

STLE

75th Annual Meeting & Exhibition

May 3-7, 2020

HYATT REGENCY CHICAGO ★★☆☆ CHICAGO, ILLINOIS (USA)

ADVANCE PROGRAM

Register by April 3
and save \$100!



Message from the Chair

STLE's 75th Annual Meeting comes home to Chicago!

Dear Industry Professional,

I'd like to extend a personal invitation to join me for STLE's 75th Annual Meeting & Exhibition, May 3-7, 2020, at the Hyatt Regency hotel in Chicago, the organization's birthplace (where the Society was formed in March 1944).

The May conference will have marked the culmination of a year of events and activities celebrating STLE's 75th Anniversary. I encourage you to start making plans now to engage with nearly 1,600 of your peers in the lubricants industry from around the world who will be participating in an extraordinary combination of technical presentations, education courses, exhibits and related business networking opportunities.

The Annual Meeting is always at the top of the list of benefits derived from STLE membership, and this year's program promises to be stronger than ever. There will be a wealth of information and business contacts waiting in Chicago for those who attend. STLE's Annual Meeting Program and Education Committees, working together with our headquarters staff and paper solicitation chairs (PSCs) representing STLE's 20 technical committees, have developed

an excellent program of more than 500 technical presentations devoted to all areas of tribology research and lubrication best practices, with presenters from academia, government and industry.

In addition to being recognized as one of the industry's premier technical meetings, the STLE Annual Meeting is also valued as an opportunity for enhancing your professional development through education and certification.



STLE has a well-known tradition of providing continuing education to industry professionals ready to take their careers to the next level and create value to their employers, customers and peers. In a survey taken after the 2019 Annual Meeting, participants rated education courses as the most valuable portion of the event in terms of meeting their business needs. 11 industry-specific courses will be presented in Chicago taught by the top experts in their respected fields.

For more experienced professionals, the STLE Annual Meeting is often the place where individuals sit for one of STLE's four technical certification exams: Certified Lubrication Specialist™, Certified Metalworking Fluids Specialist™ and Oil Monitoring Analyst I & II™.

To learn about the industry's newest technologies, products and services, make sure to visit the exhibition, which is included in the meeting registration. More than 120 companies will have booths, demonstrations and information—looking to do business with you in providing solutions and strategies to help you understand your lubrication systems that will help improve your company's bottom line.

Program details, housing and other information about the meeting are all included in this brochure for your convenience. If you require further information or assistance, please contact STLE headquarters at (847) 825-5536 (USA), or visit the conference website at www.stle.org/annualmeeting for program updates.

I look forward to seeing you in Chicago this May!

Sincerely,

Min

Dr. Min Zou
University of Arkansas
2020 Annual Meeting Program
Committee Chair



CONTENTS

3 General Information & Policies	8 Welcome to Chicago	44 Networking & Special Events
4 Registration Information	9 Program-at-a-Glance	46 2020 Exhibition/Sponsorship Opportunities
5 By the Numbers	10 Technical Sessions/Commercial Marketing Forum	47 Annual Meeting Sponsors
6 Hotel Information	41 Early Careerist/Student Posters	47 Exhibition Floor Plan
7 Meeting Registration Form	42 Education Courses	48 2020 Exhibitors List

General Information & Policies

The 2020 STLE Annual Meeting and Exhibition is sponsored by:

Society of Tribologists and Lubrication Engineers

840 Busse Highway, Park Ridge, Illinois (USA) 60068

Phone: (847) 825-5536 • Fax: (847) 825-1456

Email: info@stle.org • Web: www.stle.org



Hotel Information

Most events for STLE's 2020 Annual Meeting & Exhibition are being held in the:

Hyatt Regency Chicago
151 East Wacker Dr.
Chicago, Illinois (USA) 60601
Phone: (312) 565-1234

Hotel registrations will not be accepted by phone, but you can make your sleeping room reservation by registering online at www.stle.org (see page 6 for housing information).

About STLE

The Society of Tribologists and Lubrication Engineers (STLE) is a not-for-profit professional society founded in 1944 to advance the science of tribology and the practice of lubrication engineering in order to foster innovation, improve the performance of equipment and products, conserve resources and protect the environment. Headquartered in Park Ridge, Illinois (a Chicago suburb), STLE is the leading technical organization serving more than 13,000 industry professionals and 250 companies and organizations that comprise the tribology and lubrication engineering business sector.

STLE offers its members industry-specific education and training, professional resources, technical information, certification programs and career development.

Attendee Roster

The official attendee roster will be made available on the STLE website (www.stle.org) in April 2020 prior to the annual meeting.

About Our Annual Meeting & Exhibition

STLE's conference is where some 1,600 members of the tribology research and lubrication engineering communities gather for five days of industry-specific technical education and professional development. Highlights include some 500 paper presentations, a 120-exhibitor trade show, the popular Commercial Marketing Forum and an opportunity to establish business contacts and friendships with your peers from around the world.

Annual Meeting & Education Course Policies

- All attendees must register.
- All attendees receive a badge with their registration materials. The badge must be worn at all times and is required for admittance to any technical session, education course and the trade show.
- Badges may not be exchanged. Attendees who loan their badges to others will have their badges confiscated and their annual meeting privileges rescinded.
- Annual Meeting registration includes admittance to the trade show, technical sessions, Commercial Marketing Forum and all social events, including the Monday evening Networking Reception and Tuesday afternoon President's Luncheon.
- Distributing handouts at technical sessions is not permitted. Handouts will be given to education course attendees.
- Disseminating material or conducting business in the exhibit hall is not permitted if you are not an official exhibitor.

Recording & Photography Policies

Audio or video recording is not permitted in any of the annual meeting technical sessions or Commercial Marketing Forum presentations. Audio recording is permitted in the education courses with advance permission of the instructor. No video of any kind is permitted. STLE's official photographer will take photos of select technical sessions, Commercial Marketing Forum presentations, social events and the trade show on Tuesday, May 5.

These photos will be used to promote the 2021 STLE Annual Meeting & Exhibition in New Orleans, Louisiana (USA). If you do not wish to have your photograph taken and published, please step out of the photo frame or notify the photographer afterward if your photo has been taken so the image can be deleted.

Dress Code

Business casual dress is appropriate for STLE events at the annual meeting. Technical session and education course speakers often choose attire that is more formal on the day of their presentations.

STLE 365 App

Find all the conference details and program updates in the Annual Meeting section of the STLE 365 App (under the Events Apps Section). Download free from the iOS App Store or the Google Play Store (just search for STLE) or visit: www.tripbuilder.com/apps/stle.

Registration Information

Meeting registration entitles you to all the technical sessions, trade show admission (Monday through Wednesday), Commercial Marketing Forum and all social events, including the Monday evening Networking Reception and Tuesday afternoon President's Luncheon (ticket required). STLE Education courses are \$400 per course with full registration. **Please see the registration form on page 7.**

2020 STLE Annual Meeting Registration Rates					
Individual			Ala Carte		
Early Bird by April 3 (Save \$100!)		After April 3	General Single Day Registration	Single Education Course*	
STLE Members	\$735	\$835	\$335	\$575	
Speakers	\$735	\$835			
Presenters	\$735	\$835			
Non-members	\$1,065	\$1,165	\$500	\$775	
Life Members	\$165	\$165			
Student Members	\$100	\$100			
				<i>*Annual Meeting registration not required or included.</i>	

Cancellations

Requests must be received in writing at STLE's headquarters no later than April 3, 2020, to receive refund less \$100 handling charge. **No refunds will be issued after April 3.**

Payment Method

STLE accepts U.S. currency, check drawn on a U.S. bank and major credit cards: Mastercard, Visa (preferred), American Express and Discover.

Onsite Registration

You may register onsite at the Hyatt Regency Chicago, beginning at Noon on Saturday, May 2, 2020.

The STLE registration desk is open daily thereafter through Thursday, May 7.

Onsite registrants incur a \$100 surcharge. Advance registrants may pick up badges

and registration materials at the registration desk during the following hours:

- **Sunday, May 3** – 7 am – 6 pm
- **Monday, May 4** – 7 am – 6 pm
- **Tuesday, May 5** – 7 am – 6 pm
- **Wednesday, May 6** – 7 am – 6 pm
- **Thursday, May 7** – 7 am – Noon

Non-Members Welcome

Two Options for Attending: STLE's core annual meeting audience is our membership of tribology researchers and lubrication professionals from around the globe. However, non-members are welcome at the conference and encouraged to attend. Participating in our conference is the best way to gain an overview of STLE's many products and services and meet your peers in the

tribology and lubrication engineering communities.

STLE offers full and one-day annual meeting registration options. Because non-members pay a higher meeting registration rate, the best way to attend is by joining the society. Cost of membership is less than the difference between the member and non-member annual meeting registration rates. So you actually save money by joining STLE and coming to the meeting as a member than you would if you came as a non-member plus you get all the other benefits of STLE membership!

However, if your company does not permit you to join a professional society, another option is to pay the non-member registration rate for the annual meeting. If you do, **you'll also receive a complimentary one-year STLE membership—a \$160 value.**

How To Register:



Online

Visit **www.stle.org/annualmeeting** to register at your convenience, 24/7.



Phone

Call STLE headquarters at (847) 825-5536 and register using a major credit card.



Mail

Use the registration form on page 7 and send your completed form and payment to STLE headquarters.



Fax

Complete the enclosed registration form and submit via fax to (847) 825-1456.

By the Numbers:

Did you know about the STLE Annual Meeting

95% of surveyed attendees indicated that STLE's Annual Meeting met or exceeded their overall expectations.

40+ COUNTRIES REPRESENTED

500 EDUCATION COURSE PARTICIPANTS

40 STUDENT POSTERS

500+ TECHNICAL PRESENTATIONS

1,600 INDUSTRY PROFESSIONALS

120 EXHIBITORS

40 COMMERCIAL MARKETING FORUM SESSIONS

“It (the STLE Annual Meeting) is the best industry conference that I attend, and the business networking is very valuable.”

Follow us on Social!

Stay connected and keep up with the chatter using hashtag **#STLE2020** when joining the conversation and stay up-to-date with latest annual meeting programming information and much more!



Twitter | [@STLE_Tribology](https://twitter.com/STLE_Tribology)



Facebook | [Facebook.com/STLE](https://www.facebook.com/STLE)



Instagram | [@STLE_Tribology](https://www.instagram.com/STLE_Tribology)



LinkedIn | www.linkedin.com



Top 5 Lubricant-Related Markets Attending

- Oil Analysis
- Metalworking Fluids
- Automotive
- Manufacturing
- Bearings

Attendee Profile

5% Academia	6% Government
5% Students	18% Other
66% Industry	

Conference Takeaways:

- Industry networking
- Professional training & certification opportunities
- Explore latest new technologies



Future Industry Meeting Dates

2020 STLE Tribology Frontiers Conference

Cleveland Marriott Downtown at Key Tower • **Nov. 8-11, 2020**, Cleveland, Ohio (USA)

76th STLE Annual Meeting & Exhibition

Hyatt New Orleans • **May 16-20, 2021**, New Orleans, Louisiana (USA)

7th World Tribology Congress

Lyon Convention Centre • **Sept. 5-10, 2021**, Lyon, France

77th STLE Annual Meeting & Exhibition

Walt Disney World Swan & Dolphin • **May 15-19, 2022**, Orlando, Florida (USA)

78th STLE Annual Meeting & Exhibition

Long Beach Convention Center • **May 21-25, 2023**, Long Beach, California (USA)



To learn more about the benefits of STLE and to access a membership application, log on to www.stle.org or call STLE headquarters at 847-825-5536.

Need a Visa?

International attendees can request an invitation letter for the 2020 STLE Annual Meeting & Exhibition. For more information, contact Merle Hedland at (630) 428-2133, mhedland@stle.org.

Housing & Room Reservations

Housing for the 2020 STLE Annual Meeting & Exhibition is at:



Hyatt Regency Chicago

151 East Wacker Drive • Chicago, Illinois 60601
(312) 565-1234

Situated near the famous Magnificent Mile, Hyatt Regency Chicago is the largest hotel in Chicago and is surrounded by downtown's premier landmarks and attractions. The Hyatt Regency Chicago offers 2,032 rooms, including 123 suites. Marvel at views of the city, Chicago River, or Lake Michigan. In an easy walk or short cab ride from the hotel, guests are linked to Chicago's best shopping, cuisine, museums and theater. The Hyatt Regency Chicago is about 45-minute drive (18 miles) from O'Hare International Airport, and 35-minute drive (12 miles) from Midway International Airport.

Hyatt Regency Chicago Amenities

- Four restaurants and three bars/lounges
- Complimentary wireless Internet in lobby and guest rooms
- Spacious guest rooms with refrigerator, laptop safe and flat-screen TVs
- Complimentary 24-hour fitness center
- Multilingual staff

*STLE Annual Meeting Rates

- \$264 single/double occupancy (1 or 2 people)
- \$284 triple occupancy (3 people)
- \$314 quadruple occupancy (4 people)
- \$339 Regency Club

Attendees are encouraged to stay at the Hyatt Regency Chicago, as doing so helps STLE reduce the costs of future annual meetings. The cutoff date to receive discounted pricing is **April 3, 2020**. However, STLE cannot guarantee housing at the Hyatt Regency Chicago will be available through April 3. Reservations are made on a first-come, first-served basis. If you plan on attending the 2020 STLE Annual Meeting, you are urged to make your room reservations as soon as possible.

Reserve Your Room By April 3, 2020

- Call to make hotel reservations at (312) 565-1234
- Be sure to provide the group code: **G-ESTL**
- Make all hotel reservation changes or cancellations directly with the Hyatt Regency Chicago
- Visit www.stle.org/annualmeeting for a shortcut to the hotel registration site



**Room rates are quoted exclusive of applicable state and local taxes (which are currently 16.4%) or applicable service, or hotel specific fees in effect at the Hyatt Regency Chicago at the time of the meeting. U.S. Government rate rooms are limited; proof of federal government employment must be shown at check-in or higher rate will be charged. U.S. Government rate is the prevailing government rate.*

2020 STLE Annual Meeting Registration Form

Hyatt Regency Chicago • Chicago, IL (USA) • May 3-7, 2020



IN A HURRY? Register online at www.stle.org/annualmeeting

MAIL OR FAX THIS FORM TO: STLE, 840 Busse Highway, Park Ridge, IL (USA) 60068. Fax: 847-825-1456.

Registration Information (Please complete separate forms for each individual from your organization). • **My STLE Member # is:** _____

Title: ____ Mr. ____ Mrs. ____ Ms. ____ Dr. ____ Professor First name for badge: _____

First Name: _____ Last Name: _____

Company/Institution Name: _____

Address: _____

City: _____ State/Province: _____

Zip/Mail Code: _____ Country: _____

E-mail: _____ Fax: _____

Phone: _____ Onsite Cell Phone #* _____

Emergency Contact Name* _____ Emergency Contact Phone #* _____

***STLE does not sell conference attendee cell phone numbers. This information is requested for use only by STLE for conference updates and in case of onsite emergencies.**

☐ **Speaker or Presenter?** Session Number or Paper Title: _____

NOTE: Registration includes technical sessions, trade show admission, Networking Reception, Commercial Marketing Forum, plus one complimentary ticket to the President's Luncheon. STLE Education Courses are \$400 with full meeting registration except for NLGI Grease Course (\$800).

Cancellation requests must be received in writing no later than April 3, 2020, to receive refund less \$100 handling fee. No refunds issued after that date. Mail or fax this form to: STLE, 840 Busse Highway, Park Ridge, IL (USA) 60068 Fax: (847) 825-1456. Questions? Call (847) 825-5536.

Annual Meeting Registration Rates

Members/Speakers/Presenters: \$735 – Non-members: \$1,065

Life Members: \$165 – Student Members: \$100

After April 3 add \$100

STLE Education Courses: Discounted rate with full meeting registration (\$400 per course) except for NLGI Grease Course (\$800). Lunch included.

Sunday Education Courses, May 3, 2020 (8 am – 5 pm)

Please ✓ one course only!

- ☐ Advanced Lubrication 301: Advanced Additives
- ☐ Advanced Tribology 310: Nanotribology
- ☐ Basic Lubrication 101
- ☐ Gears 101
- ☐ NLGI – Grease 101
- ☐ Metalworking 240: Metalworking Fluid Formulation Concepts
- ☐ Synthetic Lubricants 204: Base stock Selection and Applications

Wednesday Education Courses, May 6, 2020 (8 am – 5 pm)

Please ✓ one course only!

- ☐ Advanced Lubrication 302: Advanced Lubrication Regimes
- ☐ Automotive Lubrication 202: Gasoline
- ☐ Basic Lubrication 102
- ☐ Metalworking 105: Metal Forming Fluids

Social Functions (Please ✓ all that apply)

- ☐ Monday, May 4 – Networking Reception (free). Qty: _____
- ☐ Tuesday, May 5 – President's Luncheon (*one complimentary ticket included*).
- ☐ Tuesday, May 5 – Additional President's Luncheon guest ticket (\$50)

Ala Carte Offerings

- ☐ STLE education course and lunch only. Annual Meeting registration not required or included. **Members: \$575 per course. Non-members: \$775 per course.**
- ☐ NLGI Grease Course (\$800) with or without separate meeting registration. Lunch included.

Single-Day Registration Admission

Members: \$335. Non-members: \$500

- ☐ Monday, May 4 (Technical Sessions & Trade Show Only)
- ☐ Tuesday, May 5 (Technical Sessions & Trade Show Only)
- ☐ Wednesday, May 6 (Technical Sessions & Trade Show Only)
- ☐ Thursday, May 7 (Technical Sessions Only)

Payment Information

☐ Payment Enclosed ☐ Payment Type: _____

Credit Card #: _____

Exp. Date: _____

Name on Card: _____

Payment Amount: \$ _____ . _____

Signature: _____



Sweet Home Chicago

Chicago is located along the Great Lakes shoreline. It is the third largest city in the United States, with a population of nearly 3 million and metro population approaching 10 million. Chicago is a huge vibrant city and metropolitan area that sprawls over 10,874 km².

It is well known for house music and electronical dance music, blues, jazz, comedy, shopping, dining, sports, architecture, highly-regarded colleges and universities, and premier cultural attractions.

As the hub of the Midwest, Chicago is easy to find with its picturesque skyline, calling across the waters of the huge freshwater Lake Michigan, an impressive sight that soon reveals world-class museums, miles of sandy beaches, huge parks, public art, and perhaps the finest looking downtown in the world.

With a wealth of iconic sights and neighborhoods to explore, there's enough to fill a visit of months without ever seeing the end. Prepare to cover a lot of ground; the meaning of Chicago is only found in movement, through its subways and historic elevated rail, and eyes raised to the sky.

NOTABLE ATTRACTIONS

Magnificent Mile (13-block shopping and entertainment district) ★ Grant Park and Millennium Park ★ Navy Pier

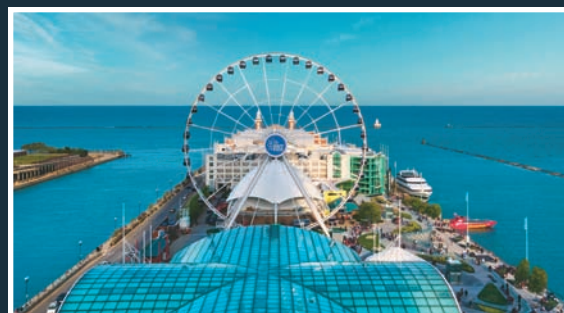
Buckingham Fountain ★ Museum of Science and Industry ★ Field Museum ★ Shedd Aquarium

Art Institute of Chicago ★ Adler Planetarium

EXPERIENCE CHICAGO

Explore the sights, and experience the food and nightlife of this world-class city on the shores of Lake Michigan.

Find out what to eat, drink, see and do at www.choosechicago.com.





2020 *Chicago* Program-at-a-Glance

*As of Dec. 3, 2019

Please visit www.stle.org/annualmeeting for the latest program information and detailed schedule.

Saturday, May 2

Noon – 6 pm
Onsite Registration

Sunday, May 3

7 am – 6 pm
Onsite Registration

7 – 8 am
Education Course Speakers
Breakfast

8 am – 5 pm
Education Courses
(*registration required)



6:30 – 8 pm
Student Networking
Reception (Hyatt Regency
Plaza Ballroom)

***Registration required**
All annual meeting events are
held at the Hyatt Regency
Chicago.

Monday, May 4

7 am – 6 pm
Onsite Registration

7 – 8 am
Speakers Breakfast

8 – 10 am
Technical Sessions and
Commercial Marketing Forum

9 am – 1 pm
Tribology **STEM** Camp

Science
Technology
Engineering
Math



10 – 10:30 am
Refreshment Break

10:30 am – Noon
Opening General Session
Keynote Address:
**21st Century Challenges for
the Tribology & Lubricants
Community**

Noon – 1:30 pm
Lunch (on your own)

Noon – 5 pm
Commercial Exhibits and
Student Posters

1:30 – 6 pm
Technical Sessions and
Commercial Marketing Forum

3 – 4 pm
**Exhibitor Appreciation
Break**

6:30 – 8 pm
Networking Reception (Hyatt
Regency Grand Ballroom)

Tuesday, May 5

7 am – 6 pm
Onsite Registration

7 – 8 am
Speakers Breakfast

8 – 10 am
Technical Sessions and
Commercial Marketing Forum

9:30 am – Noon
Commercial Exhibits and
Student Posters

10 – 10:30 am
Refreshment Break

Noon – 2 pm
President's Luncheon/
Business Meeting (Hyatt
Regency Grand Ballroom)

2 – 6 pm
Technical Sessions and
Commercial Marketing Forum



2 – 5:30 pm
Commercial Exhibits and
Student Posters

3 – 4 pm
**Exhibitor Appreciation
Break**

Wednesday, May 6

7 am – 6 pm
Onsite Registration

7 – 8 am
Speakers Breakfast

8 am – 5 pm
Education Courses
(*registration required)

8 am – Noon
Technical Sessions and
Commercial Marketing Forum

9:30 am – Noon
Commercial Exhibits and
Student Posters

10 – 10:30 am
Refreshment Break

Noon – 1:30 pm
Lunch (on your own)

1:30 – 6 pm
Technical Sessions and
Commercial Marketing Forum

3 – 3:30 pm
Refreshment Break

Thursday, May 7

7 am – Noon
Onsite Registration

7 – 8 am
Speakers Breakfast

8 – 10 am
Technical Sessions

8:30 am – 12:30 pm
STLE Certification Exams
(*registration required)

10 – 10:30 am
Refreshment Break

3 – 3:30 pm
Refreshment Break





Technical Sessions

Choose from more than 500 papers and presentations!

