Tianxing Xie, Wenjian Wang, Qiyue Liu, Southwest Jiaotong University Tribology Research Institute, Chengdu, Sichuan, China

4:30 – 5 pm
3584327: Effect of Heat Treatment and Electric Discharge Alloying on the Tribological Performance of Selective Laser Melted $AlSi_{10}Mg$
Basil Kuriachen, Thasleem P, Joy M L, National Institute of Technology Calicut, Calicut, Kerala, India; Deepak Kumar, Indian Institute of Technology Delhi, New Delhi, Delhi, India; Afzaal Ahmed, Indian Institute of Technology Palakkad, Palakkad, Kerala, India

5 – 5:30 pm
3584282: Realization of a Novel Morphing Surface Using Additive Manufacturing and Its Active Control in Friction
Motoyuki Murashima, Yusuke Imaizumi, Masato Kawaguchi, Noritsugu Umehara, Takayuki Tokoroyama, Nagoya Daigaku, Nagoya, Aichi, Japan; Toshiyuki Saito, Masayuki Takeshima, Kabushiki Kaisha JTEKT, Nagoya, Aichi, Japan; Yosuke Tsukiyama, Isami Nitta, Niigata Daigaku, Niigata, Niigata, Japan

8G • Virtual Meeting Room 7
ROLLING ELEMENT BEARINGS VI

Session Chair: Nikhil Londhe, The Timken Co., North Canton, OH

2 – 2:30 pm
3485344: Experimental and Numerical Assessment of Power Loss in an Aero-Engine Cylindrical Roller Bearing
Rami Kerrouche, Azzedine Dadouche, Mahmoud Mamou, National Research Council Canada, Ottawa, Ontario, Canada; Salah Boukraa, Universite Saad Dahlab Blida 1 Institut d'Aeronautique et des Etudes Spatiales, Ottawa, Ontario, Canada

2:30 – 3 pm
3495520: A Novel Test Rig for the Investigation of Ball Bearing Cage Friction
Thomas Russell, Farshid Sadeghi, Wyatt Peterson, Purdue University, West Lafayette, IN

3 – 3:30 pm – Break

3:30 – 4 pm
3499500: CFD Investigation of Deep Groove Ball Bearing Fluid Flow
Wyatt Peterson, Purdue University, West Lafayette, IN

8H • Virtual Meeting Room 8
SURFACE ENGINEERING II

Session Chair: Harpal Singh, Sentient Science, West Lafayette, IN

Session Vice Chair: Kora Farokhzadeh, Bruker Nano Surfaces, San Jose, CA

2 – 2:30 pm
3472312: Friction Reduction Effect of Soft Coatings
Zhou Chen, Zhejiang University, Hangzhou, Zhejiang, China

2:30 – 3 pm
3500367: Post-Additive Manufacturing Surface Modification Technology for Controlling Microstructure and Tribological Properties of Materials
Auezhan Amanov, Ruslan Karimbaev, Seimi Choi, Young-Sik Pyun, Sun Moon University, Asan, Republic of Korea

3 – 3:30 pm – Break

3:30 – 4 pm – Surface Engineering Business Meeting

stle

Society of Tribologists and Lubrication Engineers

Virtual Annual Meeting & Exhibition

Exhibitor Directory

May 17-20, 2021

Trade Show Hours:

- Monday, May 17: 10 am – 4 pm
- Tuesday, May 18: 10 am – 3:30 pm
- Wednesday, May 19: 10 am – 3:30 pm
- Thursday, May 20: 10 am – 3:30 pm

(All times listed are Eastern Daylight Time)

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(Exhibitor list as of April 12, 2021)

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The 2021 STLE exhibition program will feature more than 60 companies with virtual booths. During the STLE Annual Meeting, be sure to take advantage and connect with these companies and talk directly to technical experts and engage with the industry's leading companies looking to help provide you with solutions and strategies to improve your company's bottom line. This year's exhibitors will be previewing the lubricant industry's latest products, services and technologies.