The following is the preliminary 2020 STLE Annual Meeting technical program that will be updated right up until the meeting in Chicago. Please visit www.stle.org/annualmeeting for the latest program information. Registrants also will receive a Program Guide at the meeting with updated information.

***As of Dec. 3, 2019 – Subject to Change.**

Monday, May 4, 2020

★ Session 1A

COMMERCIAL MARKETING FORUM I

8 – 8:30 am | Open Slot

8:30 – 9 am | Chevron Phillips Chemical Co.

9 – 9:30 am | Zschimmer & Schwarz

9:30 – 10 am | ANGUS Chemical Co.

10 – 10:00 am – Break

★ Session 1B

METALWORKING FLUIDS I

Session Chair: TBD

Session Vice Chair: TBD

8 – 8:30 am

3273531 ★ Oil Soluble Polyglycol on Semi-Synthetic Metalworking as Multifunctional Enhancer Synthetic Polymeric Additive Proposal

Eduardo Lima, Dow Brazil, Jundiaí, São Paulo, Brazil

8:30 – 9 am

3279542 ★ Systematic Investigation of Phosphorous Compounds in Metalworking Fluids by Mixture Screening DoE

Yixing Philip Zhao, Alexandra Goode, Shilpa Beesabathuni, Houghton International, Norristown, PA, Yan Zhou, Houghton International, Oak Ridge, TN

9 – 9:30 am

3279198 ★ 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, Hasle-Ruegsau, Switzerland, Jordan Schmidt, Luminultra Technologies, Ltd., Fredericton, New Brunswick, Canada

9:30 – 10 am

3279916 ★ Low Foam Emulsifiers for Semi-Synthetic Metalworking Fluids

Jocelyn Zhao, Dow Chemical Investment Co., Ltd., Shanghai, China

10 – 10:30 am – Break

★ Session 1C

ROLLING ELEMENT BEARINGS I

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

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

8 – 8:30 am

3278343 ★ Replenishment of the EHL Contacts in a Grease Lubricated Ball Bearing

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

8:30 – 9 am

3285585 ★ Characterization of the Channeling Behavior of Lubricating Greases in Rolling Bearings

Sathwik Chatra Kalsanka Ramakrishna, SKF B.V., Nieuwegein, Utrecht, Netherlands, Piet Lugt, SKF Research and Technology Development, Houten, Netherlands

9 – 9:30 am

3322067 ★ Starvation in Rolling Bearings: From Single Contact Devices to Rolling Bearing Simulators

David Kostal, Josef Fryza, Petr Sperka, Ivan Krupka, Martin Hartl, Brno University of Technology, Brno, Czechia

9:30 – 10 am

3316427 ★ Effect of Lubricant Properties and Contact Conditions on False Brinelling Damage

Rachel Januszewski, Amir Kadiric, Imperial College London, London, United Kingdom, Victor Brizmer, SKF Research and Technology Development, Houten, Netherlands

10 – 10:30 am – Break

★ Session 1D

BIOTRIBOLOGY I

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

Session Vice Chair: Alison Dunn, University of Illinois at Urbana-Champaign, Urbana, IL

8 – 8:30 am

3283332 ★ Remarkable Wear and Fracture Properties and Unique 3D-Microstructure of Enamel in the Dentition of the Hadrosaurid Dinosaur

Tomas Grejtak, Tomas Babuska, Brandon Krick, Lehigh University, Bethlehem, PA, Stephen Hendricks, Gregory Erickson, Florida State University, Tallahassee, FL, Soumya Varma, Manish Jain, Yi Lee, Siddhartha Pathak, University of Nevada-Reno, Reno, NV, Mark Norell, American Museum of Natural History, New York, NY

8:30 – 9 am

3325025 ★ Tribology of Tactile Perception – FE Modeling of Skin Aging

Marc Masen, Rikeen Jobanputra, Imperial College London, South Kensington, London, United Kingdom

9 – 9:30 am

3292469 ★ Effects of Contact and Shear on Corneal Epithelial Cell Mucus Layer

Jack Famiglietti, Eric McGhee, Juan Uruena, Padraic Levings, W. Gregory Sawyer, University of Florida, Gainesville, FL

9:30 – 10 am

3284256 ★ Mechanical Regulation of Blood Flow Shear in Hemostasis Process

Xiangyu Hu, Tsinghua University, Beijing, China

10 – 10:30 am – Break

★ Session 1E

SEALS I

Session Chair: Khalid Malik, Ontario Power Generation, Pickering, Ontario, Canada

Session Vice Chair: Noel Brunetiere, Institut Pprime, Futuroscope Chasseneuil Cedex, France

8 – 8:30 am

3322475 ★ **Simulation of Transient Processes of a Hydraulic Seal with Elastohydrodynamic Lubrication**

Arne Leenders, Leibniz University Hannover, Hannover, Germany

8:30 – 9 am

3269407 ★ **Shaft and Seal Wear Determination Using a TEHD-Simulation Model**

Christoph Burkhart, Stefan Thielen, Bernd Sauer, TU Kaiserslautern, Kaiserslautern, Rhineland-Palatinate, Germany

9 – 9:30 am

3293189 ★ **Leakage Characteristics of Static Seal under Pressure Cycling Condition**

De Huang, Andreas Almqvist, Lulea Technology University, Lulea, Sweden, Chien Nguyen, Saint-Gobain, Bristol, RI

9:30 – 10 am

3286645 ★ **In Situ Observation of Three-Body Contact in Rubber Sealing Interface**

Kun Qin, Qin Zhou, Kai Zhang, China University of Geosciences – Beijing, Key Laboratory of Deep Geodrilling Technology, Ministry of Land and Resources, Beijing, China

10 – 10:30 am – Break

★ Session 1F

LUBRICATION FUNDAMENTALS I

Session Chair: TBD

Session Vice Chair: TBD

8 – 8:30 pm

3325112: ★ **The Effect of Chemical Structure on Tribological Behavior of Base Oils**

Kun Qian, Zhijiang Ye, Cameron Timothy, Mark Sidebottom, Miami University, Oxford, OH

8:30 – 9 am

3284374 ★ **Adsorption on Metal Oxides: An in Silico Design of Lubricants**

Sarah Blanck, Sophie Loehle, Centre de Recherche Total de Solaize, Solaize, France, Carine Michel, Stephan Steinmann, University of Lyone, Laboratoire de Chimie, Lyon, France

9 – 9:30 am

3284304 ★ **Molecular Dynamics Simulation of Lubricating Oil Flow in Porous Polyimide Retainers of Bearing**

Wenbin Chen, Wenzhong Wang, Pengzhe Zhu, Beijing Institute of Technology, Beijing, China

9:30 – 10 am

3337146 ★ **Using Rheology, Colloid Force Microscopy and Mathematical Modeling for Understanding the Role of Associative Polymers in Lubrication**

Eugene Pashkovski, Reid Patterson, The Lubrizol Corp., Wickliffe, OH, Timothy Murdoch, Robert Carpick, Daeyeon Lee, University of Pennsylvania, Philadelphia, PA, Ilya Kudish, ILRIMA Consulting, Inc., Sarasota, FL

10 – 10:30 am – Break

★ Session 1H

GREASE I

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

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

8 – 8:30 am

3303461 ★ **Lubrication Condition Monitoring of Practical Ball Bearings under Grease Lubrication by Electrical Impedance Method**

Taisuke Maruyama, Masayuki Maeda, NSK Ltd., Fujisawa, Kanagawa, Japan, Ken Nakano, Yokohama National University, Yokohama, Japan

8:30 – 9 am

3319594 ★ **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

9 – 9:30 am

3279951 ★ **Contact Protection by Grease in Aeronautical Heavily**

Charged Oscillating Bearings

Lucas Frache, LaMCoS Laboratory, Villeurbanne, Rhône Alpes, France

9:30 – 10 am

3284996 ★ **Complementary Approach in Stick-Slip Analysis of a Lubricated Contact: From the Local Contact Behavior to the Dynamical Response of the System**

Ilaria Ghezzi, Yves Berthier, INSA Lyon, Lyon, France, Davide Tonazzi, Francesco Massi, University of Rome La Sapienza, Rome, Italy, Michael Rovere, Cedric Le Coeur, SOMFY, Cluses, France

10 – 10:30 am – Break

★ Session 1I

TRIBOCHEMISTRY I

Superlubricity & Mechanochemistry of Carbon-Based Solid Lubricants

Session Chair: TBD

Session Vice Chair: TBD

8 – 8:30 am

3285407 ★ **The Effect of Sliding Counterbodies on Tribological Properties of Nanocrystalline Diamond Film**

Wei Qi, Tsinghua University, Beijing, China

8:30 – 9 am

3285508 ★ **Temperature Induced Structural Evolution and Superlubricity Mechanisms in Amorphous Carbon-Based Films**

Muhammad Irfan Fareed, Tsinghua University, Beijing, China

9 – 9:30 am

3281530 ★ **Atomistic Simulation Revealing the Temperature Dependence of Frictional Property of Diamond-Like Carbon in Vacuum**

Yang Wang, Koshi Adachi, Momoji Kubo, Tohoku University, Sendai, Miyagi, Japan

9:30 – 10 am

3305924 ★ **Towards, Robust Superlubricity on Industrially Relevant Surfaces and Sliding Conditions**

Anirudha Sumant, Kalyan Mutyala, Srilok Srinivasan, Jianguo Wen, Subramanian K.R. S. Sankaranarayanan, Argonne National Laboratory, Lemont, IL

10 – 10:30 am – Break



Technical Sessions

★ Session 1K

ENGINE AND DRIVETRAIN

Special Session on Electric Vehicles I

Session Chair: Babak Lotfi, ExxonMobil, Baytown, TX

Session Vice Chair: Dairene Uy, Shell Technology Center, Houston, TX

8 – 8:30 am

3274913 ★ Study of Vibration Wear in Plug-In Hybrid Vehicle Engine

Weizi Li, Shell (Shanghai) Technology Limited, Shanghai, China, Yunfei Wang, Qinhao Fan, Zhi Wang, Tsinghua University, Beijing, China, Robert Taylor, Shell Global Solutions UK, London, United Kingdom

8:30 – 9 am

3284028 ★ Thermal Management in Battery Electric Vehicle (BEV)

Dean Tomazic, FEV North America Inc., Auburn Hills, MI

9 – 9:30 am

3340704 ★ A Model for Prediction of Power Losses in Electric Vehicle Transmissions

Amir Kadiric, Joseph Shore, Imperial College London, London, United Kingdom

9:30 – 10 am

3316891 ★ Test Facility to Investigate Function and Efficiency of the Speed4E Hyper-High-Speed Electromechanical Powertrain

Lukas Pointner-Gabriel, Hermann Pflaum, Karsten Stahl, Technical University of Munich, Garching, Bavaria, Germany

10 – 10:30 am – Break

★ Session 1L

CONTACT MECHANICS I

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

Session Vice Chair: Kylie Van Meter, University of Florida, Gainesville, FL

8 – 8:30 am

3278148 ★ 3D Elastodynamic Frictional Contact Model

Xin Zhang, Qian (Jane) Wang, Northwestern University, Evanston, IL

8:30 – 9 am

3279700 ★ Investigating the Effect of Radius of Curvature Evolution on Elastic-Perfectly Plastic Contact

Eoghan O'Neill, Matthew Brake, Rice University, Houston, TX, Hamid Ghaednia, Massachusetts General Hospital-Harvard Medical School, Boston, MA

9 – 9:30 am

3302964 ★ Digital Image Correlation Based Subsurface Stress Measurements in Hydrogels

Alexander McGhee, Jack Famiglietti, Eric McGhee, University of Florida, Gainesville, FL

9:30 – 10 am

3324921 ★ Adhesion Hysteresis in Soft Contacts

Kyle Schulze, Auburn University, Auburn, AL, Alexander Bennett, University of Pennsylvania, Philadelphia, PA

10 – 10:30 am – Break

★ Session 1M

NANOTRIBOLOGY I

Session Chair: Rosa Espinosa-Marzal, University of Illinois at Urbana-Champaign, Urbana, IL

Session Vice Chair: Zhijiang Ye, Miami University, Oxford, OH

8 – 8:30 am

3287020 ★ Friction and Wear Behavior of Confined Surrogate Fuels

Judith Harrison, Sabina Maskey, Brian Morrow, U.S. Naval Academy, Annapolis, MD, J.D. Schall, North Carolina A&T State University, Greensboro, NC

8:30 – 9 am

3282147 ★ In Situ Study of the Lubrication Mechanism of Phosphonium Phosphate Ionic Liquid in Nanoscale Single-Asperity Sliding Contacts

Filippo Mangolini, Zixuan Li, Oscar Morales-Collazo, Hugo Celio, Andrei Dolocan, Joan Brennecke, The University of Texas at Austin, Austin, TX, Jerzy Sadowski, Brookhaven National Laboratory, Upton, NY

9 – 9:30 am

3325316 ★ Nanorheology of Ionic Liquids Probed by an Extended Surface Forces Apparatus

Mengwei Han, Rosa Espinosa-Marzal, University of Illinois at Urbana-Champaign, Urbana, IL

9:30 – 10 am

3304839 ★ Polarized Light Microscopy for Visualizing Liquid Crystal Lubricants in EHD Contacts

Robert Elkington, Monica Ratoi, University of Southampton, Hampshire, United Kingdom

10 – 10:30 am – Break

★ Session 2A

COMMERCIAL MARKETING FORUM II

1:30 – 2 pm | Clark Reliance Corp.

2 – 2:30 pm | Lockhart Chemical Co.

2:30 – 3 pm | The Lubrizol Corp.

3 – 4 pm – Exhibitor Appreciation Break

4 – 4:30 pm | Kao Chemicals GmbH

4:30 – 5 pm | BASF Corp.

5 – 5:30 pm | Evonik Oil Additives, USA

★ Session 2B

METALWORKING FLUIDS II

Session Chair: TBD

Session Vice Chair: TBD

1:30 – 2 pm

3283179 ★ Machining of Aluminum Alloys – Effects of Composition & Microstructure on Machinability

Robert Evans, Quaker Houghton, Conshohocken, PA

2 – 2:30 pm

3283602 ★ Lubrication and Machining of Hard Wear-Resistant Materials

Bailey Decker, Quaker Houghton, King of Prussia, PA

2:30 – 3 pm

3286000 ★ Comparing Forming Fluids Using a Cup Drawing Hydraulic Press

Joseph Schultz, Daniel Banks, Britt Minch, The Lubrizol Corp., Wickliffe, OH

3 – 4 pm – Exhibitor Appreciation Break

4 – 4:30 pm

3287711 ★ Investigation of Metal-working Fluids on Titanium Alloys

Yan Zhou, Jeff Larsh, Yixing Philip Zhao, Quaker Houghton, Conshohocken, PA, Junhui Ma, Javad Mohammadi, Olufisayo Gali, Reza Riahi, University of Windsor, Windsor, Ontario, Canada

4:30 – 5 pm

3286129 ★ **A New Ferrous Corrosion Inhibitor (CI) Reinforcing Oil-Based Industrial Lubricants in the Battle against Corrosion**

Ryan Weber, Brett Wessler, Samantha Lauro, Christina Brancel, Britt Minch, The Lubrizol Corp., Wickliffe, OH

5 – 5:30 pm

3286352 ★ **Polyglykol as Performance Wear Lubricant and Synergism with Extreme Pressure Additives on Net Oil Metalworking Fluid**

Eduardo Lima, Dow Brazil, Jundiai, São Paulo, Brazil

5:30 – 6 pm

3286526 ★ **Theoretical and Practical Deficiencies of Non-Si Defoamer Technology for Aqueous Metalworking Fluids**

Ernest Galgoc, Justin Mykiety, Münzing, Bloomfield, NJ

★ Session 2C

ROLLING ELEMENT BEARINGS II

Session Chair: Hannes Grillenberger, Schaeffler Technologies AG & Co. KG, Herzogenaurach, Bayern, Germany

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

1:30 – 2 pm

3287171 ★ **Innovative Bearing Solutions for E-Mobility Applications**

Jitesh Modi, Schaeffler Group USA, Troy, MI

2 – 2:30 pm

3287182 ★ **Electric Current Effects on Wind Turbine Rolling Element Steel**

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

2:30 – 3 pm

3285517 ★ **Voltage Induced Roller Bearing Fatigue**

André Harder, Tobias Schirra, Eckhard Kirchner, Technical University of Darmstadt, Darmstadt, Hessen, Germany

3 – 4 pm – Exhibitor Appreciation Break

4 – 4:30 pm

3279905 ★ **Load Sensing Bearing – Influence of Damage Progression on the Electric Bearing Impedance**

Tobias Schirra, Georg Martin, Eckhard Kirchner, Technical University of Darmstadt, Darmstadt, Hessen, Germany

4:30 – 5 pm

3324286 ★ **Novel and Traditional Techniques for Detection of Sub-surface Damage in Bearing Steel**

Monica Ratoi, Brian Mellor, University of Southampton, Southampton, United Kingdom, Hiroyoshi Tanaka, Joichi Sugimura, Kyushu University, Fukuoka, Japan

5 – 5:30 pm

3318097 ★ **Progress of Rolling Machine Elements**

Hirotohi Aramaki, NSK Ltd., Fujisawa, Japan

★ Session 2D

BIOTRIBOLOGY II

Session Chair: Dipankar Choudhury, University of Arkansas, Fayetteville, AR

Session Vice Chair: Kurt Beschorner, University of Pittsburgh, Pittsburgh, PA

1:30 – 2 pm

Invited Talk

2 – 2:30 pm

3322474 ★ **Cartilage and Joint Mechanics: New Insights into the Conditions of the Buried Interface**

David Burris, University of Delaware, Newark, DE

2:30 – 3 pm

3340959 ★ **The (Cartilage/Cartilage) Friction: A Model Explaining the Relation Between Charged (+/+), (-/-) and Neutral (\pm/\pm) Surfaces**

Zenon Pawlak, Tribochemistry Consulting, Salt Lake City, UT, Tomasz Kaldonski, Krzysztof Gocman, Tadeusz Kaldonski, Military University of Technology, Warsaw, Poland, Marek Macko, Kazimierz Wielki University, Bydgoszcz, Poland

3 – 4 pm – Exhibitor Appreciation Break

4 – 4:30 pm

3279450 ★ **Investigation on the Superlubricity and Nanomechanics of Liposome Adsorption on Titanium Alloys**

Yuhong Liu, Tsinghua University, Beijing, China

4:30 – 5 pm

3281562 ★ **Insight into the Lubrication Behavior of Phospholipids Pre-Adsorbed on Silica Surfaces at Different Adsorption Temperatures**

Shaofei Feng, Yuhong Liu, Tsinghua University, Beijing, China

5 – 5:30 pm

3278081 ★ **Increased Utilized Friction During Walking Predicts Shoe Wear Rates: Insights into the Wear Mechanism**

Sarah Hemler, Kurt Beschorner, University of Pittsburgh, Pittsburgh, PA

5:30 – 6 pm

3309331 ★ **Shoe Tread Wear Rate May Not Necessarily Be Associated with Material Hardness**

Sarah Hemler, Claire Tushak, Paul Walter, Kurt Beschorner, University of Pittsburgh, Pittsburgh, PA

★ Session 2E

SEALS II

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

Session Vice Chair: Jorge Pacheco, John Crane Inc., Morton Grove, IL

1:30 – 2 pm

3302009 ★ **Gas Seal Face Optimization Using a Scalable Parallel Simulation Environment**

Michael LaPresti, FPoliSolutions, Pittsburgh, PA

2 – 2:30 pm

3323410 ★ **New Dry Gas Seal Material for Enhanced Wear Resistance during Contact**

Christina Twist, Jiao Yang, Marwan Jahchan, Kanza Amanullah, Ian Goldswain, John Crane Inc., Chicago, IL

2:30 – 3 pm

3285338 ★ **A Method of Direct Measurement of Mechanical Seal Wear in Pumps and Compressors**

Mark Slivinski, Carbide Derivative Technologies, Tucson, AZ

3 – 4 pm – Exhibitor Appreciation Break



Technical Sessions

4 – 4:30 pm

3304823 ★ **Effects of Radial Force on the Sealing Performance and Tribology Behavior of Rotary Lip Seals**

Bingqi Jiang, Fei Guo, Tsinghua University, Beijing, China

4:30 – 5 pm – Seals Business Meeting

★ Session 2F

LUBRICATION FUNDAMENTALS II

Session Chair: TBD

Session Vice Chair: TBD

1:30 – 2 pm

3309106 ★ **Tribological and Tribochemical Evaluation of Various Lubricants on Steel as well as WC-DLC Coating Under Extreme-Pressure Boundary Lubrication Conditions: Bench Test: Part 1**

Kuldeep Mistry, Carl Hager, Thierry Ruzicka, Praveen Pauskar, The Timken Co., North Canton, OH

2 – 2:30 pm

3309230 ★ **Tribological and Tribochemical Evaluation of Various Lubricants on Steel as well as WC-DLC Coating Under Extreme-Pressure Boundary Lubrication Conditions: Rig Test: Part 2**

Kuldeep Mistry, Carl Hager, Doug Lucas, Praveen Pauskar, The Timken Co., North Canton, OH

2:30 – 3 pm

3285602 ★ **Designing a Simple Test to Measure Lubricant Efficiency**

Marc Ingram, Ingram Tribology Ltd., Carmarthen, United Kingdom, Izzy Roots, Clive Hamer, PCS Instruments, London, United Kingdom

3 – 4 pm – Exhibitor Appreciation Break

4 – 4:30 pm

3287631 ★ **Running-In of Rough Surface EHL Contacts**

Jonny Hansen, Marcus Björling, Roland Larsson, Luleå University of Technology, Luleå, Sweden

4:30 – 5 pm

3318394 ★ **Friction Increase in Starved EHL Contact**

Petr Sperka, Ivan Krupka, Martin Hartl, Brno University of Technology, Brno, Czechia

5 – 5:30 pm

3309028 ★ **A Novel Iteration Method for Mixed Lubrication**

Chen Shi, Zhinan Zhang, Shanghai Jiaotong University, Shanghai, China, Xiaojian Cai, Shanghai Key Laboratory of Aerospace Intelligent Control Technology, Shanghai, China

5:30 – 6 pm

3282852 ★ **Correlation of EHD Friction with Molecular Structure of Highly Refined Hydrocarbon Base Oils**

Hak Mook Kim, SK innovation, Daejeon, Republic of Korea, Hugh Spikes, Imperial College London, London, United Kingdom

★ Session 2H

GREASE II

Session Chair: Wenyang Zhang, Tesla, Palo Alto, CA

Session Vice Chair: TBD

1:30 – 2 pm

3285676 ★ **Do Polymers Affect the Mechanical Stability of Grease?**

Erik Willett, Functional Products Inc., Macedonia, OH

2 – 2:30 pm

3284674 ★ **Back to the Basics, Part II: Fundamental Building Blocks of Grease Formulation – The Next Story**

Joseph Kaperick, Afton Chemical Corp., Richmond, VA

2:30 – 3 pm

3284232 ★ **Effect of Tribofilm Component on Preventing White Etching Crack in Grease Lubricated Ball Bearings**

Takeshi Tsuda, Yurie Yamashita, Kouji Yoshizaki, Takanori Kurokawa, Hirokazu Arai, JTEKT Corp., Kashiwara, Osaka, Japan

3 – 4 pm – Exhibitor Appreciation Break

4 – 4:30 pm

3278125 ★ **Enhanced Performance Characteristics in Greases with Alkylated Naphthalenes**

Ross Dworet, Amanda Harris, Maureen Hunter, King Industries Inc., Norwalk, CT

4:30 – 5 pm

3308601 ★ **Polymer Grease Flow Behavior Under Low- and High-Pressure**

Josep Farré, UPC – Technical University of Catalonia, Terrassa, Spain, Lars Westerberg, Luleå University of

Technology, Luleå, Sweden, Gemma Camp, UPC, Riells del Fai, Spain, Jasmina Casals-Terré, Universitat Politècnica de Catalunya, Terrassa, Spain

5 – 5:30 pm – Grease Business Meeting

★ Session 2I

TRIBOCHEMISTRY II

Tribocatalysis of Additives

Session Chair: TBD

Session Vice Chair: TBD

1:30 – 2 pm

3316033 ★ **Nature of ZDDP Tribofilm, Part A: Effect of Relative Humidity**

Pourya Parsaeian, Abdel Dorgham, Ardian Morina, Anne Neville, University of Leeds, Leeds, United Kingdom

2 – 2:30 pm

3329999 ★ **Friction and Wear Performance of Novel Hybrid Base Fluids with Phosphorous Containing Additives**

Sergei Glavatskiy, Yiyuan Tian, KTH Royal Institute of Technology, Stockholm, Sweden, Thomas Norrby, Nynas AB, Nynashamn, Sweden

2:30 – 3 pm

3282109 ★ **Anti-Wear Performance and Lubrication Mechanism of New TiO₂ Particle-Based Lubricant Additives**

Fabrice Dassenoy, Sophie Pavan, Jules Galipaud, LTDS – Ecole Centrale de Lyon, Ecully, France, Istvan Jenei, Stockholm University, Stockholm, Sweden, Stephan Wieber, Michael Hagemann, EVONIK, Darmstadt, Germany

3 – 4 pm – Exhibitor Appreciation Break

4 – 5 pm

3339340 ★ **Invited Talk:**

Tribocatalytic Formation of Carbon Films & Tribochemistry of Graphene/Graphite and MoDTC

M. Clelia Righi, University of Modena and Reggio Emilia, Modena, Italy

5 – 5:30 pm

3283545 ★ **MoDTC Tribofilm Growth from Low Viscosity Fully Formulated Engine Oils**

Gerda Vaitkunaite, Cayetano Espejo, Chun Wang, Anne Neville, Ardian Morina, University of Leeds, Leeds, Yorkshire, United Kingdom, Benoit Thiebaut, Catherine Charrin, TOTAL, Solaize, France

★ Session 2K

ENGINE AND DRIVETRAIN

Special Session on Electric Vehicles II

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

Session Vice Chair: Babak Lotfi,
ExxonMobil, Baytown, TX

1:30 – 2 pm

3343494 ★ Hybrid/Electric Powertrain
Components & Tribology

Raj Chandramohan, Tyler Garrard, BorgWarner Inc.,
Arden, NC

2 – 2:30 pm

3322965 ★ Dielectric Fluids for Use
in Hybrid and Electric Vehicles

Gareth Moody, Croda, New Castle, DE

2:30 – 3 pm

3328322 ★ Ultra-Low Viscosity
Synthetic Fluids for Electric
Vehicles (EVs)

Babak Lotfi, ExxonMobil Chemical Co., Houston, TX

3 – 4 pm – Exhibitor Appreciation Break

4 – 4:30 pm

3297982 ★ Lubricant & Greases
Solutions for the Whole Electrical
Vehicle Drivetrain Including the
Thermal Management of Batteries

Torsten Murr, Shell Global Solutions Germany, Hamburg,
Germany

4:30 – 5 pm

3284626 ★ Effects of Lubricant
Additives on Copper in Soaking
Test

Xinggao Fang, Don Pheneger, Afton Chemical Co.,
Richmond, VA

★ Session 2L

CONTACT MECHANICS II

Session Chair: Alexander McGhee,
University of Florida, Gainesville, FL

Session Vice Chair: Noel Brunetiere,
Institut Pprime, Futuroscope Chasseneuil
Cedex, France

1:30 – 2 pm

3325660 ★ Effects of Surface
Roughness and Viscoelastic
Properties on the Friction from the

Sliding Contact between Elastomer
and a Dissimilar Hard Surface:
A Numerical Investigation

Huan Zhang, Daniel Mosher, United Technologies
Research Center, East Hartford, CT

2 – 2:30 pm

3325986 ★ Elastic Rough Surface
Contact & Root Mean Square Slope

Robert Jackson, Yang Xu, Swarna Saha, Kyle Schulze,
Auburn University, Auburn, AL

2:30 – 3 pm

3325269 ★ The Contact Mechanics
Challenge for Predicting Indentation
Hardness

Matthew Brake, Rice University, Houston, TX, George
Pharr IV, Texas A&M University, College Station, TX,
Rosa Maria Espinosa Marzal, University of Illinois
Urbana-Champaign, Urbana, IL, Philip Egberts,
University of Calgary, Calgary, Alberta, Canada

3 – 4 pm – Exhibitor Appreciation Break

4 – 4:30 pm

3325628 ★ Effects of Lubrication on
Normal Elastic-Plastic Contact

Senyo Ahadzie, Rice University, Houston, TX

4:30 – 5 pm

3313360 ★ Influences of Adsorbed
Water on the Interfacial Adhesion
in the Early Stage of Sliding

Zaid Subhi, Malaysia-Japan International Institute of
Technology, Kuala Lumpur, Kuala Lumpur, Malaysia

5 – 5:30 pm

3288287 ★ An Investigation on
Oblique Gravitational Wave Trapping
Using Poroflexible Geometry in
Stratified Sea with Varying Base
Topography

Nagmani Prasad, Indian Institute of Technology,
Dhanbad, Jharkhand, India

5:30 – 6 pm

3309555 ★ Contact Deformation and
Stress Field of Materials Containing
Debonded Inhomogeneities Under
Cyclic Loading

Donglong Li, Northwestern University, Evanston, IL

6 – 6:30 pm – Contact Mechanics
Business Meeting

★ Session 2M

NANOTRIBOLOGY II

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

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

1:30 – 2:30 pm

3289517 ★ Invited Talk:
Functionalizing Hydrogels with
Polymer Brushes to Produce
Lubricious Surfaces

Nicholas Spencer, ETH Zurich, Zurich, Switzerland

2:30 – 3 pm

3333229 ★ Mechanochemical
Decomposition of Phosphate Esters
Confined and Sheared Between
Iron Oxide Surfaces

James Ewen, Carlos Ayestaran Latorre, Daniele Dini,
Imperial College London, London, United Kingdom

3 – 4 pm – Exhibitor Appreciation Break

4 – 4:30 pm

3320006 ★ Effect of Macromolecular
Architecture on Dynamic Cross-
linked Self-Healing Polymers

Zhijiang Ye, Qinghua Fang, Ballal Ahammed, Borui
Zhang, Mehdi Zanjani, Dominik Konkolewicz, Miami
University, Oxford, OH

4:30 – 5 pm

3337880 ★ Ab-Initio and Molecular
Dynamics Simulations to Study
Surfactants Interactions with
Engineering Surfaces

Carlos Ayestaran Latorre, James Ewen, Daniele Dini,
Imperial College London, London, United Kingdom,
Chiara Gattinoni, ETH Zurich, Zurich, Switzerland

5 – 5:30 pm

3318070 ★ High Temperature
Nanomechanical & Nanotribological
Behavior of Nitrogen-Doped Carbon
Overcoats Films

Ahmad Shakil, Andreas Polycarpou, Texas A&M
University, College Station, TX

5:30 – 6 pm

3285152 ★ Effect of Chain Weight
on Transfer-Film Formation Due to
Friction Between PTFE and Si₃N₄

Huijie Tang, Le Gu, Harbin Institute of Technology,
Harbin, Heilongjiang, China



Technical Sessions

Tuesday, May 5, 2020

★ Session 3A

COMMERCIAL MARKETING FORUM III

8 – 8:30 am | Open Slot

8:30 – 9 am | Biosynthetic Technologies

9 – 9:30 am | The Lubrizol Corp.

9:30 – 10 am | Münzing

10 – 10:30 am – Break

10:30 – 11 am | Croda, Inc.

11 – 11:30 am | Evonik Oil Additives, USA

11:30 am – Noon | King Industries Inc.

★ Session 3B

METALWORKING FLUIDS III

Session Chair: TBD

Session Vice Chair: TBD

8 – 8:30 am

3303669 ★ Foam Control and Formulation Techniques to Minimize Foam in Water Dilutable MWFs

Michael Miller, Univar Solutions, Houston, TX

8:30 – 9 am

3286360 ★ Non-Ionic Performance Surfactants on High Performance Metal Cleaners

Eduardo Lima, Dow Brazil, Jundiai, São Paulo, Brazil

9 – 9:30 am

3313898 ★ Metalworking Fluids and Chloride Corrosion on Aluminum Alloys

Alan Cross, John Burke, Quaker Houghton, Norristown, PA

9:30 – 10 am

3324594 ★ Reserving Metalworking Formulation Space for the Impossibilities

Nicole Clarkson, Clayton Cooper, Soraya Kraszczyk, ANGUS Chemical Co., Buffalo Grove, IL

10 – 10:30 am – Break

10:30 – 11 am

3325105 ★ Beating the Odds – How to Consistently Build Successful Products

Emil Schnellbacher, Chemico Systems, Chesterfield, MI

11 – 11:30 am

3314190 ★ Concentration and Stability Profiles of Copper-Infused Wire Drawing Fluids

Matt Vanden Eynden, Formulaction, Inc., Worthington, OH, Christelle Tisserand, Yoann Iefeuvre, Pascal Bru, Gerard Meunier, Formulaction, Toulouse, France

11:30 am – Noon

3283029 ★ Surface Behavior and Lubricative Properties of Hydroxyproline Rich, Natural Proteins in Metal Working Fluids

Eric Yezdimer, Gelita USA, Sergeant Bluff, IA, Matthias Reihmann, Gelita AG, Eberbach, Germany

★ Session 3C

ROLLING ELEMENT BEARINGS III

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

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

8 – 8:30 am

3282380 ★ Numerical Modeling of Three-Dimensional Crack Propagation Under Rolling Contact Fatigue

Florian Meray, Daniel Nelias, Anthony Gravouil, Thibaut Chaise, Univ Lyon, INSA-Lyon, Villeurbanne, France, Bruno Descharrieres, Airbus Helicopters, Marignane, France

8:30 – 9 am

3309993 ★ Evolution of Short Surface Cracks under Rolling Contact: 3D Crack Morphology and Influence of Material Composition

Chiara Bertuccioli, Finn Giuliani, Amir Kadiric, Imperial College London, London, United Kingdom

9 – 9:30 am

3278313 ★ Propagation of Rolling Contact Fatigue Cracks in Ball Bearing

Kenji Matsumoto, Honda R&D Co., Ltd., Haga-gun, Japan, Naoaki Yoshida, Kyushu University, Kasuga, Fukuoka, Japan, Akira Sasaki, Maintek, Yokohama, Kanagawa, Japan

9:30 – 10 am

3323724 ★ Investigation into the Propagation of Surface Cracks Under Rolling Contact Using Experimental and Numerical Methods

Bjoern Kunzelmann, Amir Kadiric, Imperial College London, London, United Kingdom, Guillermo Morales-Espejel, SKF Research and Technology Development, Houten, Netherlands

10 – 10:30 am – Break

10:30 – 11 am

3283782 ★ Investigation of Formation Mechanisms of Dark Etching Regions and White Etching Bands in SAE 52100 Steel Bearings

Mostafa El Laithy, Ling Wang, Terry Harvey, University of Southampton, Southampton, United Kingdom, Bernd Viernusel, Schaeffler Technologies AG & Co. KG, Schweinfurt, Germany

11 – 11:30 am

3284271 ★ Formation of White Etching Areas / Cracks on a Four-Disk Rig – Investigating Microstructural Changes

Adrian Mikitisin, Central Facility for Electron Microscopy, Aachen, Germany, Florian Steinweg, Institute for Materials Applications in Mechanical Engineering, Aachen, Germany

11:30 am – Noon

3285641 ★ Fracture-Mechanical Evaluation of Inclusions – Comparison with Test Results and Other Approaches

Joerg Binderszewsky, Wolfram Kruhoeffer, Toni Blass, Schaeffler Technologies AG & Co. KG, Herzogenaurach, Germany

★ Session 3D

BIOTRIBOLOGY III

Session Chair: Dipankar Choudhury, University of Arkansas, Fayetteville, AR

Session Vice Chair: Jack Famiglietti, University of Florida, Gainesville, FL

8 – 8:30 am

3280258 ★ Tribological Effect of Nanodiamonds as Potential Lubricant for Artificial Joints

Asghar Shirani, Diana Berman, University of North Texas, Little Elm, TX

8:30 – 9 am

**3324250 ★ Novel Bio-Tribometer
Exposing Macrophages to Freshly
Generated In-Situ CoCrMo-Debris**

Simona Radice, Kathrin Ebinger, Lauryn Samelko,
Pourzal Robin, Nadim Hallab, Markus Wimmer, Rush
University Medical Center, Chicago, IL

9 – 9:30 am

**3316419 ★ Fretting-Corrosion
Induced Hydrogen Permeation in
Biomedical Ti-Alloys**

Micheal Bryant, University of Leeds, Leeds, United
Kingdom

9:30 – 10 am

Invited Talk

10 – 10:30 am – Break

10:30 – 11 am

**3284242 ★ A Biomaterial for Cartilage
Replacement – A Tribological Study**

Rahul Ribeiro, Arun B.P., Alliance University, Bengaluru,
Karnataka, India

11 – 11:30 am

**3286662 ★ Sniffing Wear Patterns:
Acoustic Emission Signals as a
Diagnostic Tool for Joint Wear**

Khadijat Olorunlambe, Hua Zhe, Duncan Shepherd,
Karl Dearn, University of Birmingham, Birmingham,
United Kingdom

★ Session 3F

**LUBRICATION
FUNDAMENTALS III**

Session Chair: TBD

Session Vice Chair: TBD

8 – 8:30 am

**3321496 ★ Macroscale Superlubricity
Enabled by Hydrated Multivalent
Ions**

Tianyi Han, Zhang Chenhui, Jianbin Luo, Tsinghua
University, Beijing, China

8:30 – 9 am

**3277410 ★ The Effect of Magnetic
Field on the Hydration Revealed by
THz Spectroscopy and MDs**

Yanqi Gu, Tianbao Ma, Jianbin Luo, State Key Laboratory
of Tribology – Tsinghua University, Beijing, China

9 – 9:30 am

**3302240 ★ Three-Way Compatibility
Among Ionic Liquids, MoDTC, and**

PIBSI Dispersant

Weimin Li, Lanzhou Institute of Chemical Physics,
Lanzhou, Gansu, China, Chanaka Kumara, Huimin Luo,
Harry Meyer, Xin He, Jun Qu, Oak Ridge National
Laboratory, Oak Ridge, TN, Dien Ngo, Seong Kim,
Pennsylvania State University, University Park, PA

9:30 – 10 am

**3284970 ★ Tribo-Induced Interfacial
Nanostructures Assisting Robust
Superlubricity in Amorphous
Carbon Films: From Mechanisms
to Tailoring Strategies**

Xinchun Chen, Tsinghua University, Beijing, China

10 – 10:30 am – Break

10:30 – 11 am

**3337896 ★ Viscosity-Temperature
Equations for Petroleum-Based
Lubricating Oils**

Jack Zakarian, JAZTech Consulting, LLC, Orinda, CA,
Shaun Flannigan, Ashlie Martini, University of
California, Merced, Merced, CA

11 – 11:30 am

**3293046 ★ The Molecular Origins of
Viscosity in the Ester Lubricants**

Thomas Theyson, TensTech Inc., Matthews, NC

11:30 am – Noon

**3299774 ★ Shear-Thinning and
Rheological Transition in Lubricants
Sheared at High Strain Rates**

Vikram Jadhao, Indiana University, Bloomington, IN

★ Session 3G

MATERIALS TRIBOLOGY I

*Solid Lubricants for Extreme
Applications*

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

Session Vice Chair: Tyler Torgerson,
University of North Texas, Denton, TX

8 – 9 am

**Invited Talk: Lubrication by Carbon –
Surface Aromatization a General
Route for Achieving Superlubricity**

Maria-Isabel De Barros Bouchet, École Centrale de Lyon

9 – 9:30 am

**3286873: ★ Aging Gracefully:
Storage Effects on the Run-In of
MoS₂-Based Solid Lubricants**

Michael Dugger, Brendan Nation, Morgan Jones,

Nicolas Argibay, John Curry, Michael Chandross, Sandia
National Laboratories, Albuquerque, NM

9:30 – 10 am

**3320312 ★ Tribological Properties
of Duplex PEO/Chameleon Coating
on Aluminum Alloys**

Asghar Shirani, Samir Aouadi, Andery Voevodin,
Diana Berman, University of North Texas, Little Elm, TX,
Aleksy Yerokhin, University of Manchester, Manchester,
United Kingdom, Jon-Erik Mogonye, U.S. Army Research
Laboratory, Adelphi, MD, Andras Korenyi-Both,
Tribologix Inc., Golden, CO

10 – 10:30 am – Break

10:30 – 11 am

**3286767 ★ Tribological Performance
of PS400 Coating from Cryogenic
to Elevated Temperatures for Space
Application**

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

11 – 11:30 am

**3309532 ★ Tribochemistry and
Performance of Nanoparticle
Additives in Spacecraft Lubricants**

Andrew Clough, Edith Leung, Jeffrey Lince,
The Aerospace Corp., El Segundo, CA

11:30 am – Noon

**3339073 ★ Effect of Stoichiometry
and Oxygen on Crystallization of
MoS₂ from Atomic and Molecular
Precursors**

Rimei Chen, Ashlie Martini, University of California,
Merced, Merced, CA, Arben Jusufi, Andrew Konicek,
Chris Kliever, Aditya Jaishankar, Alan Schilowitz,
ExxonMobil Research and Engineering Co., Annandale, NJ

★ Session 3H

GREASE III

Session Chair: Gareth Fish, The Lubrizol
Corp., Wickliffe, OH

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

8 – 8:30 am

**3308619 ★ A New Methodology to
Characterize Constant Velocity
Joint Greases**

Valentin Ripard, Fabrice Ville, Jérôme Cavolet, LaMCoS –
INSA Lyon, Villeurbanne, France, Pierre Charles, Groupe
PSA, Velizy-Villacoublay, France



Technical Sessions

8:30 – 9 am

3284263 ★ Correlating the Adhesion and Tackiness of Greases to Their Frictional Performance

Emmanuel Georgiou, Dirk Drees, Falex Tribology NV, Rotselaar, Belgium

9 – 9:30 am

3324539 ★ Review of Custom SRV Tribological Test Fixturing to Simulate Bearing Test Rig Conditions

Rob Mulkern, Nye Lubricants, Fairhaven, MA

9:30 – 10 am

3322529 ★ On the Modeling of Lubricating Grease Thickener Deformation

Lars Westerberg, Naser Hamed, Luleå University of Technology, Luleå, Sweden

10 – 10:30 am – Break

10:30 – 11 am

3340628 ★ The Effect of Heavy Viscosity Base Oils on Grease Performance Properties

Edward Casserly, Ergon, Jackson, MS

11 – 11:30 am

3347641 ★ Application of Nano-Structure Urea Grease (INS-UG) to Wave Generation Gear

Hideki Nakata, Idemitsu Kosan, Co.Ltd, Tokyo, Japan

★ Session 3I

TRIBOCHEMISTRY III

Tribofilm Growth – Modeling & Characterization

Session Chair: TBD

Session Vice Chair: TBD

8 – 8:30 am

3338744 ★ First-Principles Insights into the Mechanism of Metal-Polymer Contact Electrification for Triboelectric Nanogenerator

Alessandra Ciniero, Imperial College London, London, United Kingdom

8:30 – 9 am

3325336 ★ Relating Tribofilm Formation and Performance to the Adsorption Strength of Surface-Active Precursors

Arman Mohammad Khan, Qian (Jane) Wang, Yip-Wah Chung, Northwestern University, Evanston, IL, Hongxing Wu, Xi'an Jiaotong University, Xian, China

9 – 9:30 am

3325221 ★ Comparing the Composition and Evolution of Macro- and Nano-Scale Phosphorus Antiwear Tribofilms with ToF-SIMS

Kerry Cogen, Ryan Rieth, Infineum USA L.P., Linden, NJ, Matthias Lorenz, Alison Pawlicki, Nikolay Borodinov, Olga Ovchinnikova, Oak Ridge National Laboratory, Oak Ridge, TN

9:30 – 10 am

3325301 ★ Understanding the In-Situ Formation and Evolution of Phosphorus Antiwear Tribofilms with FFM and NanoIR-AFM

Kerry Cogen, Ryan Rieth, Hitesh Thaker, Infineum USA L.P., Linden, NJ, Alison Pawlicki, Nikolay Borodinov, Olga Ovchinnikova, Oak Ridge National Laboratory, Oak Ridge, TN

10 – 10:30 am – Break

10:30 – 11 am

3286546 ★ Fundamentals of Tribochemistry – Model Study with Tribopolymerization of Adsorbate Molecules

Seong Kim, Xin He, Pennsylvania State University, State College, PA

11 – 11:30 am

3285552 ★ Tribochemical Process on Silicon Surface: Fundamental Understanding and Application to Nanofabrication

Linmao Qian, Lei Chen, Chen Xiao, Southwest Jiaotong University, Chengdu, Sichuan, China, Seong Kim, Pennsylvania State University, State College, PA

11:30 am – Noon

3313186 ★ Molecular Simulation Approach to Attack Friction Fade Out Phenomena

Hitoshi Washizu, Hirotoshi Akiyama, Riio Nakae, University of Hyogo, Kobe, Japan

★ Session 3J

CONDITION MONITORING I

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

Session Vice Chair: Kemberlee Snelling, Trico Corp., Davison, MI

8:30 – 9 am

3285675 ★ The Increased Acid Number Question – Does it or Doesn't it Cause Corrosion?