The exhibit schedule and format have been planned to suit your learning needs. The following pages list the 2021 exhibitors, with their addresses, and a description of the products or services they are exhibiting. These exhibitors are looking forward to connecting and doing business with you. Take the opportunity to visit all the exhibitors during the four days of the virtual conference and let their expertise put you in the forefront of your company and the industry.

Please visit **www.stle.org/annualmeeting** for the most up-to-date list on additional exhibitors that will be participating.

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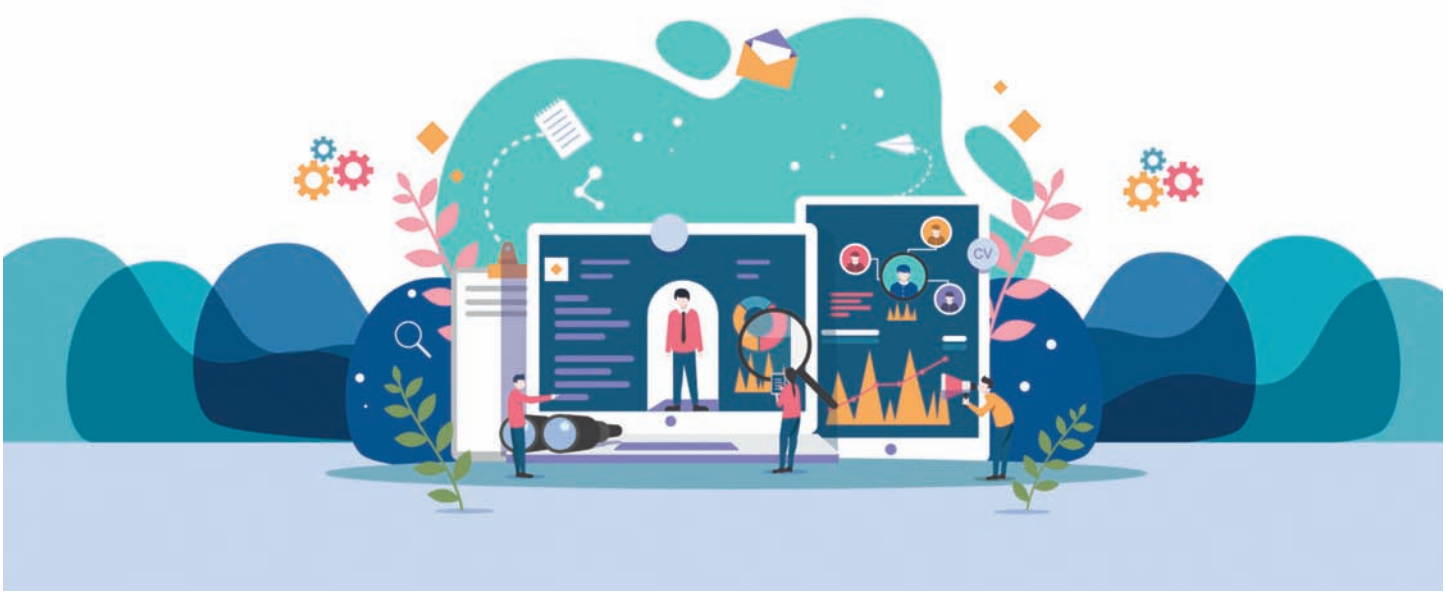

EARLY CAREER POSTERS

Influences of Adsorbed Water on the Interfacial Tribological Phenomena in the Early Stage of Sliding

Z.A. Subhi, Malaysia-Japan International Institute of Technology, Kuala Lumpur, Malaysia

Surfaces are covered by adsorbed water layer due to ambient humidity. In the tribology of micro contacts, frictional and adhesive properties are sensitive to the adsorbed water because surface phenomena become more dominant than volumetric phenomena and therefore the influences of adsorbed water on adhesion become dominant. This study aimed to explore the mechanism of humidity changes to influence the adhesion by the observation of the tribological behaviour during the very early stage of sliding. In this study, a unidirectional ball-on-ball configuration tribo-contact simulator (T-CS) along with atmospheric humidity controller, were used to simulate the micro-sliding between two asperities. Results have suggested that the medium rate of relative humidity can be a critical condition for the tribo-contact due to the effect of liquid assisted adhesion. This critical condition is perhaps caused by the negative Laplace pressure of the meniscus bridge formed between the adsorbed water layer.