Michael D. Holloway, 5th Order Industry, Highland Village, TX

9 – 9:30 am

3285444 ★ Introduction of Online Oil Condition Monitoring System for Hydraulic Excavator

Hideki Akita, Hitachi Construction Machinery Co., Ltd., Tsuchiura, Ibaraki, Japan

9:30 – 10 am

3284840 ★ The Analysis of Wear and Wear Products from Gearboxes Utilization of Statistical Analysis

Surapol Raadnui, KMUTNB, Bangkok, Bang-Sue, Thailand

10 – 10:30 am – Break

10:30 – 11 am

3317073 ★ High Throughput Particle Count and Elemental Analysis of In-Service Oils in One Run

Autumn Wassmuth, PerkinElmer, New Haven, CT

11 – 11:30 am

3285697 ★ Strange Influences on Oil Analysis Results

Michael D. Holloway, 5th Order Industry, Highland Village, TX

★ Session 3K

ENGINE & DRIVE TRAIN I

Session Chair: Behzad Mahmoudi, Chevron Oronite LLC, Richmond, CA

Session Vice Chair: Abhishek Kar, Shell Global Solutions US Inc., Houston, TX

8 – 8:30 am

3274941 ★ Emission and Vehicle Performance Evaluation of Aged Gasoline Particle Filter via Accelerated Ash and Soot Loading

Weizi Li, Xiaojun Wu, Shell (Shanghai) Technology Limited, Shanghai, China, Yansong Lin, Jinchong Pan, Suzhou Automotive Research Institute, Tsinghua University, Suzhou, China, Chen Yang, Haijun Yang, Geely Powertrain Research Institute, Ningbo, China

8:30 – 9 am

3318940 ★ **Facile Mimicking of Internal Engine Oil Viscosity at Real Temperature and Shear by Way of a Microfluidic Rheometer**

Matt Vanden Eynden, Formulaction, Inc., Worthington, OH, Patrycja Adamska, Thanina Amiar, Hubert Ranchon, Pascal Bru, Gerard Meunier, Formulaction, Toulouse, France

9 – 9:30 am

3294373 ★ **Effects of Powertrain Formulations in Taxi Cab Severe Field Service**

JoRuetta Ellington, Evonik Industries, Horsham, PA

9:30 – 10 am

3284520 ★ **Friction and Wear of Thermal Spray Coatings for Cylinder Bores**

Arup Gangopadhyay, Larry Elie, Robert Zdrodowski, Zhiqiang Liu, Urban Morawitz, Joachim Patschull, Cliff Maki, Ford Motor Co., Novi, MI, Hamed Ghaednia, Gehring Group, Farmington Hills, MI

10 – 10:30 am – Break

10:30 – 11 am

3285656 ★ **Development of a Fired-Engine Test Cycle to Evaluate the Effect of Engine Oil Formulation on Emulsion Formation**

Dan Engstrom, Southwest Research Institute, San Antonio, TX

11 – 11:30 am

3286684 ★ **Component Wear in Diesel Engine High Pressure Fuel Pumps Operating with Heavy Fuel**

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

11:30 am – Noon

3283984 ★ **Influence of Fluids on the Operational Efficiency of Transmissions and Drivetrain Components**

Dean Tomazic, FEV North America Inc., Auburn Hills, MI

★ Session 3L

CONTACT MECHANICS III

Session Chair: Kylie Van Meter, University of Florida, Gainesville, FL

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

8 – 8:30 am

3278124 ★ **Computational Contact Modeling of Lithium Metal and Solid Electrolyte Interfaces**

Xin Zhang, Qian (Jane) Wang, Northwestern University, Evanston, IL, Stephen Harris, Lawrence Berkeley National Lab, Berkeley, CA

8:30 – 9 am

3283853 ★ **Comparison of Scale in Indentation Experiments**

John Despard, Matthew Brake, Rice University, Houston, TX

9 – 9:30 am

3315526 ★ **A Benchmark Study of Conformal Contact**

Jiahui Hou, Pu Li, JiangLin Li, Xiaoqing Jin, Chongqing University, Chongqing, China, Leon M. Keer, Northwestern University, Evanston, IL

9:30 – 10 am

3314982 ★ **The Origin of the Friction Coefficient for Randomly Rough Surfaces in Elastic Contact**

Feng-Chun Hsia, Cyrian Leriche, Steve Franklin, Bart Weber, Advanced Research Center for Nanolithography (ARCNL), Amsterdam, Netherlands, Daniel Bonn, University of Amsterdam, Amsterdam, Netherlands

10 – 10:30 am – Break

10:30 – 11 am

3322337 ★ **Transient Thermo-mechanical Analysis of Asperity Sliding Contact Considering the Effect of Temperature and Strain Rate on Material Properties**

Bin Zhao, Hanzhang Xu, Xiquan Lu, Zhigang Liu, Tongyang Li, Harbin Engineering University, Harbin, China

11 – 11:30 am

3317854 ★ **High-Temperature Nanomechanical Behavior of Inconel 617 Surface Oxides**

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

11:30 am – Noon

3323585 ★ **High-Temperature Contact Creep and Friction of Inconel 617 Surface Oxides**

Sepehr Salari, Lamar University, Fairfax, VA, Md Saifur Rahman, Andreas Polycarpou, Texas A&M University, Fairfax, VA, Ali Beheshti, George Mason University, Fairfax, VA

★ Session 3M

LUBRICATION FUNDAMENTALS: SPECIAL SESSION 1

Four Decades of Patri-Cheng Average Flow Model and Future Challenges in Tribology

Session Chair: TBD

Session Vice Chair: TBD

Invited Talks: As the lubrication science deepens in understanding and widens in its application to novel fields, time has come to review progress made in the past 40 years and discuss current challenges and future needs. This symposium brings together researchers in the field of lubrication to share their accomplishments in research and present their visions for future research and development.

★ Session 4A

COMMERCIAL MARKETING FORUM IV

2 – 3 pm | Afton Chemical's Key Driver Seminar

3 – 4 pm – **Exhibitor Appreciation Break**

4 – 4:30 pm | The Lubrizol Corp.

4:30 – 5 pm | BASF Corp.

5 – 5:30 pm | Eastman Chemical Co.



Technical Sessions

★ Session 4B

METALWORKING FLUIDS IV

Session Chair: TBD

Session Vice Chair: TBD

2 – 2:30 pm

3324812 ★ **Cross-Functional Benefits of Metalworking Fluid Additives**

Nicole Clarkson, ANGUS Chemical Co., Buffalo Grove, IL, Michael Stapels, Kao Chemicals GmbH, Emmerich am Rhein, Germany, Clayton Cooper, Soraya Kraszczyk, ANGUS Chemical Co., Buffalo Grove, IL, Sabine Wohlfahrt, Lea Tekath, Kao Chemicals GmbH, Emmerich am Rhein, Germany

2:30 – 3 pm

3297106 ★ **Investigation of O/W Emulsion in Rolling of Strips**

Behnam Hajshirmohammadi, Louisiana State University, Baton Rouge, LA

3 – 4 pm – Exhibitor Appreciation Break

4 – 4:30 pm

3303685 ★ **Measuring Tapping Performance Parameters – Using Tapping Torque to Evaluate Coolants and Coolant Additives**

Michael Miller, Univar Solutions, Houston, TX

4:30 – 5 pm

3319978 ★ **Correlation of Cutting Fluid Lubricity to Tool Life in Hard Metal Machining with an Improved Tapping Torque Test Method**

Chandra Khadilkar, Brian Mattes, Z. Tahir, Master Fluid Solutions, Perrysburg, OH

5 – 5:30 pm

3310322 ★ **The Performance of Environmentally Friendly Metal - working Fluids in Drilling on Titanium Alloy**

Junhui Ma, Javad Mohammadi, Olufisayo Gali, Reza Riahi, University of Windsor, Windsor, Ontario, Canada, Yan Zhou, Houghton International, Oak Ridge, TN, Jeff Larsh, Kris Januszkiewicz, Yixing Zhao, Quaker Houghton, Philadelphia, PA

5:30 – 6 pm – Metalworking Fluids Business Meeting

★ Session 4C

ROLLING ELEMENT BEARINGS IV

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

Session Vice Chair: Behrooz Jalalahmadi, Sentient Science Corp., Charlotte, NC

2 – 2:30 pm

3329361 ★ **Experimental and Numerical Assessment of Power Loss in Aero-Engine Cylindrical Roller Bearings: M50 versus Hybrid Bearings**

Rami Kerrouche, Azzedine Dadouche, Mahmoud Mamou, National Research Council Canada, Ottawa, Ontario, Canada, Salah Boukraa, University of Saad Dahlab, Blida, Algeria

2:30 – 3 pm

3285428 ★ **Minimum Energy Hypothesis in Quasi-Static Equilibrium Solutions for Angular Contact Ball Bearings**

Pradeep Gupta, PKG Inc., Clifton Park, NY

3 – 4 pm – Exhibitor Appreciation Break

4 – 4:30 pm

3283250 ★ **Bearing Performance Analysis Using an Advanced Dynamic Bearing Model**

Young Kang, Matthew Wilmer, The Timken Co., North Canton, OH

4:30 – 5 pm

3285157 ★ **Investigation of Cage Instability Mechanism with Considering Cage Design**

Yuanqing Liu, Wenzhong Wang, Beijing Institute of Technology, Beijing, China

5 – 5:30 pm

3311744 ★ **Experimental & Numerical Investigation of Spherical Rolling Element Bearing Performance Under Different Combinations of Radial and Axial Loads, Speed and Lubrication**

Nikhil Londhe, John Rhodes, Caleb Chovan, Shawn Froelich, The Timken Co., Canton, OH

5:30 – 6 pm

3282859 ★ **Investigation on the Mixed Lubrication Performance of a Coated Angular Contact Ball Bearing**

Jiqiang Wu, Liqin Wang, Tingjian Wang, Harbin Institute of Technology, Harbin, China

6 – 6:30 pm – Rolling Element Bearing Business Meeting

★ Session 4D

BIOTRIBOLOGY IV

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

Session Vice Chair: Gagan Srivastava, Dow Chemical Co., Jackson, TX

2 – 2:30 pm

3325108 ★ **Biotribological Investigation of Cartilage Inspired Textured Ti-6Al-4V and PEEK Interface**

Dipankar Choudhury, Evelyn Smith, Josh Goss, Min Zou, University of Arkansas, Fayetteville, AR

2:30 – 3 pm

3313747 ★ **A New Laser Textured Structure to Improve Tribocorrosion Behavior of Ti-6Al-4V ELI for Orthopedic Applications**

Yidong Xu, Jiahui Qi, Mingwen Bai, Jiawei Xi, Nutter John, Mark Rainforth, University of Sheffield, Sheffield, United Kingdom

3 – 4 pm – Exhibitor Appreciation Break

4 – 4:30 pm

3276530 ★ **Experimental Biotribological Testing of Hydrogels and Articular Cartilage for Medical Engineering Applications**

Florian Rummel, Anton Paar Germany GmbH, Ostfildern, Germany, Dominique Felk, Tübingen University, Tübingen, Germany, Kartik Pondicherry, Anton Paar GmbH, Graz, Austria

4:30 – 5 pm

3285465 ★ **Comparison of the Biotribological Behaviors of an Artificial Cervical Disc with the Articulation of TC4-XPE and CoCrMo-XPE**

Song Wang, Research Institute of Tsinghua University, Shenzhen, Guangdong, China

5 – 5:30 pm

3325261 ★ Wear of Antibacterial Coatings on CoCrMo Under Butterfly Motion and Dynamic Loads in a Biotribometer

Angela Maria Tortora, Deepak Halenahally Veeregowda, Ducom Instruments Europe B.V, Groningen, Netherlands

5:30 – 6 pm – Biotribology Business Meeting

★ Session 4E

SURFACE ENGINEERING I

Additive Manufacturing

Session Chair: TBD

Session Vice Chair: TBD

2 – 2:30 pm

3282152 ★ Effect of Test Temperature on Tribological Behavior of Additively Manufactured Stellite 21 Coating on 350 Maraging Steel

Sougata Roy, Niyanth Sridharan, Jun Qu, Oak Ridge National Laboratory, Oak Ridge, TN, Hamed Ghaednia, Gehring Group, Farmington Hills, MI, Arup Gangopadhyay, Ford Motor Co., Novi, MI

2:30 – 3 pm

3287053 ★ Surface Energy & Wetting Behavior of Additive Manufactured Inconel 718 Alloy for Efficient Tribological System

Arpith Siddaiah, Pankaj Kumar, Manoranjan Misra, Pradeep Menezes, University of Nevada-Reno, Reno, NV

3 – 4 pm – Exhibitor Appreciation Break

4 – 4:30 pm

3316642 ★ Tribology of Surfaces with 3D Textures Fabricated via Two Photon Lithography: A Multi-Scale In-Situ Study

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

4:30 – 5 pm

3322986 ★ Characterization and Performance of a PTFE-Based Ice-Phobic Coating

Robert Fleming, Arkansas State University, Jonesboro, AR, Giselle Toledo, German Perez Bakovic, Sam Beckford, SurfTec, Fayetteville, AR

5 – 5:30 pm

3285432 ★ Post-Additive Manufacturing Surface Modification Technology for Controlling Microstructure and Tribological Properties of Metallic Alloys

Auezhan Amanov, Young-Sik Pyun, Sun Moon University, Asan, Republic of Korea

★ Session 4F

LUBRICATION FUNDAMENTALS IV

Session Chair: TBD

Session Vice Chair: TBD

2 – 2:30 pm

3321896 ★ Soot Composition and its Impact on Wear

Nicole Doerr, Serhiy Budnyk, Adam Agocs, Marcella Frauscher, AC2T Research GmbH, Wiener Neustadt, Austria

2:30 – 3 pm

3325719 ★ A System Engineering Approach to Reduce Soot Wear

Deepak Halenahally Veeregowda, Angela Maria Tortora, Ducom Instruments Europe B.V, Groningen, Netherlands

3 – 4 pm – Exhibitor Appreciation Break

4 – 4:30 pm

3291404 ★ A New Approach to Optimize the One-Dimensional Lubricated Contact

Mhammed El Gadari, Ensam Meknes, Meknes, Morocco, Mohamed Hajjam, Institut Pprime, Poitiers, France

4:30 – 5 pm

3284937 ★ Investigation of the Lubricant Oil Flow Pattern Around Rolling Point Contacts

Hongbai Chen, Wenzhong Wang, He Liang, Beijing Institute of Technology, Beijing, China

5 – 5:30 pm

3281895 ★ Achieving Liquid Superlubricity Under Boundary Lubrication Conditions

Qiang Ma, Arman Mohammad Khan, Qian (Jane) Wang, Yip-Wah Chung, Northwestern University, Evanston, IL

5:30 – 6 pm

3273970 ★ Influence of Surface Thermal Properties on EHL Friction

Wassim Habchi, Lebanese American University, Byblos, Lebanon, Scott Bair, Georgia Institute of Technology, Atlanta, GA

★ Session 4G

MATERIALS TRIBOLOGY II

Protective Thin Films & Coatings

Session Chair: Mary Makowicz, Pratt & Whitney, East Hartford, CT

Session Vice Chair: TBD

2 – 2:30 pm

3286724 ★ Polymer Coatings as “Pre-Deposited Transfer Layers” for Extreme Temperature Applications

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

2:30 – 3 pm

3317704 ★ Effect of Cosmic Radiation on the Micro/Nano - mechanical and Morphological Properties of Selected Hard and Soft Coatings

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

3 – 4 pm – Exhibitor Appreciation Break

4 – 4:30 pm

3284210 ★ Carbon Nanotube Forest as a Protective Coating for Tribological Application

Chanaka Kumara, Michael Lance, Jun Qu, Oak Ridge National Laboratory, Oak Ridge, TN

4:30 – 5 pm

3325457 ★ Ultralow Wear Plasma Enhanced Atomic Layer Deposited Nitrides: Exploring Processing, Structure, Properties & Mechanisms

Tomas Babuska, Jewel Haik, Istiaque Chowdhury, Nicholas Strandwitz, Brandon Krick, Lehigh University, Bethlehem, PA, Mark Sowa, Veeco CNT, Waltham, MA, Alexander Kozen, University of Maryland, College Park, MD, Guosong Zeng, Lawrence Berkeley National Laboratory, Berkeley, CA, Kylie Van Meter, University of Florida, Gainesville, FL

5 – 5:30 pm – Materials Tribology Business Meeting



Technical Sessions

★ Session 4H

GREASE IV

Session Chair: Scott Crawford, Primrose Oil Co., Dallas, TX

Session Vice Chair: Erik Willett, Functional Products Inc., Macedonia, OH

2 – 2:30 pm

3286489 ★ Fully Customizable Calcium Sulfonate Greases for Optimum Performances

Guillaume Notheaux, SEQENS, Porcheville, France

2:30 – 3 pm

3321671 ★ A New Preformed Polyurea Thickener for Grease

Zhe Jia, John Cuthbert, Kevin Capaldo, Bruce Hook, Andrew Larson, Dow Chemical, Freeport, TX

3 – 4 pm – Exhibitor Appreciation Break

4 – 4:30 pm

3332057 ★ Novel Additive for Water Elimination in Bearing Greases

Germán Prieto, Walter Tuckart, Camila Müller, Consejo Nacional de Investigaciones Científicas y Técnicas, Bahía Blanca, Buenos Aires, Argentina, Bruno Pilotti, Andrés Ciolino, Planta Piloto de Química/UNS-CONICET, Bahía Blanca, Buenos Aires, Argentina

4:30 – 5 pm

3284306 ★ The Impact of Viscosity of Naphthenic Oils on Different Type of Lubricating Greases

Mehdi Fathi-Najafi, Nynas AB, Nynäshamn, Sweden, Ameneh Schneider, Optimol Instruments Prueftechnik GmbH, Munich, Germany

5 – 5:30 pm

3282417 ★ The Effects of Addition of Zinc Stearate in Grease on the Tribological Properties of PA66-GF Composite in Contact with Carbon Steel

Takeshi Kunishima, Vincent Fridrici, Gaëtan Bouvard, Jean-Christophe Abry, Philippe Kapsa, LTDS Laboratoire de Tribologie et Dynamique des Systèmes, Lyon, France

★ Session 4I

TRIBOCHEMISTRY IV

Perspectives & Applications

Session Chair: TBD

Session Vice Chair: TBD

2 – 2:30 pm

3324464 ★ Tribocchemistry – Past, Present, and Future

Stephen Hsu, George Washington University, Washington, DC

2:30 – 3 pm

3284999 ★ Mechanochemical Wear of Silicate Glass: Beyond the Conventional Materials Removal

Hongtu He, Southwest University of Science and Technology, Mianyang, Sichuan, China, Seung Ho Hahn, Seong Kim, Pennsylvania State University, State College, PA

3 – 4 pm – Exhibitor Appreciation Break

4 – 4:30 pm

3291335 ★ Durable Lubricating Properties of Mussel-Inspired Polydopamine Nanoparticles as a Water-Based Additive

Guangyan Chen, Yongyong He, Jianbin Luo, State Key Laboratory of Tribology, Beijing, China, Jun Zhao, Beijing University of Chemical Technology, Beijing, China

★ Session 4J

CONDITION MONITORING II

Session Chair: Daniel Walsh, Spectro Scientific, Chelmsford, MA

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

2 – 2:30 pm

3271943 ★ Determination of Total Oil Content in Metalworking Fluid Emulsions by a Fourier-Transform Infrared Method

Brittney Lagerman, BP Lubricants USA Inc., Naperville, IL

2:30 – 3 pm

3284704 ★ Analysis of Metal Additives and Wear Metals in Lubricants by High-Resolution ICP-OES

Oliver Buettel, Siqi Sun, Analytik Jena US LLC, Upland, CA

3 – 4 pm – Exhibitor Appreciation Break

4 – 4:30 pm

3293271 ★ Prevention of Electrostatic Charge Generation in Filtration of Low Conductive Oils by Surface Modification of Modern Filter Media

John Duchowski, Johannes Staudt, HYDAC FluidCareCenter®, Sulzbach, Saar, Germany, Stephan Leyer, University of Luxembourg, Luxembourg

4:30 – 5 pm

3295693 ★ Isolation & Identification of Oxidation Products in Thermally Oxidized Group I, III, and IV Base Oils by Flow Modulated Two-Dimensional Gas Chromatography – Time of Flight Mass Spectrometry

Paul Harvath, Added Dimension Consulting, Lake Orion, MI, Christina Kelly, Joe Binkley, Lorne Fell, LECO Corp., St. Joseph, MI, John Bucci, Bill VanBergen, Savant Group, Midland, MI

5 – 5:30 pm

3310476 ★ Fast and Reliable Quality Control of Fresh and In-Service Lubricants by FT-MidIR Spectrometry

Aaron Mendez, Ayalalytical Instruments, Chicago, IL

5:30 – 6 pm – Condition Monitoring Business Meeting

★ Session 4K

ENGINE AND DRIVETRAIN II

Session Chair: Oluwaseyi Ogunsola, Shell Technology Center, Houston, TX

Session Vice Chair: Piotr Grzyska, Afton Chemical Corp., Richmond, VA

2 – 2:30 pm

3316461 ★ A Study of Surface Acoustic Wave Sensors to Evaluate Fuel Dilution in Engine Oils

Seyed Mirmiran, FCA US LLC, Auburn Hills, MI, Lisa Williams, Randi Price, Spectro Scientific, Chelmsford, MA

2:30 – 3 pm

3296296 ★ Real-Time Wear Mapping of a 2.0L Turbocharged Gasoline Direct Injection Engine – Part II

Peter Lee, Gregory Hansen, Carlos Sanchez, Craig Wileman, Cole Hudson, Southwest Research Institute, San Antonio, TX

3 – 4 pm – Exhibitor Appreciation Break

4 – 4:30 pm

3323460 ★ The Effect of Engine Oil and Lubrication System Design on Engine Friction as Demonstrated in a Motored Engine

William Anderson, Kongsheng Yang, Yun Zhang, Sha Yang, Afton Chemical Corp., Richmond, VA, Yuele Ding, PATAC, Shanghai, China

4:30 – 5 pm

3286119 ★ Development and Testing of a Low Viscosity, Fuel-Efficient, Heavy-Duty Diesel Engine Oil for Severe Service

Allen Comfort, US Army Ground Vehicle Systems Center, Warren, MI, Steven Thrush, Oakland University, Rochester, MI

5 – 5:30 pm

3269401 ★ Efficiency and Friction Investigation on Drive Chains – Comparison between Two Different Tribological Test Rig Concepts

Dominik Meffert, Andre Becker, Bernd Sauer, Technische Universität Kaiserslautern, Kaiserslautern, Germany

5:30 – 6 pm

3313981 ★ Piston Ring on Liner Lubrication Monitoring in a Marine Diesel Engine using Ultrasound

Jack Rooke, Xiangwei Li, Rob Dwyer-Joyce, University of Sheffield, Sheffield, South Yorkshire, United Kingdom, Henry Brunskill, Peak to Peak Measurement Solutions Ltd., Sheffield, South Yorkshire, United Kingdom, Matthias Stark, WinGD, Winterthur, Switzerland

6 – 6:30 pm

3326611 ★ Tribological Aspects of Utilizing Wet Friction Materials in Wet Clutch Systems

Vladimir Klotchikhine, Greening Inc., Detroit, MI

★ Session 4L

2D MATERIALS

Materials Tribology and Nanotribology Joint Session I

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

Session Vice Chair: Nicholas Chan, University of Calgary, Calgary, New Brunswick, Canada

2 – 2:30 pm

3286531 ★ Chemical and Physical Origins of Friction on Two-Dimensionally Flat Surface with Atomic Steps

Seong Kim, Zhe Chen, Pennsylvania State University, State College, PA, Ashlie Martini, Arash Khajeh, Mohammad R. Vazirisereshk, University of California, Merced, Merced, CA

2:30 – 3 pm

3288831 ★ Superlubricity of Black Phosphorus as Lubricant Additive

Hanjun Gong, Guoxin Xie, Shuai Wu, Tsinghua University, Beijing, China, Wei Wang, Xi'an University of Architecture and Technology, Xi'an, China, Ziyi Cui, Zhuzhou Electrical Locomotive Co., Zhuzhou, China

3 – 4 pm – Exhibitor Appreciation Break

4 – 4:30 pm

3323166 ★ In-Situ Reactive Formation of MoS₂ Tribofilms: Interaction with ZDDP and Dispersants

Manel Rodriguez Ripoll, Bernhard Kohlhauser, Sara Spiller, AC2T Research GmbH, Wiener Neustadt, Austria, Carmen Vladu, CEST GmbH, Wiener Neustadt, Austria

4:30 – 5 pm

3321456 ★ Effect of Ni Dopant and Environment on Wear Life of MoS₂ Dry Film Lubricant

Azhar Vellore, Sergio Romero Garcia, Ashlie Martini, University of California, Merced, Merced, CA, Duval Johnson, Andrew Kennett, Matthew Heverly, NASA Jet Propulsion Laboratory (JPL), Pasadena, CA, Nicholas Walters, Lawrence Livermore National Laboratory, Livermore, CA

5 – 5:30 pm

3279907 ★ In-Plane Potential Gradient Induces Low Frictional Energy Dissipation During the Stick-Slip Sliding on the Surfaces of 2D Materials

Feng He, Xiao Yang, Guoxin Xie, Jianbin Luo, State Key Laboratory of Tribology, Tsinghua University, Beijing, China

5:30 – 6 pm

3281733 ★ Tribo-Induced Interfacial Material Transfer of AFM Probe Assisting Superlubricity in WS₂/Graphene Heterojunction

Jisen Tian, Tsinghua University, Beijing, China

★ Session 4M

LUBRICATION FUNDAMENTALS SPECIAL SESSION

Four Decades of Patri-Cheng Average Flow Model and Future Challenges in Tribology (Invited Talks Only)

Session Chair: TBD

Session Vice Chair: TBD

As the lubrication science deepens in understanding and widens in its application to novel fields, time has come to review progress made in the past 40 years and discuss current challenges and future needs. This symposium brings together researchers in the field of lubrication to share their accomplishments in research and present their visions for future research and development.



Technical Sessions

Wednesday, May 6, 2020

★ Session 5A

COMMERCIAL MARKETING FORUM V

8 – 8:30 am | Open Slot

8:30 – 9 am | Open Slot

9 – 9:30 am | Pilot Chemical Co.

9:30 – 10 am | STLE Emerging Trends Report

10 – 10:30 am – Break

10:30 – 11 am | Savant Labs & Institute of Materials

★ Session 5B

ENVIRONMENTALLY FRIENDLY FLUIDS I

Session Chair: Brajendra Sharma, University of Illinois at Urbana-Champaign, Urbana, IL

Session Vice Chair: Mark Miller, Biosynthetic Technologies, Indianapolis, IN

8:30 – 9 am

3283665 ★ EU Ecolabel for Lubricants – European Approach to Evaluate EALs

Salvatore Rea, Lanxess Corp., Perkasi, PA, Thomas Klein, Lanxess Deutschland GmbH, Mannheim, Germany

9 – 9:30 am

3322919 ★ EALs for Marine Vessel Stern Tubes – Not all Esters are Equal
Kevin Duncan, Croda, Cowick, United Kingdom

9:30 – 10 am

3285535 ★ Experimental Comparison of EALs for Marine Vessel Stern Tubes

Sam Davison, University of Sheffield, Sheffield, South Yorkshire, United Kingdom

10 – 10:30 am – Break

10:30 – 11 am

3308645 ★ Triblock Polyalkylene Glycols as Hydrolytic Stability Improvers for Esters

Martin Greaves, Dow Chemical, Horgen, Switzerland

11 – 11:30 am

3285392 ★ Group V Basestocks on the Rise – Unconventional Basestocks as One Lever for More Sustainable Lubrication

Frank Rittig, René Koschabek, Henrik Heinemann, Uwe Förster, Edith Tuznya, BASF SE, Ludwigshafen, Germany, Gene Zehler, BASF Corp., Cincinnati, OH

11:30 am – Noon

3324278 ★ Optimization of Bio-Derived Basefluid Properties to Improve Efficiency in Hydraulic Systems

M. Cinta Lorenzo Martin, Oyelayo Ajayi, George R. Fenske, Argonne National Laboratory, Lemont, IL, Girma Biresaw, Grigor Bantchev, USDA-ARS-NCAUR-BOR, Peoria, IL

★ Session 5C

ROLLING ELEMENT BEARINGS V

Session Chair: Vasilios Bakolas, Schaeffler Technologies AG & Co. KG, Schweinfurt, Germany

Session Vice Chair: Trevor Slack, American Roller Bearing Co., Morganton, NC

8 – 8:30 am

3279481 ★ Dynamics in Kinematics – Running Noise Calculation of Bearings in the Kinematic Regime

Hannes Grillenberger, Schaeffler Technologies AG & Co. KG, Herzogenaurach, Bayern, Germany

8:30 – 9 am

3286527 ★ A Strongly Coupled FDM – FEM Model for 2D Elastohydro-dynamically Lubricated Contact

Wyatt Peterson, Thomas Russell, Farshid Sadeghi, Purdue University, West Lafayette, IN, Michael Tekletsion Berhan, Ford Motor Co., Dearborn, MI

9 – 9:30 am

3323754 ★ Fatigue Spall Propagation of AISI 52100 and VIM-VAR M50 Angular-Contact Bearings

Jeremy Nickell, Lewis Rosado, Mathew Kirsch, AFRL/RQTM, Wright Patterson Air Force Base, OH

9:30 – 10 am

3288261 ★ Influence on Rolling Bearing Performance of Contact Temperature and Wear

Jonas Stahl, Lars-Erik Stacke, AB SKF, Goteborg, Sweden, Guillermo Morales-Espejel, SKF BV, Houten, Netherlands

10 – 10:30 am – Break

10:30 – 11 am

3286447 ★ The Rating Life of Needle Roller Bearings in Universal Joints

Georg Breslau, Institute of Machine Elements and Machine Design (Technische Universität Dresden), Dresden, Germany

11 – 11:30 am

3316320 ★ Service Life in Rolling Element Bearings

Bruno Mevel, NTN-SNR, Annecy, France

★ Session 5D

FLUID FILM BEARINGS I

Session Chair: TBD

Session Vice Chair: TBD

8 – 8:30 am

3286293 ★ Drag Power Loss Correlations for Flooded Tilting Pad Journal Bearings – A Predictive Model and its Experimental Verification

Manish Thorat, Wei Li, Elliott Group, Jeannette, PA, Luis San Andres, Texas A&M University, College Station, TX, Hardik Jani, Honeywell, Mt. Laurel, NJ, Hussain Kaizar, Kelm Engineering, Friendswood, TX

8:30 – 9 am

3322397 ★ Performance Evaluation of Different Configurations of Hydrostatic Grinding Spindles

Hua-Chih Huang, Wei-Yang Chen, National Kaohsiung University of Science and Technology, Kaohsiung City, Taiwan

9 – 9:30 am

3319883 ★ Numerical & Experimental Analysis of Starvation for a Tilting Pad Journal Bearing

Scan DeCamillo, Kingsbury, Inc., Philadelphia, PA, Cori Watson-Kassa, University of Virginia, Charlottesville, VA

9:30 – 10 am

3286458 ★ Computer Experimental Design for Tribological Optimization

Nenzi Wang, Yu-Wen Chen, Chang Gung University, Tao-Yuan, Taiwan

10 – 10:30 am – Break

10:30 – 11 am

3285921 ★ Experimental Response of a Rotor Supported on Simple Rigid Surface Gas Bearings

Keun Ryu, Youngseok Song, Hanyang University, Seoul, Republic of Korea

11 – 11:30 am

3323521 ★ On the Significance of Bearing Configurations and Imbalances on the Dynamics of Small Automotive Turbochargers: A Lesson from Comprehensive Experiments and Predictions

Keun Ryu, Kyuman Kim, Hanyang University, Seoul, Republic of Korea

11:30 am – Noon

3326426 ★ Experimental and Numerical Analysis of a Connecting Rod Bearing

Aurelian Fatu, Mihail Radoi, Yann Henry, Institut Pprime, Angoulême, France

★ Session 5E

TRIBOLOGY OF BIOMATERIALS

Biotribology and Materials Tribology Joint Session I

Session Chair: George Degen, University of California, Santa Barbara, Santa Barbara, CA

Session Vice Chair: Kylie Van Meter, University of Florida, Gainesville, FL

8 – 8:30 am

3324450 ★ Mechanisms of Aqueous Gel Adhesion

George Degen, Allison Chau, Angela Pitenis, University of California, Santa Barbara, Santa Barbara, CA

8:30 – 9 am

3325549 ★ Microstructural Contribution to Hydrogel Frictional Dissipation

Tooba Shoaib, Paige C. Prendergast, Justin Silberman, Rosa Espinosa-Marzal, University of Illinois at Urbana-Champaign, Urbana, IL

9 – 9:30 am

3324847 ★ Speed-Independent Friction with Yield Stress Gradients

Eric McGhee, W. Gregory Sawyer, University of Florida, Gainesville, FL

9:30 – 10 am

3325050 ★ Fragile Objects and Interfaces

Angela Pitenis, George Degen, Allison Chau, University of California, Santa Barbara, Santa Barbara, CA

10 – 10:30 am – Break

10:30 – 11 am

3315962 ★ A Numerical Modeling Framework for Lubrication in Compliant Contacts

Abdullah Azam, Abdel Dorgham, Micheal Bryant, Mark Wilson, Nikil Kapur, Anne Neville, University of Leeds, Leeds, United Kingdom

11 – 11:30 am

3324615 ★ 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, Faculty of Health and Medicine, Krems, Austria

11:30 am – Noon

3324098 ★ Mechanical and Biological Responses of Cartilage to Tribological Challenge- a 3-Factor Central Composite Design Analysis

Catherine Yuh, Benjamin Witt, Spencer Fullam, Susanna Chubinskaya, Markus Wimmer, Rush University, Chicago, IL, Suzanne Maher, Hospital for Special Surgery, New York City, NY

★ Session 5F

LUBRICATION FUNDAMENTALS V

Session Chair: TBD

Session Vice Chair: TBD

8 – 8:30 am

3283757 ★ Sliding Tribological Performance of the Proppant in Shale Rock Fractures Under Water-Based Fracturing Fluid

Huijie Zhang, Shuhai Liu, Huaping Xiao, China University of Petroleum-Beijing, Beijing, China

8:30 – 9 am

3323479 ★ Rheology and Wear Reduction Characteristics of Base Oils in Pure Sliding Point Contacts

Sipho Masilela, Philip de Vaal, University of Pretoria, Pretoria, Gauteng, South Africa

9 – 9:30 am

3323514 ★ The Effect of Temperature on the Friction and Wear Behavior of Fuel Oils Under Oxygen and Nitrogen (Inert) Atmosphere

Trinity Thobejane, Philip de Vaal, University of Pretoria, Pretoria, Gauteng, South Africa

9:30 – 10 am

3324555 ★ Steady State Friction of Metals: Progress in Prediction

Stephen Hsu, George Washington University, Washington, DC

10 – 10:30 am – Break

10:30 – 11 am

3323522 ★ Thermo-Kinetic Behavior and Lubricity of Molecularly Thin Lubricant in Head-Disk Interface

Changdong Yeo, Shahriar Rahman, Jingan Song, Texas Tech University, Lubbock, TX

11 – 11:30 am

3325184 ★ Development of Lubricity Test Methods to Investigate Aging of Lubricants

Deepak Halenahally Veeragowda, Fabio Alemanno, Giulia Chiarioni, Ducom Instruments Europe B.V., Groningen, Netherlands

11:30 am – Noon

3323616 ★ Using Bespoke Friction Rigs to Develop the Next Generation of Slideway Technologies

Ralph Lumby, Afton Chemical Ltd., Bracknell, United Kingdom

★ Session 5G

MATERIALS TRIBOLOGY III

Hard to Soft: Fluoropolymer Composites & Hydrogels

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

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

8 – 8:30 am

3319935 ★ A Comparative Study on the Structure – Process Relationship of PTFE-PEEK Composites

Kasey Campbell, Cooper Atkinson, Tomas Babuska, Brantley Balsamo, Christopher Junk, Brandon Krick, Lehigh University, Bethlehem, PA, Mark Sidebottom, Miami University, Oxford, OH

8:30 – 9 am

3289374 ★ Maximizing the Impact of Nanofillers on PTFE Wear Resistance

Istiaque Alam, Aman Garodia, David Burris, University of Delaware, Newark, DE



Technical Sessions

9 – 9:30 am

3323503 ★ Effect of Filler and Countersurface Mechanical Properties on Wear of Fluoropolymer Composites

Mark Sidebottom, Sifat Ullah, Miami University, Oxford, OH, Nathan Heckman, Brad Boyce, Sandia National Laboratory, Albuquerque, NM, Tomas Babuska, Brandon Krick, Lehigh University, Bethlehem, PA

9:30 – 10 am

3324515 ★ Fluoropolymer Composites: Effect of Counterface and Filler Material Properties on Wear Performance

Sifat Ullah, Mark Sidebottom, Alex Rhodes, Jan Gabski, Miami University, Oxford, OH

10 – 10:30 am – Break

10:30 – 11 am

3323565 ★ Hysteretic Lubrication of Polyacrylamide Hydrogels Caused by Transient Water Film Formation

Jiho Kim, Alison Dunn, University of Illinois at Urbana-Champaign, Urbana, IL

11 – 11:30 am

3322046 ★ Compositional Dependence of Hydrogel Wear Mechanisms Under Mild Abrasion

Shabnam Bonyadi, Alison Dunn, University of Illinois at Urbana-Champaign, Urbana, IL

11:30 am – Noon

3285834 ★ Linking Energy Loss in Soft Adhesion to Surface Roughness

Tevis Jacobs, Abhijeet Gujrati, Subarna Khanal, University of Pittsburgh, Pittsburgh, PA, Siddhesh Dalvi, Ali Dhinojwala, University of Akron, Akron, OH, Lars Pastewka, University of Freiburg, Freiburg, Germany

★ Session 5H

2D MATERIALS

Materials Tribology and Nanotribology Joint Session II

Session Chair: Philip Egberts, University of Calgary, Calgary, Alberta, Canada

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

8 – 8:30 am

3286667 ★ Hydrodynamic Slip and Frictional Characteristics of the

Graphene-Liquid Interface

Rosa Espinosa-Marzal, Gus Greenwood, Jin Myung Kim, SungWoo Nam, University of Illinois at Urbana-Champaign, Urbana, IL

8:30 – 9 am

3320097 ★ Novel Solid Lubricants for Use in Multifarious Environments at High Load and Sliding Speeds

Aditya Ayyagari, Kalyan Mutyala, Anirudha Sumant, Argonne National Laboratory, Lemont, IL

9 – 9:30 am

3272845 ★ Liquid Superlubricity Enabled with Two-Dimensional Nano-Additives

Hongdong Wang, Yuhong Liu, Tsinghua University, Beijing, China, Ali Erdemir, Argonne National Laboratory, Argonne, IL, Jianbin Luo, Tsinghua University, Beijing, China

9:30 – 10 am

3285813 ★ Shear Response of Graphene in N-Hexadecane

Behnoosh Sattari Baboukani, Prathima Nalam, University at Buffalo, Buffalo, NY, Zhijiang Ye, Miami University, Oxford, OH

10 – 10:30 am – Break

10:30 – 11:30 am

Invited Talk

Jonathan Felts, Texas A&M University

11:30 am – Noon

3282823 ★ Direct Visualization of Exciton Transport in Defective Few-Layer WS₂ by Ultrafast Microscopy

Huan Liu, Dameng Liu, Jianbin Luo, State Key Laboratory of Tribology, Tsinghua University, Beijing, China

★ Session 5I

SURFACE ENGINEERING II

Surface Texture

Session Chair: TBD

Session Vice Chair: TBD

8 – 8:30 am

3281368 ★ Tribology and Biomimetic Surface Application in Oil and Gas Field

Yanbao Guo, Zheng Zhang, Xuanli Zhou, Deguo Wang, China University of Petroleum, Beijing, China

8:30 – 9 am

3287110 ★ The Effect of the Surface Texturing Fabrication Technique on the Coefficient of Friction Under Dry Sliding Contact Condition

Ola Rashwan, Pennsylvania State University – Harrisburg, Middletown, PA, Vesselin Stoilov, University of Windsor, Windsor, Ontario, Canada

9 – 9:30 am

3323364 ★ Friction Characteristics of Arbitrary Biosurfaces

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

9:30 – 10 am

3323495 ★ Design Guide of Laser Surface Texturing for Reduction of Wear and Coefficient of Friction by Using Different Geometries on Tools for Manufacturing Applications

Demófilo Maldonado, Laura Pena-Paras, Natalia Rodriguez, Marcelo Posada, Universidad de Monterrey, San Pedro, Mexico

10 – 10:30 am – Break

10:30 – 11 am

3323715 ★ Tribological Effects of Triangle-Shaped Surface Textures under Unidirectional Lubricated Sliding

Pawel Pawlus, Slawomir Wos, Waldemar Koszela, Andrzej Dzierwa, Rzeszow University of Technology, Rzeszow, Poland

11 – 11:30 am

3324246 ★ Surface Texture Design Guideline and Testing

Stephen Hsu, Govindaiah Patakamuri, George Washington University, Washington, DC, Tim Cushing, GMC, Detroit, MI

11:30 am – Noon

3284264 ★ Effect of Film-Temperature Boundary Conditions on the Lubrication Performance of Micro-Dimpled Parallel Thrust Bearing

Tae-Jo Park, Gyeongsang National University, Jinju, Republic of Korea

★ Session 5J

CONDITION MONITORING III

Session Chair: Kemberlee Snelling,
Trico Corp., Davison, MI

Session Vice Chair: Daniel Walsh,
Spectro Scientific, Chelmsford, MA

8:30 – 9 am

3284243 ★ **Monitoring of Transmissions With Oil Immersed Discs in Heavy Duty Equipment: Ineffectiveness of Standard Oil Analysis and the Need for Specific Testing**

Joseph Fotue, TOTAL Cameroon, Douala, Cameroon

9 – 9:30 am

3287103 ★ **Product Quality Maintenance & Reliability in the Lubricant Supply Chain**