Molecular Dynamics Simulation of Drag Reduction by Nanobubble Clusters as Affected by Surface Morphology

Y. Lu, Wuhan University of Technology, Wuhan, China

The investigations of natural superhydrophobic surfaces of plants and animals showed that the wettability property is governed by the nanostructure characteristics of the surface. As a result of the improved surface hydrophobic by morphology, the trapping of gas is promoted on surface cavities to induce friction drag reduction, but gas cushion cannot stably exist. Nanoscopic gas bubbles that exhibit along lifetime and considerable stability may help improve the situation. In this study, molecular dynamics simulations are performed to analyze the formation behavior of nanobubble and the effect of nanobubble flow on the nanochannel with various surface morphologies. Results show that the existence of gaseous nanobubbles can be trapped by the surface cavities, which replace the dense and orderly absorbed liquid layer in non-bubble flow. Therefore, introducing surface morphology can further improve the effect on drag reduction.

Tribological Properties of Additive Manufactured Ti_6Al_4V Against Tungsten Carbide Under Dry Condition

X. Liang, Tsinghua University, Beijing, China

With the development of additive manufacturing (AM technology, titanium alloy manufactured by AM is widely used in aviation manufacturing. Although AM can achieve near net shape, the necessary machining is inevitable. In this paper, the tribological behaviors and wear mechanism of additive manufactured Ti_6Al_4V against tungsten carbide under dry friction condition are studied. The influence of normal load and temperature on friction coefficient were studied. The results show that the effect of load and temperature on friction coefficient is not obvious. We calculated the wear rate and found that the wear rate increased with the increase of load but decreased significantly with the increase of temperature. EDS analysis on the surface of the friction pair shows that tungsten oxide is generated on the friction surface at high temperature. Because tungsten oxide has lubrication properties, it reduces the wear rate at high temperature.

STUDENT POSTERS

Synergistic Effect of Combining TiO_2 and Montmorillonite Clay Nanoparticles as Lubricant Additives for Milling Processes

M.G. Flores, C.S. Rico, G.E. Gonzalez, Universidad de Monterrey, San Pedro Garza García, Mexico

In this work, nanoparticles of TiO_2 and montmorillonite clay were mixed with varying proportions and added to a cutting fluid for milling of an AISI 4340 steel. Due to its semi-spherical shape and small size nano TiO_2 fill surface valleys reducing friction; montmorillonite, being a multilayer flake-like nanomaterial may reduce friction and wear through exfoliation of their weakly-bonded layers. Laboratory experiments were performed in a four-ball tribotester to determine the best proportions of TiO_2 and

montmorillonite clay that provided a synergistic effect. Milling experiments were performed in a CNC equipment with varying feed rate, depth of cut and cutting speed. Plates of AISI 4340 steel were milled with cutting inserts of cemented carbides. A Box Behnken experimental design was performed in order to optimize the milling input parameters and nanoparticle combinations that provided the lowest surface roughness of steel plates, spindle load and wear of cutting inserts.

Wear and Corrosion Performance of Friction Stir Spot Processed 316L Stainless Steel Deposited by High Deposition Rate Cold Spray Additive Manufacturing Process

P.R. Kalvala, M. Daroonparvar, M. Misra, A.M. Ralls, A.K. Kasar, P. Menezes, University of Nevada–Reno, Reno, NV

High Deposition Rate Cold Spray (HDR-CS) is a novel solid-state metal deposition process that uses the additive based principles from additive manufacturing (AM). By rapidly accelerating metal particles to a substrate, components can be prepared where the particles' intrinsic metallurgical properties are retained thus serving as an advantage over other AM-based technologies. Expanding CS to an industrial perspective, CS deposits act as an easy and effective method to repair various parts. This is especially true in marine-based industries where the combination of cyclic loading and corrosion can greatly diminish the surface material over time. However, the synergism between the wear and corrosion of CS 316L is not well studied. In this work, friction-stir processing (FSP) has been used to enhance the CS coatings' wear-corrosion resistance. The microstructural evolution and mechanical properties were then analyzed. The mechanisms for the improved wear-corrosion resistance are discussed.