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

9:30 – 10 am

3323493 ★ **Bearing Condition Monitoring with High-Frequency Impedance Analysis**

Georg Martin, TU Darmstadt, Darmstadt, Germany

10 – 10:30 am – Break

10:30 – 11 am

3324910 ★ **Diagnosing the Root Cause of an Overheated Gearbox**

Evan Zabawski, TestOil, Calgary, Alberta, Canada

11 – 11:30 am

3324972 ★ **Diagnosing Improper Bearing Lubrication Using Oil Analysis**

Evan Zabawski, TestOil, Calgary, Alberta, Canada

★ Session 5K

ENGINE AND DRIVETRAIN III

Session Chair: Raj Chandramohan, BorgWarner Inc., Arden, NC

Session Vice Chair: Behzad Mahmoudi, Chevron Oronite LLC, Richmond, CA

8 – 8:30 am

3322996 ★ **Tribofilm Chemistry for Engine Oils Formulated with Organic Polymeric Friction Modifiers**

John Eastwood, Croda, Goole, East Yorkshire, United Kingdom

8:30 – 9 am

3324584 ★ **Organic Polymeric Friction Modifiers Effects on Tribofilm Formation and Properties in HDDEO Formulations**

Alexei Kurchan, Croda, New Castle, DE

9 – 9:30 am

3286465 ★ **Lubrication Property Analysis of Piston Ring in Low Speed Marine Considering Oil Supply**

Xuan Ma, Tongyang Li, Bowen Jiao, Xiqun Lu, Harbin Engineering University, Harbin, Heilongjiang, China

9:30 – 10 am

3279177 ★ **Road to Ultra-Low Viscosity 0W Oils: Quantifying Frictional Benefits on the Journal Bearing Machine and Start/Stop Durability via Sapphire Rig Tests**

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) Inc., London, United Kingdom

10 – 10:30 am – Break

10:30 – 11 am

3310366 ★ **Lubricating Behavior at a Fluid-Solid Interface**

Yan Chen, Hong Liang, Texas A&M University, College Station, TX, Johnny Yue, Lawrence Berkeley National Laboratory, Berkeley, CA, Mojdeh Rasoulzadeh, The University of Alabama, Tuscaloosa, AL

11 – 11:30 am

3320910 ★ **Optimizing Lubricant Formulation with Group II Base Oils for Automotive Applications**

Yue-Rong Li, Chevron, Richmond, CA

11:30 am – Noon

3305842 ★ **Low Viscosity Engine Oils, a Comparative Evaluation of Advanced Base Stock Technology**

Paula Vettel, Steve Haffner, David Matucha, Novvi LLC, Emeryville, CA

★ Session 5L

TRIBOTESTING I

Session Chair: TBD

Session Vice Chair: TBD

8 – 8:30 am

3277865 ★ **On Measuring the Friction Component of Oils**

Kenneth Budinski, Bud Labs, Rochester, NY

8:30 – 9 am

3285253 ★ **Impact-Slide Wear Testing for Evaluation of Hard Coatings for Tooling Applications**

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

9 – 9:30 am

3287117 ★ **Development of a Novel Test Method for Friction Assessments of Shock Absorber Fluids**

Jason Papacek, Calumet Specialty Products Partners, Indianapolis, IN

9:30 – 10 am

3289046 ★ **Statistical Considerations in Wear Scar Measurement in Antifriction Coatings**

Melissa Mushrush, DuPont de Nemours, Inc., Midland, MI, Kevin Wier, The Dow Chemical Co., Midland, MI

10 – 10:30 am – Break

10:30 – 11 am

3296301 ★ **Investigation of the Sensitivity of the Wire-On-Capstan**

Peter Lee, Southwest Research Institute, San Antonio, TX

11 – 11:30 am

3321771 ★ **Investigation of Lubrication Regime Transitions for High-Speed Reciprocating Applications**

Oluwaseyi Ogunsola, Shell Global Solutions, Houston, TX

11:30 am – Noon

3294506 ★ **Depletion of MoDTC and Synergism with OFM in Boundary Lubricated Tribological Contacts**

Simon Barnes, Shahriar Kosarieh, Ardian Morina, Anne Neville, University of Leeds, Witney, Oxon, United Kingdom, David Gillespie, Gareth Moody, Croda, Goole, United Kingdom



Technical Sessions

★ Session 5M

LUBRICATION FUNDAMENTALS SPECIAL SESSION

Four Decades of Patri-Cheng Average Flow Model and Future Challenges in Tribology (Invited Talks Only)

Session Chair: TBD

Session Vice Chair: TBD

As the lubrication science deepens in understanding and widens in its application to novel fields, time has come to review progress made in the past 40 years and discuss current challenges and future needs. This symposium brings together researchers in the field of lubrication to share their accomplishments in research and present their visions for future research and development.

★ Session 6A

COMMERCIAL MARKETING FORUM VI

1:30 – 2 pm | Open Slot

2 – 2:30 pm | Open Slot

2:30 – 3 pm | Open Slot

3 – 3:30 pm – Break

3:30 – 4 pm | Open Slot

4 – 4:30 pm | Open Slot

4:30 – 5 pm | Open Slot

★ Session 6B

NONFERROUS METALS I

Biobased and Synthetic Lubricants

Session Chair: Girma Biresaw, BOR, USDA-ARS-NCAUR-BOR, Peoria, IL

Session Vice Chair: Rick Pruhs, Quaker Houghton, Waverly, IA

1:30 – 2 pm

3286625 ★ Cold, Clean and Green: Biomimetic Industrial Lubricants to Support the Cold Chain

Iestyn Stead, David Eckold, Karl Dearn, University of Birmingham, Birmingham, United Kingdom

2 – 2:30 pm

3305233 ★ A Non-Ferrous Study Investigating the Lubricity and Film Thickness Behavior of Rolling Oils Containing Mixed Ester Packages on Varying Grades of Aluminium

Emma Pates, Stephen Chestnutt, Total UK, London, United Kingdom, Annie King, Total Specialties USA, Inc., Linden, NJ

2:30 – 3 pm

3308433 ★ Non-Edible Vegetable Oils: Options and Choices for Meeting Different Types Lubricant Requirements

Joseph Pattathilchira Varghese, (formerly with Indian Oil R&D Center), Faridabad, Haryana, India

3 – 3:30 pm – Break

3:30 – 4 pm

3319543 ★ Vaporization and Flow Properties of Biobased Oils

Tom Karis, TEK Data Systems, Aromas, CA, Girma Biresaw, USDA-ARS-NCAUR-BOR, Peoria, IL, P. Iaccarino, Raj Shah, Koehler Instruments Co., Inc., Holtsville, NY

4 – 4:30 pm

3320243 ★ Biobased Disulfide Additive Based on Soybean Oil

Girma Biresaw, Grigor Bantchev, James Lansing, Rogers Harry-O'Kuru, USDA-ARS-NCAUR-BOR, Peoria, IL, Yunzhi Chen, South China University of Technology, Guangzhou, Guangzhou, China

4:30 – 5 pm

3327894 ★ Gas-to-Liquids (GTL) Technology Advances in Metalworking and Aluminum Rolling Fluids Are Enhancing Safety, Operations and Performance

Gregory Wehr, ChemGroup, Inc., Louisville, LA

5 – 5:30 pm

3303091 ★ Synthesis, Characterization and Physical Properties of Dimer Acid 2-Ethylhexyl Ester (DA2EH)

Shehu Isah, Delaware State University, Norristown, PA, Victor Wyatt, Helen Ngo, Jianwei Zhang, USDA-ARS, Wyndmoore, PA

5:30 – 6 pm – Nonferrous Business Meeting

★ Session 6C

SYNTHETIC LUBRICANTS AND HYDRAULICS I

Session Chair: Lauren Huffman, Dow Chemical Co., Midland, MI

Session Vice Chair: Robert Davidson, Afton Chemical Corp., Richmond, VA

1:30 – 2 pm

3301723 ★ Novel Base Oil Technologies for Industrial Gear Oils

Justin Langston, Gabriela Fedor, Thomas Schimmel, Evonik Oil Additives, Horsham, PA

2 – 2:30 pm

3281345 ★ Oil Miscible Polyalkylene Glycol (OMP) – An Excellent Novel Base Fluid for High Performance Lubricant Formulations

Govind Khemchandani, Sasol, Westlake, LA

2:30 – 3 pm

3285879 ★ New Hydrolytic Stability Testing on Biobased Lubricants and Base Fluids

Marlon Lutz, Biosynthetic Technologies, Indianapolis, IN

3 – 3:30 pm – Break

3:30 – 4 pm

3295567 ★ Fluid Effects on Mechanical Efficiency of Hydraulic Pumps

Pawan Panwar, Ashlie Martini, University of California, Merced, Merced, CA, Paul Michael, Milwaukee School of Engineering, Milwaukee, WI

4 – 4:30 pm

3296238 ★ Fluid Effects on Stick-Slip Friction in Hydraulic Cylinder Rod Seals

Paul Michael, Muhammad Khan, Milwaukee School of Engineering, Milwaukee, WI, Fred Ondarza, Shell Global Solutions, Houston, TX

4:30 – 5 pm

3325464 ★ Could the Latest Oil Technology Give You Cleaner, Longer-Lasting and More Productive Hydraulic Systems?

Sravani Gullapalli, Sameer Sathaye, Shell Global Solutions US Inc., Houston, TX

5 – 5:30 pm

3321722 ★ Tribological Performance of Used and Artificially Altered Hydraulic Oils

Nicole Doerr, Serhiy Budnyk, AC2T Research GmbH, Wiener Neustadt, Austria, Daria Kolbas, Gubkin Russian State University of Oil and Gas, Moscow, Russian Federation, Ameneh Schneider, Optimol Instruments Prueftechnik GmbH, Munich, Germany, Franz Novotny-Farkas, Engineer Consultant, Schwechat, Austria

5:30 – 6 pm – Synthetic Lubricants & Hydraulics Business Meeting

★ Session 6D

FLUID FILM BEARINGS II

Session Chair: TBD

Session Vice Chair: TBD

1:30 – 2 pm

3281808 ★ A New Fully Coupled Aeroelastic Model for Air Foil Journal Bearings

Yang Hu, Yonggang Meng, Tsinghua University, Beijing, China

2 – 2:30 pm

3323393 ★ Numerical & Experimental Investigation of Aerostatic Bearing with Applications to High-Frequency Rotation (More Than 100 kHz)

Rajdeep Deb, Beat Meier, Solid State Nuclear Magnetic Resonance, ETH Zurich, Zurich, Switzerland, Patrick Jenny, Institute of Fluid Dynamics, Zurich, Switzerland, Dirk Wilhelm, ZHAW School of Engineering, Winterthur, Switzerland

2:30 – 3 pm

3325188 ★ Externally Pressurized Porous Gas Bearings: Measurements of Static Load Characteristics and Rotordynamic Performance

Keun Ryu, Hanyang University, Ansan, Gyeonggi-do, Republic of Korea

3 – 3:30 pm – Break

3:30 – 4 pm

3283576 ★ Measuring Oil Films in Dynamically Loaded Journal Bearings

Scott Beamish, Rob Dwyer-Joyce, University of Sheffield, Sheffield, United Kingdom, Henry Dodson, Ricardo, Leamington Spa, United Kingdom

4 – 4:30 pm

3290036 ★ Non-Newtonian Couple-Stress Squeeze Film Behavior between Oscillating Anisotropic Porous Circular Discs with Sealed Boundary

Benyebka Bou-Said, INSA Lyon, Villeurbanne, France, Mustapha Lahmar, Guelma University, Guelma, Algeria

4:30 – 5 pm

3308592 ★ Rotating Gear Supported by a Plain Journal Bearing: A Numerical Analysis of the Dynamic Characteristics

Balint Pap, Florent Lejeune, Ludwig Biadalla, Safran Transmission Systems, Colombes, France

5 – 5:30 pm

3323571 ★ Rotating Gear Supported by a Plain Journal Bearing: An Experimental Case Study

Balint Pap, Antoine Pennacino, Safran Transmission Systems, Colombes, France

5:30 – 6 pm – Fluid Film Bearings Business Meeting

★ Session 6E

WEAR I

Session Chair: Mathieu Renouf, CNRS University of Montpellier, Montpellier, France

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

1:30 – 2 pm

3281805 ★ Suppressed Triboluminescence Attributed to Electron Structure Changes in the Doped Surface

Changhui Song, Liran Ma, Jianbin Luo, State Key Laboratory of Tribology, Beijing, China

2 – 2:30 pm

3300187 ★ An Analytical Model of Erosive Wear of BioMass Comminution Components

George Fenske, Oyelayo Ajayi, Argonne National Laboratory, Argonne, IL, Jun Qu, Kyungjun Lee, Oak Ridge National Laboratory, Oak Ridge, TN, Jeffrey Lacey, Idaho National Laboratory, Idaho Falls, ID

2:30 – 3 pm

3279796 ★ Tribo-Corrosion Behavior of AISI 4715 Pipeline Steel Used in Hydraulic Fracturing

Jitendra Panda, Brandon Wong, Philip Egberts, University of Calgary, Calgary, Alberta, Canada, Tom McLoughlin, Keri Yule, Calfrac Well Services Ltd., Calgary, Alberta, Canada

3 – 3:30 pm – Break

3:30 – 4 pm

3301686 ★ Adhesive Wear of the Workpiece Material to Abrasive Grits during the Grinding Process

Matthew Marshall, University of Leeds, Leeds, West Yorkshire, United Kingdom

4 – 4:30 pm

3323520 ★ In Situ Observation of Friction and Wear Characteristics of Aluminum Alloys

Kazuyuki Yagi, Yuya Abe, Joichi Sugimura, Kyuhu University, Fukuoka, Japan

4:30 – 5 pm

3319067 ★ Anti-Wear and Anti-Corrosion of Polymer-Alloy Composites

Peter Renner, M. Ozyaydin, Hong Liang, Texas A&M University, College Station, TX

5 – 5:30 pm

3285167 ★ Analysis on Surface Damage of M50 Steel at High-Speed Impact-Sliding Contacts

Che Wang, Harbin Institute of Technology, Harbin, Heilongjiang, China

5:30 – 6 pm

3304314 ★ Investigating & Mitigating Wear of Hammer Mill for Size Reduction of Biomass Feedstock

Kyungjun Lee, James Keiser, Jun Qu, Oak Ridge National Laboratory, Oak Ridge, TN, Jeffrey Lacey, Vicki S. Thompson, Idaho National Laboratory, Idaho Falls, ID, Oyelayo Ajayi, George R. Fenske, Argonne National Laboratory, Argonne, IL

6 – 6:30 pm – Wear Business Meeting



Technical Sessions

★ Session 6F

LUBRICATION FUNDAMENTALS VI

Session Chair: TBD

Session Vice Chair: TBD

1:30 – 2 pm

3285726 ★ **Selecting Suppliers for Your Lubricant Additives and Base Oils**

Michael D. Holloway, 5th Order Industry, Highland Village, TX

2 – 2:30 pm

3276873 ★ **Analytical Approaches to Chemical Structure and Physical Property Measurements of Lubricant Oils**

Eleanor Riches, Caitlyn Da Costa, Jeff Goshawk, Gordon Jones, Michael Jones, Waters Corp., Wilmslow, United Kingdom, James Browne, TA Instruments – Waters Corp., New Castle, DE

2:30 – 3 pm

3285561 ★ **Influence of Base Oils on Heat Transfer Characteristics of Lubricants for E-Motors in HEVs and EVs**

Masato Yokomizo, Narita Keiichi, Idemitsu Kosan Co., Ltd., Ichihara-shi, Chiba, Japan

3 – 3:30 pm – Break

3:30 – 4 pm

3286550 ★ **Base Oil, Ionic Liquid, Anti-Wear Additive, and Friction Modifier – Which One is at the Solid/Lubricant Interface?**

Seong Kim, Dien Ngo, Pennsylvania State University, State College, PA, Jun Qu, Xin He, Huimin Luo, Oak Ridge National Laboratory, Oak Ridge, TN

4 – 4:30 pm

3277617 ★ **Research on Durable Organic Friction Modifiers for PCMO and HDDEO Applications**

Brian Casey, Vincent Gatto, Vanderbilt Chemicals, LLC, Norwalk, CT

4:30 – 5 pm

3285405 ★ **In Situ Studies on the Adsorption of Lubricant Additives**

Alex Mannion, BASF Corp., Florham Park, NJ, Jennifer Honselmann, Fraunhofer IWM, Karlsruhe, Germany, Martin Dienwiebel, Karlsruhe Institute of Technology KIT, Karlsruhe, Germany, Thomas Ruehle, Patrick Wilke, BASF SE, Ludwigshafen, Germany

5 – 5:30 pm

3288324 ★ **Fuel Economy Motor Oils: Formulation, Testing and Approval Challenges**

Boris Zhmud, BIZOL Germany GmbH, Berlin, Germany

5:30 – 6 pm – Lubrication Fundamentals Business Meeting

★ Session 6G

MATERIALS TRIBOLOGY IV

Advanced Engineering Polymers

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

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

1:30 – 2 pm

3281574 ★ **Effect of Temperature and Filler on the Tribological Responses of Sintered Polyimides**

Kian Kun Yap, Marc Masen, Imperial College London, South Kensington, London, United Kingdom

2 – 2:30 pm

3305030 ★ **Understanding Friction and Wear Performance of High-Temperature Thermoplastics Across Different Lubrication Regimes**

Isaac Ballinas, Allegheny Performance Plastics, Leetsdale, PA

2:30 – 3 pm

3285141 ★ **Effect of Thermal Aging Treatment on Blend Phase Morphology and Tribological Performance of PI/UHMWPE Blend Composites**

Bingxue Cheng, Hongfei Shang, Tianmin Shao, State Key Laboratory of Tribology, Tsinghua University, Beijing, China, Haitao Duan, Jian Li, Wuhan Research Institute of Materials Protection, Wuhan, Hubei, China, Song Chen, Hunan Institute of Science and Technology, Yuyang, Hunan, China

3 – 3:30 pm – Break

3:30 – 4 pm

3277831 ★ **Tribological Performance of Polyimides and Other Engineering Polymers Against Various Metallic Surfaces**

Jennifer Vail, DuPont, Wilmington, DE

4 – 4:30 pm

3286058 ★ **Tribological Behavior of Textured Polymer Surfaces**

Mohammad Hossain, Emeka Chukwuonu, Bhavinkumar Patel, Texas A&M University-Kingsville, Kingsville, TX, Hung-Jue Sue, Texas A&M University, College Station, TX

4:30 – 5 pm

3323158 ★ **Lubrication-Induced Softening of Polymeric Materials in Tribological Contacts**

Go Tatsumi, Monica Ratoi, Brian Mellor, University of Southampton, Southampton, United Kingdom, Yuji Shitara, Shinji Hasegawa, Kiyomi Sakamoto, JXTG Nippon Oil & Energy Corp., Yokohama, Japan

5 – 5:30 pm

3309851 ★ **Nanoscale Structures Determined Tribological Behaviors of Styrene-Ethylene-Butylene-Styrene Block Copolymer**

Qinghua Fang, Changchun Institute of Applied Chemistry, Chinese Academy of Sciences, Changchun, Jilin, China

★ Session 6H

2D MATERIALS

Materials Tribology and Nanotribology Joint Session III

Session Chair: Shilpa Beesabathuni, Quaker Houghton, Eagleville, PA

Session Vice Chair: Mengwei Han, University of Illinois at Urbana-Champaign, Urbana, IL

1:30 – 2 pm

3325478 ★ **Probing the Influence of Water and Oxygen on the Friction and Wear of MoS₂ Using In Situ LEIS**

Tomas Babuska, Brandon Krick, Lehigh University, Bethlehem, PA, John Curry, Sandia National Laboratory, Albuquerque, NM

2 – 2:30 pm

3285663 ★ **Nanomechanical Properties of Ti₃C₂ and Nb₂C MXene**

Xuanli Zhou, Yanbao Guo, Quan Xu, Deguo Wang, China University of Petroleum, Beijing, China

2:30 – 3 pm

3282352 ★ **Understanding Interlayer Contact Conductance in Twisted Bilayer Graphene**

Zhiwei Yu, Tianbao Ma, Jianbin Luo, State Key Laboratory of Tribology, Tsinghua University, Beijing, China

3 – 3:30 pm – Break

3:30 – 4 pm

3286917 ★ **Friction and Mechanical Stiffness Measurements on Graphene-covered Substrates: The Influence of Water Intercalation**

Philip Egberts, Zahra Aboolizadeh, Peng Gong, Leszek Sudak, University of Calgary, Calgary, Alberta, Canada

4 – 4:30 pm

3297772 ★ **Nanotribology of 2D Transition Metal Dichalcogenides: Friction Contrast between MoS₂, MoSe₂, and MoTe₂**

Mohammad R. Vazirisereshk, Ashlie Martini, University of California, Merced, Merced, CA, Kathryn Hasz, Meng-Qiang Zhao, A.T. Charlie Johnson, Robert Carpick, University of Pennsylvania, Philadelphia, PA

4:30 – 5 pm

3285069 ★ **Environmental Effects on Friction of Graphene Step Edges**

Zhe Chen, Seong Kim, Pennsylvania State University, University Park, PA

5 – 5:30 pm

3283657 ★ **The Evolution Mechanism of Ultra-Low Friction Interface Based on Onion-Like Carbon Structure**

Jianxun Xu, Tsinghua University, Beijing, China

5:30 – 6 pm

3276812 ★ **Interfacial Nanostructured Tribofilm of Long-Durability and Ultralow-Wear 2D-Materials/QDs Coating**

Xuan Yin, State Key Laboratory of Tribology, Tsinghua University, Beijing, China

6 – 6:30 pm

3278877 ★ **Nanoscale Tribological Behavior of Few Layer Graphene with Considering Material Microstructure and Potential**

Shengguang Zhu, Guangdong Xinhui CIMC Special Transportation Equipment Co., Ltd., Jiangmen, Guangdong, China

★ Session 6I

SURFACE ENGINEERING III

Session Chair: TBD

Session Vice Chair: TBD

1:30 – 2 pm

3317907 ★ **Research on the Frictional Performance of Laser Textured and Rough Surface Based on Pin-On-Disk Test**

Bo Xu, Bifeng Yin, Xuan Xie, Zhiling Chen, Xuefeng Wang, Jiangsu University, Zhen Jiang, China

2 – 2:30 pm

3281789 ★ **Mechanochemical Surface Finishing: The Rebinder Effect in Action**

Boris Zhmud, Applied Nano Surfaces Sweden AB, Uppsala, Sweden

2:30 – 3 pm

3288844 ★ **Surface Functionality Prediction via Curvature Analysis**

Mark Malburg, Digital Metrology Solutions, Columbus, IN

3 – 3:30 pm – Break

3:30 – 4 pm

3320195 ★ **The Influence of Disc Surface Texture on Tribological Performance of Disc-Ball Sliding Pair under Dry Sliding Conditions**

Andrzej Dzierwa, Pawel Pawlus, Rzeszow University of Technology, Rzeszow, Poland, Rafal Reizer, University of Rzeszow, College of Natural Sciences, Rzeszow, Poland

4 – 4:30 pm

3325618 ★ **Morphology Image-Based Surface Classification by Using Convolutional Neural Network (CNN)**

Huan Zhang, Daniel Mosher, United Technologies Research Center, East Hartford, CT

4:30 – 5 pm

3291319 ★ **Capillary Force Lithography and Nanodrawing Techniques for Engineering Nanoscale Polymer Patterns for Tribological Applications**

Eui-Sung Yoon, Hong Nam Kim, Korea Institute of Science and Technology, Seoul, Seongbuk-gu, Republic of Korea, Prashant Pendyala, Hanyang University, Seoul, Republic of Korea

5 – 5:30 pm

3325943 ★ **Investigation of the Evolution of Pores During Scuffing Resistance Tests Performed on Sintered Steel Vacuum Impregnated with Graphite**

Nicolas Araya, Aloisio Klein, Cristiano Binder, Guilherme Neves, Universidade Federal de Santa Catarina, Florianópolis, Santa Catarina, Brazil, Jose Biasoli de Mello, Universidade Federal de Uberlândia, Uberlândia, Minas Gerais, Brazil

5:30 – 6 pm – Surface Engineering Business Meeting

★ Session 6K

ENGINE AND DRIVETRAIN IV

Session Chair: Raj Chandramohan, BorgWarner Inc., Arden, NC

Session Vice Chair: Piotr Grzyska, Afton Chemical Corp., Richmond, VA

1:30 – 2 pm

3314847 ★ **A Ceramic Nano-Composite Coating for Potential Engine Applications**

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

2 – 2:30 pm

3287678 ★ **Formulation Approaches to Meet the Latest SAE J306 Standard for Automotive Gear Oils**

Justin Mills, Evonik Oil Additives, Horsham, PA

2:30 – 3 pm

3305554 ★ **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, Julien Couet, Boris Eisenberg, Evonik Oil Additives, Horsham, PA

3 – 3:30 pm – Break



Technical Sessions

3:30 – 4 pm

3307947 ★ Effect of Friction Modifier and Extreme Pressure Agent on NVH of Chain CVTF

Toshiaki Iwai, Idemitsu Kosan, Ichihara, Chiba, Japan

4 – 4:30 pm

3318911 ★ Three-Dimensional Multiphase Physics-Based Model to Study Engine Cylinder-Kit Assembly Tribology

Sadiyah Sabah Chowdhury, Harold Schock, Michigan State University, East Lansing, MI

4:30 – 5 pm

3284934 ★ Finite Element Analysis of Cylinder Liner Thermal Deformation Based on Fluid-Solid Coupling

Bowen Jiao, Xuan Ma, Tongyang Li, Xiqun Lu, Zhigang Liu, Harbin Engineering University, Harbin, Heilongjiang, China

5 – 5:30 pm

3294961 ★ Wear and Friction Simulations for the Main Journal Bearings under Start-Stop and Transient-Loading Conditions

Zhiqiang Liu, Arup Gangopadhyay, Ford Motor Co., Dearborn, MI

5:30 – 6 pm – Engine & Drivetrain Business Meeting

★ Session 6L TRIBOTESTING II

Session Chair: TBD

Session Vice Chair: TBD

1:30 – 2 pm

3305068 ★ Understanding Friction and Wear Performance of High Temperature Thermoplastics Across Different Lubrication Regimes

Isaac Ballinas, Allegheny Performance Plastics, Leetsdale, PA

2 – 2:30 pm

3309375 ★ Localized Scuffing of a Flake Graphite Cast Iron Cylinder Liner by Geometric Contact Pressure Variation

John Walker, Zach Barnes, Peng Jiang, Timothy Kamps, University of Southampton, Southampton, Hampshire, United Kingdom

2:30 – 3 pm

3310894 ★ Shoe Tread Can Reduce Slip Risk on Surface Contaminated with Slurry Contaminants

Mahiyar Nasarwanji, Kurt Beschoner, University of Pittsburgh, Pittsburgh, PA, Jonisha Pollard, National Institute for Occupational Safety and Health, Pittsburgh, PA

3 – 3:30 pm – Break

3:30 – 4 pm

3314683 ★ An Updated Method for Fuel Lubricity: Line-On-Cylinder Lubricity Evaluator (LOCLE)

Greg Hansen, Peter Lee, Southwest Research Institute, San Antonio, TX

4 – 4:30 pm

3316313 ★ Improving Repeatability of Friction and Wear Testing Results on the SRV Test Rig

Howard Benade, University of Pretoria, Pinetown, KwaZulu Natal, South Africa

4:30 – 5 pm

3280430 ★ Nano Diamond as Potential Candidate for Sliding Wear Applications Under Lubricated Conditions

Ankush Raina, Shri Mata Vaishno Devi University, Katra, Jammu and Kashmir, India

★ Session 6M NANOTRIBOLOGY III

Session Chair: Tevis Jacobs, University of Pittsburgh, Pittsburgh, PA

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

1:30 – 2:30 pm

3318323 ★ Invited Talk: Mechanical Dissipation of Energy: From Breaking of Bonds to the Release of Adhesive Contacts

Lars Pastewka, Richard Jana, Antoine Sanner, University of Freiburg, Freiburg, Germany

2:30 – 3 pm

3303722 ★ Stress-Dependent Adhesion in Nanoscale Contacts

Sai Bharadwaj Vishnubhotla, Andrew Baker, Tevis Jacobs, University of Pittsburgh, Pittsburgh, PA, Rimei Chen, Ashlie Martini, University of California, Merced, Merced, CA

3 – 3:30 pm – Break

3:30 – 4 pm

3282831 ★ Study of Deformation Behaviors of Nanoscale Textured Surfaces in the Contact Using Molecular Dynamics

Pengzhe Zhu, Beijing Institute of Technology, Beijing, China, Baozhen Li, Beijing Jiaotong University, Beijing, China

4 – 4:30 pm

3284114 ★ Influence of Crystal Anisotropy on Deformation Behaviors in Nanoscratching of AlN

Baozhen Li, Beijing Jiaotong University, Beijing, China, Pengzhe Zhu, Beijing Institute of Technology, Beijing, China

4:30 – 5 pm

3317629 ★ Super Lubricity of Solids from Quantum Mechanics

Bo Zhang, Saga University, Saga-shi, Saga, Japan

5 – 5:30 pm

3294663 ★ Resolution of Stability Issues in Fluid Systems Containing Nanostructured Particles

Stephan Wieber, Michael Hagemann, Roland Wilkens, Aidan Rose, Evonik Resource Efficiency GmbH, Darmstadt, Germany

5:30 – 6 pm

3323530 ★ Nanomechanical and Tribological Properties of Hardened 60NiTi

Charles Miller, Min Zou, University of Arkansas, Fayetteville, AR

6 – 6:30 pm – Nanotribology Business Meeting

★ Session 6N ROUNDTABLE DISCUSSION SESSION

A scientific brainstorming and networking event is organized on the basis of discussion roundtables (DRTs) by the STLE Rolling Element Bearing Technical Committee, together with other technical committees. This event aims to encourage open discussions between experts of different disciplines on various topics of interest. The format of the DRTs is very fruitful to facilitate a creative atmosphere on complex topics character and to find technical impulses by brainstorming.

The topics are proposed by the table hosts themselves and are based on current interests. A typical property of DRTs is the writable table cloth to inspire the discussion, as well keep notes for subsequent discussions.

The benefit of DRTs goes beyond the technical impulses. During the DRTs, the hosts will guide the discussion only and not give a lecture. Active participation, including experience sharing of each participant, is one of the main features of this event, providing an unique opportunity to connect and learn.

Thursday, May 7, 2020

★ Session 7B

NONFERROUS METALS II

Lubricant Analysis and Filtration

Session Chair: TBD

Session Vice Chair: Andrea Knopp, Constellium, Ravenswood, WV

8:30 – 9 am

3279624 ★ **Analysis of Nonferrous Rolling Emulsions Using Laser Diffraction and Multiple Light Scattering**

Tom Oleksiak, Lucinda Knelsen, Novelis, Inc., Kennesaw, GA

9 – 9:30 am

3284266 ★ **Improving and Expanding the Applicability of an Existing Pin & Vee Standardized Test Method for Cutting Fluid Evaluation**

Emmanuel Georgiou, Dirk Drees, Falex Tribology NV, Rotselaar, Belgium

9:30 – 10 am

3285657 ★ **Chemistry Behind Settling Metal Fines in Aqueous Metalworking Fluids**

Stefanie Velez, James Sullivan, Münzing, Bloomfield, NJ

10 – 10:30 am – Break

10:30 – 11 am

3286026 ★ **Filtration of Rolling Oil Fluids**

Craig Thomas, JR Schneider Co., Inc., Benicia, CA

1 – 11:30 am

3286714 ★ **Nuclear Magnetic Resonance as a Useful Tool for Routine Analysis of Emulsions**

Josef Leimhofer, AMAG Rolling GmbH, Ranshofen, Austria

11:30 am – Noon

3322954 ★ **Tramp Oils – What Are They and How Do You Deal with Them?**

Andrea Knopp, Constellium, Ravenswood, WV

★ Session 7C

ENVIRONMENTALLY FRIENDLY FLUIDS II

Session Chair: Selim Erhan, Archer Daniels Midland, Decatur, IL

Session Vice Chair: Brajendra K. Sharma, University of Illinois Urbana-Champaign, Champaign, IL

8:30 – 9 am

3288275 ★ **A New Generation of Bio-Based Extreme Pressure Additives**

Lotje Smolders, Oleon, Oelegem, Belgium

9 – 9:30 am

3281884 ★ **Biobased Bright Stock Replacement: Property-Blending Relationships and Formulation Challenges**

Boris Zhmud, Applied Nano Surfaces Sweden AB, Uppsala, Sweden, Ian Bancroft, Natalia Slawniak, University of York, York, United Kingdom

9:30 – 10 am

3285681 ★ **New Hydrolytic Stability Testing on Biobased Lubricants and Base Fluids**

Mark Miller, Alex Kitchel, Biosynthetic Technologies, Indianapolis, IN

10 – 10:30 am – Break

10:30 – 11 am

3316323 ★ **Biomimetic Tribology: Exploiting Synovial Fluid Lubrication Mechanisms for Mechanical Devices**

Manoj Murali, Marc Masen, Philippa Cann, Imperial College London, London, United Kingdom

11 – 11:30 am

3314861 ★ **Nature-Guided Design of Biolubricants Based on the Unique Fatty Acid Structure of Chinese Violet Seed Oil**

Diana Berman, Asghar Shirani, Trevor Romsdahl, Kent Chapman, University of North Texas, Denton, TX, Edgar Cahoon, University of Nebraska-Lincoln, Lincoln, NE, Robert Minto, Indiana University-Purdue University, Indianapolis, IN

11:30 am – Noon

3283219 ★ **Latest in Biosynthetic Base Oils – Evaluating Estolide Performance Characteristics in Expanding Viscosity Ranges**

Jake Bredsguard, Biosynthetic Technologies, Indianapolis, IN

★ Session 7D

FLUID FILM BEARINGS III

Session Chair: TBD

Session Vice Chair: TBD

8 – 8:30 am

3279210 ★ **Effect of Partial Coatings on the TEHD Behavior of Plain Journal Bearings with Considering Wall Slip**

Shuhui Cui, Michel Fillon, Institut Pprime, Poitiers, France, Le Gu, Harbin Institute of Technology, Harbin, China

8:30 – 9 am

3280451 ★ **Synthesis of the Experimental Analyses of Thermal Unbalance Effects Induced by Cylindrical and Tilting Pad Journal Bearings**

Thibaud Plantegenet, Mihai Arghir, Pascal Jolly, Institut Pprime – Université de Poitiers, Poitiers, France, Mohamed-Amine Hassini, EDF Lab Paris Saclay, Palaiseau, France



Technical Sessions

9 – 9:30 am

3284942 ★ **Effects of Film Temperature Boundary Conditions on the Thermal Wedge Lubrication in Parallel Thrust Bearings**

Tae-Jo Park, Gyeongsang National University, Jinju, Republic of Korea

9:30 – 10 am

3316740 ★ **Experimental-Theoretical Correlation Study of the Morton Effect**

Alan Palazzolo, Dongil Shin, Jongin Yang, Xiaomeng Tong, Erwin Thomas, Texas A&M University, College Station, TX

10 – 10:30 am – Break

10:30 – 11 am

3284955 ★ **Lubrication Characteristics Analysis of Slipper-Swash Plate Interface in Swash Plate Type Axial Piston Pump**

Xiangxu Meng, Xuan Ma, Xiqun Lu, Tongyang Li, Bowen Jiao, Wen Sun, Yongqiang Wang, Harbin Engineering University, Harbin, China

11 – 11:30 am

3285598 ★ **Effect of Groove Textures on the Dynamic Characteristics of a Water-Lubricated Hydrodynamic Bearing**

Huihui Feng, Xiulin Ji, Hohai University, Changzhou, Jiangsu, China

11:30 am – Noon

3284425 ★ **On Development of 7KW Oil-Free Compressor Driven by 120000 r/min Permanent Magnet Motor with Gas Foil Bearings**

Guanghui Zhang, Zhansheng Liu, Harbin Institute of Technology, Harbin, Heilongjiang Province, China, Xiaowei Wang, Nanjing University of Aeronautics and Astronautics, Nanjing, China, Shiwei Ji, Nanjing Shenwei Huizhogn Me Company, Nanjing, China

★ Session 7E

WEAR II

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

Session Vice Chair: Chin-Pei, Cummins, Inc., Columbus, IN

8 – 8:30 am

3324718 ★ **Helium Tribology of Ni-Based Alloys at High Temperature Up to 950°C**

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

8:30 – 9 am

3284276 ★ **Enhancing Wear Resistance of Selective Laser Melted (SLM) Parts**

Yang Yang, Yi Zhu, Zhejiang University, Hangzhou, China

9 – 9:30 am

3300118 ★ **A Review of Tribological and Surface Behavior of MAX Phase-Based Composites**

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

9:30 – 10 am

3284171 ★ **Wear Mechanisms of DLC: A Reactive Molecular Dynamics Study**

Yang Wang, Tohoku University, Sendai, Japan

10 – 10:30 am – Break

10:30 – 11 am

3313790 ★ **Load-Carrying Capacity of Aircraft Turbine Engine Lubricants Using the FZG-Ryder Gear Test Rig**

Alexander Fletcher, Patrick Hellman, Air Force Research Laboratory, Wright-Patterson Air Force Base, OH, Peter John, University of Dayton Research Institute, Dayton, OH

11 – 11:30 am

3293669 ★ **Introducing a Next Generation of Anti-Wear Technology for Lubricants**

Christelle Chretien, Solvay, Bristol, PA

11:30 am – Noon

3281367 ★ **Fretting Friction and Wear of Flange Gasket**

Zheng Zhang, China University of Petroleum, Beijing, China, Deguo Wang, Yanbao Guo, China University of Petroleum, Beijing, China

★ Session 7F

LUBRICATION FUNDAMENTALS VII

Session Chair: TBD

Session Vice Chair: TBD

8 – 8:30 am

3288865 ★ **Mechanochemistry in High Pressure EHD Contacts**

Hugh Spikes, Jie Zhang, Janet Wong, Daniele Dini, Imperial College London, London, United Kingdom

8:30 – 9 am

3293309 ★ **Adsorption Behaviors of Organic Friction Modifiers on Iron Oxide Surfaces: A Nonequilibrium Molecular Dynamics**

Junqin Shi, Haifeng Wang, Northwestern Polytechnical University, Xi'an, Shaanxi, China, Jie Lu, Qian (Jane) Wang, Jannat Ahmed, Northwestern University, Evanston, IL, Ning Ren, Valvoline Inc., Lexington, KY

9 – 9:30 am

3301806 ★ **Tuned Polar Methacrylate Viscosity Index Improvers for Enhanced Shear Stability and Wear Prevention**

Lelia Cosimbescu, Kristen Campbell, Marie Swita, Pacific Northwest National Laboratory, Richland, WA, Robert Erck, Argonne National Laboratory, Argonne, IL

9:30 – 10 am

3293985 ★ **Mechanochemical Reactions between Di-Tert-Butyl Disulfide and Ferrous Surfaces**

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

10 – 10:30 am – Break

10:30 – 11 am

3310741 ★ **An Investigation of Anti-Oxidant Expression in Naphthenic Base Oils**

Thomas Norrby, Jinxia Li, Nynas AB, Nynashamn, Sweden

11 – 11:30 am

3308132 ★ Tribological Properties of Sulfur- and Phosphorus-Free Organic Molybdenum Compounds as Additives in Oil

Wenjun Huai, Zhang Chenhui, Tsinghua University, Beijing, China

11:30 am – Noon

3316347 ★ Influence of Rubbing Material on ZDDP Tribofilm Formation

Mao Ueda, Amir Kadiric, Hugh Spikes, Imperial College London, London, United Kingdom

★ Session 7G

MATERIALS TRIBOLOGY V

Metallic Materials Fundamentals & Extreme Applications

Session Chair: Nicolas Argibay, Sandia National Laboratories, Albuquerque, NM

Session Vice Chair: TBD

8 – 8:30 am

3279771 ★ Tribological and Mechanical Properties of High Entropy Alloys

Morgan Jones, Brendan Nation, Ping Lu, Andrew Kustas, Nicolas Argibay, Sandia National Laboratory, Albuquerque, NM

8:30 – 9 am

3276302 ★ Tribological Behavior of Light Weight Al Matrix Composites Reinforced with Silicon Carbide and Tungsten Disulfide

Juanjuan Zhu, Rob Dwyer-Joyce, The University of Sheffield, Sheffield, United Kingdom

9 – 9:30 am

3284265 ★ Establishing a Methodology for Studying the Tribological Properties of Cold Sprayed Nanostructured Coatings

Emmanuel Georgiou, Dirk Drees, Falex Tribology NV, Rotselaar, Belgium

9:30 – 10 am

3337937 ★ Large-Scale Molecular Dynamics Simulations Studies of Microstructural Evolution in Sliding Cu-Ni Surfaces

Daniele Dini, Imperial College London, London, United Kingdom, Stefan Eder, Carsten Gachot, TU Wien, Vienna, Austria, Manel Rodriguez Ripoll, Ulrike Cihak-Bayr, AC2T Research GmbH, Vienna, Austria

10 – 10:30 am – Break

10:30 – 11 am

3293730 ★ Reduced Cost NiTi-Alloy Bearings Made via Near Net Shape Powder Metallurgy Processes

Christopher DellaCorte, NASA, Cleveland, OH

11 – 11:30 am

3320997 ★ Development of Self-Adaptive Lubricating Silver Aluminum Borate Composite for Wide Temperature Range

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

11:30 am – Noon

3321728 ★ Influences of ZrO₂ Crystal Structure on the Tribological Properties of Copper Metal Matrix Composites

Haibin Zhou, Pingping Yao, Central South University, Changsha, Hunan, China

★ Session 7H

GEARS I

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

Session Vice Chair: Hyung Yoon, Caterpillar, Peoria, IL

8 – 8:30 am

3285653 ★ Experimental Study on Lubricants and Methods to Enhance the Survivability of Rotorcraft Gearbox Under Loss of Lubrication Condition

Azhaarudeen Anifa Mohamed Faruck, Carsten Gachot, Michael Weigand, Vienna University of Technology, Vienna, Austria

8:30 – 9 am

3285724 ★ Approach for the Development of an Alternative Classification Method for Gear Oils for High-Loaded Hypoid Gears According to API GL-5

Alexander Drechsel, Josef Pellkofer, Michael Hein, Karsten Stahl, Technical University of Munich, Garching bei München, Germany

9 – 9:30 am

3305164 ★ Starvation Tests on FZG Test-Rig: Experimental Method and Thermal Modelisation

Pierre Navet, Fabrice Ville, LaMCoS – INSA Lyon,

Villeurbanne, France, Christophe Changenet, ECAM Lyon, Lyon, France, Dhafer Ghribi, Safran Transmission Systems, Colombes, France

9:30 – 10 am

3313567 ★ Analysis Method of Pressure Field and Temperature Field Distribution of the Gearbox

Jialiang Yu, Karl Dearn, University of Birmingham, Birmingham, United Kingdom

10 – 10:30 am – Break

10:30 – 11 am

3323607 ★ The Effect of Contact Conditions on the Initiation and Progression of Micropitting Damage

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

11 – 11:30 am

3330016 ★ Influence of Grease Composition on the Service Life of Heavily Loaded Spiral Bevel Gears

Sergei Glavatskih, KTH Royal Institute of Technology, Stockholm, Sweden, Joel Olsson, Per Forsberg, Atlas Copco Industrial Technique AB, Nacka, Sweden, Johan Leckner, Rene Westbroek, Axel Christiernsson International AB, Nol, Sweden

★ Session 7J

POWER GENERATION I

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

Session Vice Chairs: Matthew Hobbs, EPT, Calgary, Alberta, Canada, Jatin Mehta, Fluotec International, Bayonne, NJ