The Effect of Axisymmetric Texture Floor Profile on the Lubricant Film Thickness of Textured Hard-on-Soft Prosthetic Hip Implant Bearings

Q. Allen, B. Raeymaekers, University of Utah, Salt Lake City, UT

Polyethylene wear debris causes osteolysis and premature failure of prosthetic hip implants. We design a pattern of texture features on the femoral head to increase the lubricant film pressure and thickness and reduce the polyethylene wear in hard-on-soft prosthetic hip implants. Specifically, we use a soft elastohydrodynamic lubrication model to study the effect of different axisymmetric texture floor profiles on the lubricant film thickness. We find the optimum texture parameters that maximize the lubricant film thickness for each texture floor profile as a function of bearing operating conditions. We find that flat texture floor profiles create thicker lubricant films than curved and sloped texture floor profiles. We compare the texture feature volumes of the optimum texture design parameters and find a linear relationship between the texture feature volume and the corresponding optimum lubricant film thickness that holds true independent of the axisymmetric texture floor profile.

The Interfacial Gradient and its Role in Ultralow Wear Sliding

I. Alam, D.L. Burris, University of Delaware, Newark, DE, J. Ye, J. Wei, J. Zeng, W. Sun, X. Liu, K. Liu, Hefei University of Technology, Anhui, China

In this paper, we elucidate the effects of interfacial gradients within the native ultralow wear PTFE composite-on-transfer film system using interrupted wear tests and intermittent surface analysis. As anticipated, the transition from high wear to ultralow wear was accompanied by small adherent debris, tribochemical formation of carboxylates, increased surface energy, and increased adhesion. Interestingly, we observed significant differences on either side of the interface during low wear sliding; compared to the running films on the composite surface, the transfer films on the counterface exhibited consistently greater tribochemical degradation, surface energy, and adhesion to a model alumina probe. This interfacial gradient, we propose, is a necessary feature of the ultralow wear system and functions by setting the direction and driving force for transfer wear. In this case, the interfacial gradient stabilizes the transfer film and minimizes the driving force for running film wear.

Molecular Dynamics Investigation of Core-Shell Nanostructures

S.E. Hughes, R. Fleming, Arkansas State University, Jonesboro, AK

Core-shell nanostructures (CSNs) are novel structures that have the potential to exhibit unique mechanical properties. Experimentally, surfaces patterned with Al/a-Si CSNs have been shown to have a low coefficient of friction and high durability. Molecular dynamics (MD) simulations can provide helpful insight into the material behavior of CSNs and help garner a better understanding of the physical mechanisms which enable these unique material properties. In this study, MD simulations are performed to investigate the role of core material and core-shell interface on the dynamics of dislocations nucleated within the core of CSNs during contact loading. Better understanding of the properties of CSNs will further enable their use in tribological applications, such as solid lubrication.

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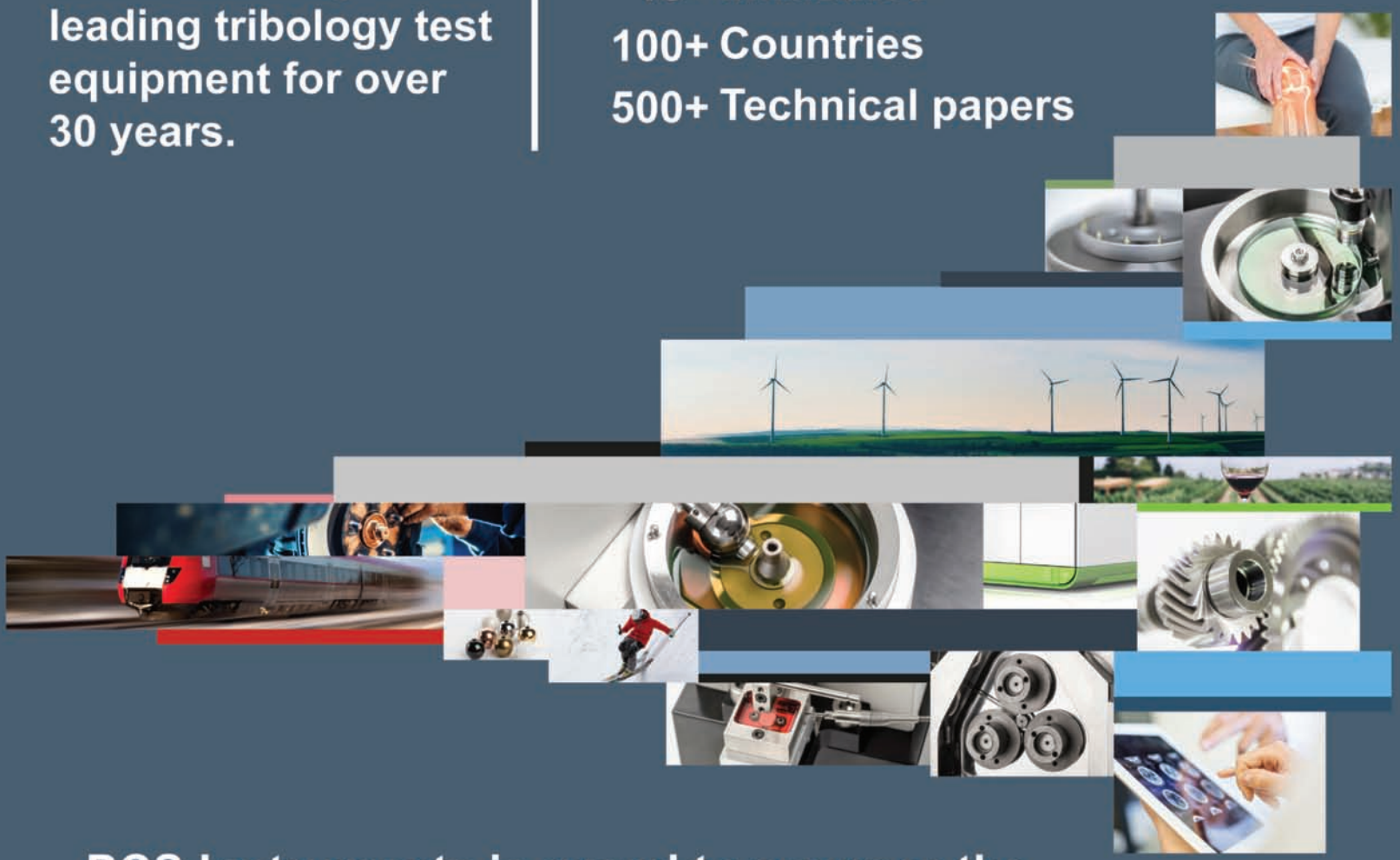

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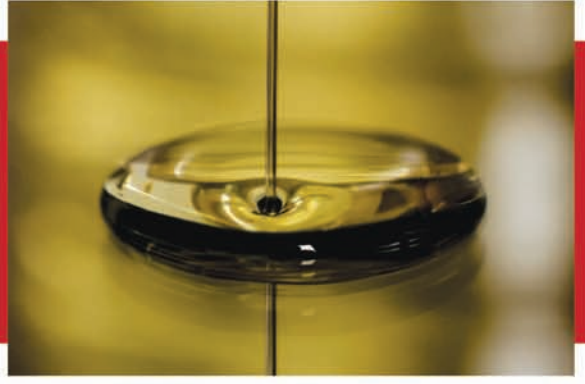

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STLE Committee Business Meetings

Monday, May 17, 2021

1A Seals Business Meeting
12:30 – 1 pm • Virtual Meeting Room 1

1C Fluid Film Bearings Business Meeting
12:30 – 1 pm • Virtual Meeting Room 3

1D Gears Business Meeting
Noon – 12:30 pm • Virtual Meeting Room 4

1G Power Generation Business Meeting
12:30 – 1 pm • Virtual Meeting Room 7

2B Environmentally Friendly Fluids Business Meeting
6 – 6:30 pm • Virtual Meeting Room 2

2E Metalworking Fluids Business Meeting
5:30 – 6 pm • Virtual Meeting Room 5

2G Wind Turbine Business Meeting
4 – 4:30 pm • Virtual Meeting Room 7

2J Synthetic Lubricants and Hydraulics Business Meeting
5 – 5:30 pm • Virtual Meeting Room 9

Tuesday, May 18, 2021

4A Condition Monitoring Business Meeting
4:30 – 5 pm • Virtual Meeting Room 1

4C Nonferrous Metals Business Meeting
4:30 – 5 pm • Virtual Meeting Room 3

4D Materials Tribology Business Meeting
5 – 5:30 pm • Virtual Meeting Room 4

4F Nanotribology Business Meeting
5 – 5:30 pm • Virtual Meeting Room 6

Wednesday, May 19, 2021

5G Rolling Element Bearings Business Meeting
12:30 – 1 pm • Virtual Meeting Room 7

6A Biotribology Business Meeting
4:30 – 5 pm • Virtual Meeting Room 1

6C Engine & Drive Train Business Meeting
4:30 – 5 pm • Virtual Meeting Room 3

6D Lubrication Fundamentals Business Meeting
5:30 – 6 pm • Virtual Meeting Room 4

6E Wear Business Meeting
5:30 – 6 pm • Virtual Meeting Room 5

6F Tribotesting Business Meeting
5:30 – 6 pm • Virtual Meeting Room 6

Thursday, May 20, 2021

8A Grease Business Meeting
4:30 – 5 pm • Virtual Meeting Room 1

8B Contact Mechanics Business Meeting
4:30 – 5 pm • Virtual Meeting Room 2

8H Surface Engineering Business Meeting
3:30 – 4 pm • Virtual Meeting Room 8

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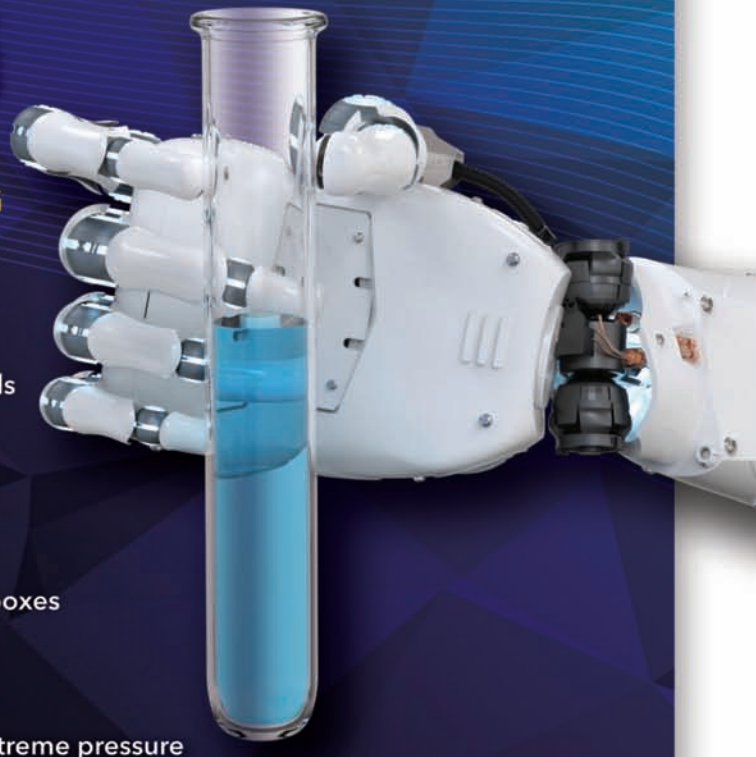

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- Responds well to common waste treatment methods
- Estimated HLB 5-7

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- Hard water stable
- Hydrolytically stable
- Easily cleaned and leaves no residue
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