8 – 8:30 am

3332465 ★ Power Generation Tribological Success Stories

Ken Brown, Eco Fluid Center Ltd., Toronto, Ontario, Canada

8:30 – 9 am

3332098 ★ Understanding Deposit-Derived Bearing Temperature Excursions

Jatin Mehta, Fluotec International, Bayonne, NJ

9 – 9:30 am

3320199 ★ Ksp and Thermodynamic Considerations Relevant to Effective Varnish-Removal

Matthew Hobbs, Peter Dufresne, EPT, Calgary, Alberta, Canada



Technical Sessions

9:30 – 10 am

3301562 ★ **Determination of Relative Concentrations of Phosphate Ester Isomers in Turbine Control Systems by Matrix Assisted Laser Desorption Ionization – High Resolution Mass Spectrometry (MALDI-HRMS)**

John Duchowski, Johannes Staudt, HYDAC FluidCareCenter®, Sulzbach, Saar, Germany, Gerard Palmer, HYDAC Technology Ltd., Witney, Oxfordshire, United Kingdom

10 – 10:30 am – Break

10:30 – 11 am

3272921 ★ **Salvaging Poorly Stored Turbine Oil**

Nnamdi Achebe, Petrosave Integrated Services Ltd., Amuwo-Odofi, Nigeria

11 – 11:30 am

3332142 ★ **Using Solvency Enhancing Technology as an Alternative to Traditional Flushing**

Jatin Mehta, Fluitec International, Bayonne, NJ

11:30 am – Noon – Power Generation Business Meeting

★ Session 7K

ENGINE AND DRIVETRAIN V

Session Chair: TBD

Session Vice Chair: TBD

8 – 8:30 am

3286639 ★ **Developing a Framework to Address LSPI through a Better Understanding of Lubricant and Fuel Effects**

Abhishek Kar, Allen Aradi, Sarah Remmert, Shell Global Solutions US Inc., Houston, TX, Jennifer Kensler, Shell International Exploration and Production, Houston, TX, Karin Haumann, Shell Lubricants, Houston, TX, Robert Mainwaring, Shell Global Solutions (UK), London, United Kingdom

8:30 – 9 am

3325364 ★ **Friction at Ring-Liner Interface with Systematic Surface Characterization**

Arman Mohammad Khan, Qian (Jane) Wang, Northwestern University, Evanston, IL, Zhe Li, Yuchuan Liu, General Motors Corp., Detroit, MI

★ Session 7L

TRIBOTESTING III

Session Chair: TBD

Session Vice Chair: TBD

8 – 8:30 am

3323446 ★ **Online Surface Topography Evolution of a Unidirectional Dry Sliding Contact Using a Chromatic Confocal 3D Line Sensor**

Timothy Kamps, Mark Gee, John Nunn, Christopher Jones, National Physical Laboratory, Teddington, United Kingdom

8:30 – 9 am

3325120 ★ **Development of a Friction and Wear Screener for Main Bearings**

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

9 – 9:30 am

3325243 ★ **A Glimpse into Smart Tribology Lab**

Deepak Halenahally Veeregowda, Ducom Instruments Europe B.V., Groningen, Netherlands

9:30 – 10 am

3323481 ★ **Tribology TRL Methodology for Drive System Technologies**

Lavern Wedeven, William Black, Graham Wedeven, Robert Homan, Nelson Forster, Wedeven Associates, Inc., Edmont, PA

10 – 10:30 am – Break

10:30 – 11 am

3340476 ★ **A New Test Method for Direct Measurement of Friction in Biomass Material**

M. Cinta Lorenzo Martin, Oyelayo Ajayi, George R. Fenske, Argonne National Laboratory, Lemont, IL, Jordan Klinger, Yidong Xia, Idaho National Laboratory, Idaho, ID, Troy Semelsberger, Los Alamos National Laboratory, Los Alamos, NM

11 – 11:30 am

3325291 ★ **Effect of Important Surface Texture Parameters on the Initiation of Scuffing Failure Under High Frequency Reciprocating Motion**

Ali Kolivand, Zahed Huq, Emerson, Sidney, OH

11:30 am – Noon

3326341 ★ **Inorganic Fullerene-Like Nano Tungsten Disulfide (WS₂) as Grease Additives: A Study of Concentration Effects on the Tribo-protective Mechanism**

Manish Patel, NanoTech Industrial Solutions, Lake Charles, LA, Sedhuraman Mathiravedu, Pranesh Aswath, University of Texas at Arlington, Arlington, TX

★ Session 7M

NANOTRIBOLOGY IV

Session Chair: Zhijiang Ye, Miami University, Oxford, OH

Session Vice Chair: Sai Bharadwaj Vishnubhotla, University of Pittsburgh, Pittsburgh, PA

8 – 9 am

3286429 ★ **Invited Talk: The Fascinating Frictional Properties of Layered Materials – Insights from Atomistic Modeling**
Michael Urbakh, Tel Aviv University, Tel Aviv, Israel

9 – 9:30 am

3286643 ★ **Understanding the Impact of the Structural Ordering of Organic Molecules at 2D Confined Spaces on Nanotribological Properties**

Prathima Nalam, Behnoosh Sattari Baboukani, University at Buffalo, Buffalo, NY, Zhijiang Ye, Miami University, Oxford, OH

9:30 – 10 am

3328462 ★ **Friction Characteristics of HOPG and 2D Transition Metal Di- Chalcogenides Under Cryogenic Conditions- Role of Interfaces**

Praveena Manimunda, Syed Asif, Douglas Stauffer, Bruker Nano Surfaces, Edina, MN

10 – 10:30 am – Break

10:30 – 11 am

3285286 ★ **The General Reference Lever: A Simple, Reliable and Traceable Calibration Method for Arbitrary Normal & Friction Forces**

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

11 – 11:30 am

3282964 ★ **Experimental Determination of Pair Potential Parameters Using Frequency**

Modulation Atomic Force Microscopy

Nicholas Chan, Carrie Lin, Philip Egberts, University of Calgary, Calgary, New Brunswick, Canada, Tevis Jacobs, University of Pittsburgh, Pittsburgh, PA, Robert Carpick, University of Pennsylvania, Philadelphia, PA

11:30 am – Noon

3286113 ★ Inorganic Fullerene-like Tungsten Disulfide (IF-WS₂) Nanoparticles as Performance Additive in an Industrial Lubricant: Field Trial Results, Constraints and Opportunities

Benoit Thiebaut, Frédéric Michel, Stéphane Gavand, TOTAL MS, Solaize, France

★ Session 7N

ENGINE AND DRIVETRAIN AND LUBRICATION FUNDAMENTALS JOINT SESSION

Lab to Field – Bridging the Gap Between Bench and Engine I

Session Chair: Brendan Miller, Chevron Oronite LLC, Richmond, CA

This session includes papers that cover the transition from lab scale bench tests to full implementation in actual application.

9 – 9:30 am

3285424 ★ The Tribological Performances of MoDTC with Highly Branched Alkyl Groups and Highly Sulfurized Core in a Fully Formulated Engine Oil

Hui Xiang, Changqi Liu, Guangzhou Jetsun Lubrication Technology Co., Ltd., Guangzhou, Guangdong, China

9:30 – 10 am

3308455 ★ Interactions Between Nanoparticles and Extreme Pressure Additives: Toward High Performance Low Viscosity Lubricants

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

10 – 10:30 am – Break

10:30 – 11 am

3321894 ★ 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

3324592 ★ The Use of Microcap - sulated Friction Modifier Additives for Fuel Economy Enhancement

Stephen Hsu, Govindaiah Patakamuri, George Washington University, Washington, DC, Tim Cushing, GM, Detroit, MI

11:30 am – Noon

3287491 ★ Piston Deposit Control: A Fundamental Mechanistic Study

Anil Agiral, Anthony Gilbert, Christopher Kabb, Nico Proust, Binbin Guo, The Lubrizol Corp., Wickliffe, OH

★ Session 8B

NONFERROUS METALS III

Lubricant Additives and Tribology

Session Chair: Annie King, Total Specialty Lubricants, Linden, NJ

Session Vice Chair: Tom Oleksiak, Novelis, Inc., Kennesaw, GA

1:30 – 2 pm

3298424 ★ Insights into the Formation of Protective Tribo-Layer on Ti6Al4V in the Simulated Body Fluid Environment

Jiahui Qi, University of Sheffield, Sheffield, United Kingdom

2 – 2:30 pm

3285603 ★ Structure-Performance Evaluation of Synthetic Metal-working Fluid Additives

Tiffany Meyers, Clariant, Mount Holly, NC

2:30 – 3 pm

3285880 ★ 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., Westlake, OH

3 – 3:30 pm – Break

3:30 – 4 pm

3321043 ★ Wear-Corrosion Synergism Behavior of Additive Manufactured Ti-6Al-4V Alloy

Pradeep Menezes, Ashish Kasar, Arpith Siddaiah, Pankaj Kumar, Manoranjan Misra, University of Nevada-Reno, Reno, NV



Share your STLE 2020 Annual Meeting Presentation with Submission of an Extended Abstract

In an effort to provide attendees with the opportunity of not missing a presentation, STLE encourages speakers to submit an optional 2-3 page extended abstract or provide digital copies of their presentation slides. We recommend speakers submit materials before **April 3, 2020**, to ensure presentations are available to attendees before the meeting.

Submissions must be in PDF format and can be emailed to Karl Phipps at presentations@stle.org.

For more information about requirements, please visit www.stle.org/annualmeeting.



Technical Sessions

4 – 4:30 pm

3324656 ★ **Correlation between Microscopic Surface Damage and Frictional Behavior of Lubricants for Stamping Automotive Aluminum Sheet Products**

Mehdi Shafiei, Shania Polson, Novelis, Novi, MI

4:30 – 5 pm

3324704 ★ **Metal Corrosion: Looking Farther Than the Eye Can See**

Clayton Cooper, Nicole Clarkson, Soraya Kraszczyk, ANGUS Chemical Co., Buffalo Grove, IL

5 – 5:30 pm

3332316 ★ **Hot Rolling Emulsions and the Importance of Antioxidant Additives**

Bill Poynor, Kaiser Aluminum, Spokane, WA, Annie King, Wayne Jenkins, Total Specialty Lubricants, Linden, NJ

★ Session 8C

ENVIRONMENTALLY FRIENDLY FLUIDS III

Session Chair: Daniel Garbark, Battelle Memorial Institute, Columbus, OH

Session Vice Chair: Ashok Cholli, Polnox Corp., Lowell, MA

1:30 – 2 pm

3323643 ★ **Addressing the Thermo-Oxidative Stability and Other Issues Facing the Biolubricant Formulation**

Ashok Cholli, Polnox Corp., Lowell, MA

2 – 2:30 pm

3290027 ★ **Lubricity Improvement of the Ultra-Low Sulphur Diesel Fuel with Vegetable Oils**

Andrew Sakyi, University of Pretoria, Pretoria, Gauteng, South Africa

2:30 – 3 pm

3270649 ★ **Evaluation of Chaumugra Oil (Hydnocarpus Wightiana) as a Potential Environment-Friendly Lubricant Base Stock**

Jayadas Haridas, Cochin University of Science and Technology, Ernakulam, Kerala, India

3 – 3:30 pm – Break

3:30 – 4 pm

3279513 ★ **Bacterial Toxicity and Biodegradability of Ionic Liquids Studied for Using in Lubrication**

David Blanco, Paula Oulego, Javier Faes, Rubén González, Jose Luis Viesca, Antolin Hernández Battez, University of Oviedo, Gijón, Asturias, Spain

★ Session 8D

FLUID FILM BEARINGS IV

Session Chair: Aurelian Fatu, Institut Pprime, Angoulême, France

Session Vice Chair: TBD

1:30 – 2 pm

3322976 ★ **Loading Performance of Metal Rubber-Bump Foil Gas Bearings**

Chuanbing Zhang, Hongrui Ao, Hongyuan Jiang, Harbin Institute of Technology, Harbin, China

2 – 2:30 pm

3323240 ★ **Coupling Transient Mixed Lubrication and Wear for Journal Bearing Modeling**

Guo Xiang, State Key Laboratory of Mechanical Transmission, Chongqing, China, Yanfeng Han, Chongqing University, Chongqing, China

2:30 – 3 pm

3322243 ★ **An Optimization Research of Journal Bearing under Steady Operations Using Taguchi and Grey Relational Analysis Methods**

Chongpei Liu, Bin Zhao, Xiqun Lu, Wanyou Li, Harbin Engineering University, Harbin, China

3 – 3:30 pm – Break

3:30 – 4 pm

3322422 ★ **Optimization of Oil Supply to a Starved Slider Bearing Based on Wettability Gradient**

P.L. Wong, C.L. Liu, City University of Hong Kong, Kowloon, Hong Kong, F. Guo, Qingdao University of Technology, Qingdao, China

4 – 4:30 pm

3338294 ★ **Simulating the Effect of Micro-Textures for Friction Reductions in Conformal Bearing Systems**

Francisco Profito, University of São Paulo, São Paulo, Brazil, Sorin-Cristian Vladescu, Tom Reddyhoff, Daniele Dini, Imperial College London, London, United Kingdom

★ Session 8E

WEAR III

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

Session Vice Chair: Arnab Ghosh, EtaGen, Inc., Menlo Park, CA

1:30 – 2 pm

3322854 ★ **Insights Learned from Fretting Fatigue FEA Simulations and Surface Characterization of Metal Substrates**

Iyabo Lawal, Matthew Brake, Rice University, Houston, TX

2 – 2:30 pm

3314627 ★ **Principal Tensile Stress Predicts Locations of Shoe Wear Consistent with Natural Wear Patterns**

Kurt Beschoner, Sarah Hemler, University of Pittsburgh, Pittsburgh, PA, Takeshi Yamaguchi, Tohoku University, Sendai, Miyagi, Japan

2:30 – 3 pm

3318528 ★ **Elevated Temperature Fretting Wear Analysis of Additively Manufactured Inconel 625 with Surface Strength Improvements**

Manisha Tripathy, Ali Beheshti, George Mason University, Fairfax, VA, Lloyd Hackel, Curtiss-Wright Surface Technology, Livermore, CA, Keivan Davami, The University of Alabama, Tuscaloosa, AL

3 – 3:30 pm – Break

3:30 – 4 pm

3319943 ★ **Elevated Temperature Fretting Wear Study of Additively Manufactured 17-4 PH Stainless Steel**

Manisha Tripathy, Ali Beheshti, George Mason University, Fairfax, VA, Pooriya Nezhadfar, Nima Shamsaei, Auburn University, Auburn, AL, Keivan Davami, The University of Alabama, Tuscaloosa, AL

4 – 4:30 pm

3340519 ★ **Effects of Wear on Dynamics Characteristics of Mechanisms with Multi-Clearance Joints**

Zhengfeng Bai, Jijun Zhao, Junsheng Zhou, Harbin Institute of Technology, Weihai, Shandong, China

4:30 – 5 pm

3281561 ★ **Microstructure Based Material Model to Predict Wear Rate and Wear Depth During Manufacturing**

Burak Bal, Abdullah Gul University, Kayseri, Turkey

5 – 5:30 pm

3284846 ★ **Adhesive and Abrasive Gear Wear Prediction Models: Utilization of Statistical Analysis**

Surapol Raadnui, KMUTNB, Bangkok, Bang-Sue, Thailand

★ Session 8F

LUBRICATION FUNDAMENTALS VIII

Session Chair: TBD

Session Vice Chair: TBD

1:30 – 2 pm

3318381 ★ **Evaluation of Interactions Between Molybdenum-Based Friction Modifiers and Other Additives in Lubricants**

Yu Min Kiw, Philippe Schaeffer, Pierre Adam, University of Strasbourg, Strasbourg, France, Benoit Thiebaut, Chantal Boyer, Géraldine Papin, TOTAL MS, Solaize, France

2 – 2:30 pm

3323327 ★ **High-Throughput Design of Organic Friction Reducers in Engine Oils**

Jing Yang, Jon Paul Janet, Fang Liu, Heather J. Kulik, Massachusetts Institute of Technology, Cambridge, MA

2:30 – 3 pm

3324150 ★ **Oxidative Stability of Estolides**

Travis Thompson, Biosynthetic Technologies, Indianapolis, IN

3 – 3:30 pm – Break

3:30 – 4 pm

3324202 ★ **Practical Considerations for the Development of Amine and Phenol Synergies**

Jun Dong, Songwon Industrial Group, Glen Allen, VA

4 – 4:30 pm

3286456 ★ **An Optimization Routine to Obtain Lubricant Parameters from EHD Friction Measurements**

Marcus Björling, Andreas Almqvist, Luleå University of Technology, Luleå, Sweden

4:30 – 5 pm

3283796 ★ **A Molecular Dynamics Approach to Predict Pour Points of Fluids**

Jannat Ahmed, Jie Lu, Qian (Jane) Wang, Northwestern University, Evanston, IL, Junqin Shi, Northwestern Polytechnical University, Xi'an, China, Ning Ren, Fran Lockwood, Valvoline Inc., Lexington, KY

★ Session 8G

MATERIALS TRIBOLOGY VI

Additives & Fluid Lubricated Contacts

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

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

1:30 – 2 pm

3286543 ★ **Tribological Performance of Hard Coatings in Low Viscosity Fuels**

Tyler Torgerson, Asghar Shirani, Thomas Scharf, Diana Berman, University of North Texas, Denton, TX, Satish Dixit, Plasma Technology Inc., Torrance, CA, Stephen Berkebile, Army Research Laboratory, Aberdeen Proving Ground, MD

2 – 2:30 pm

3323741 ★ **Tribological Study of PDA+PTFE Coating in Oil-Lubricated Condition**

Sujan Ghosh, Min Zou, University of Arkansas, Fayetteville, AR

2:30 – 3 pm

3320789 ★ **PDA/PTFE + Graphite Particles Coating on 60NiTi: Effect of Coating Thickness and Substrate Roughness**

Dipankar Choudhury, Charles Miller, Min Zou, University of Arkansas, Fayetteville, AR

3 – 3:30 pm – Break

3:30 – 4 pm

3303737 ★ **Compatibility of Polar Oils and Anti-Wear Additives with Steel-Coating Contacts**

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

4 – 4:30 pm

3301476 ★ **Slipp Film and Bearing**

Hong Liu, Lanzhou Jiaotong University, Lanzhou, China

4:30 – 5 pm

3282835 ★ **Reversible Light Controlled Friction Achieved by Diarylethene Molecules**

Shuangxi Tang, Liran Ma, Tsinghua University, Beijing, China

★ Session 8H

GEARS II

Session Chair: Michael Blumenfeld, ExxonMobil Research & Engineering, Annandale, NJ

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

1:30 – 2 pm

3285540 ★ **Permissible Water Content of Gear Lubricants Regarding the Pitting Performance of Case-Carburized Gears**

Nadine Sagraloff, Thomas Tobie, Karsten Stahl, Technical University of Munich, Munich, Germany, Christian Engelhardt, Patentanwälte von Bezold, Munich, Germany

2 – 2:30 pm

3286616 ★ **Pitch Line Fracture: A Frictional Problem in Polymer Gears?**

Sutartip Wittayapiyanon, Karl Dearn, University of Birmingham, Birmingham, United Kingdom

2:30 – 3 pm

3288465 ★ **Sodium Presence in Gearboxes, What are the Inconveniences for Lubrication?**

Jorge Alarcon, Bureau Veritas, Stafford, TX

3 – 3:30 pm – Break

3:30 – 4 pm

3298112 ★ **The Appropriateness of Laser Sintered PEEK for Gear Applications**

Zainab Shukur, Karl Dearn, University of Birmingham, Birmingham, United Kingdom

★ Session 8J

WIND TURBINE TRIBOLOGY I

Session Chair: TBD

Session Vice Chair: TBD

1:30 – 2 pm

3281806 ★ **Detection of White Etching Cracks (WECs) Using Electrostatic**



Technical Sessions

Sensing Techniques

Kamran Esmaili, Ling Wang, Terry Harvey, Neil White, University of Southampton, Southampton, United Kingdom, Walter Holweger, Schaeffler Technologies GmbH & Co. KG, Herzogenaurach, Germany

2 – 2:30 pm

3319018 ★ Efficiency and Lifetime Improvement for Wind Turbines by Using Silicon-Based Additive Technology

Stefan Bill, REWITEC GmbH, Lahnau, Hesse, Germany

2:30 – 3 pm

3285610 ★ Early State Processes in White Etching Crack Formation

Tarek Lutz, NMI, Reutlingen, Germany

3 – 3:30 pm – Break

3:30 – 4 pm

3337339 ★ Validation of Combined Analytical Methods to Predict Slip in Cylindrical Roller Bearings

Yi Guo, Jon Keller, National Renewable Energy Laboratory, Golden, CO

4 – 4:30 pm

3318691 ★ Credibility Analysis of Thermal Coupling Finite Element Model of Friction Pair of Wind Power Spindle Brake Based on Response Surface Method

Ying Liu, Nanchang University, Nanchang, Jiangxi, China

4:30 pm – 5 pm

3365799 ★ Understanding Main Bearing Failure Modes & Developing Applicable Benchtop Grease Tests

Benjamin Gould, Nick Demas, Robert Erck, Aaron Greco, Argonne National Laboratory

5 – 5:30 pm – Wind Turbine Tribology Business Meeting

★ Session 8K

ENGINE AND DRIVETRAIN AND LUBRICATION FUNDAMENTALS JOINT SESSION

Lab to Field – Bridging the Gap Between Bench and Engine II

Session Chair: Piotr Grzyska, Afton Chemical Corp., Richmond, VA

Session Vice Chair: TBD

This session includes papers that cover the transition from lab scale bench tests to full implementation in actual application.

1:30 – 2 pm

3285016 ★ Optimizing the Piston-Bore Tribology through Honing and Tribofinishing

Boris Zhmud, Applied Nano Surfaces Sweden AB, Uppsala, Sweden, Konstantin Risse, Florian Welzel, Otto-von-Guericke-University of Magdeburg, Magdeburg, Germany

2 – 2:30 pm

3296303 ★ Piston Ring Coating Development – From Bench to Vehicle

Peter Lee, Southwest Research Institute, San Antonio, TX

2:30 – 3 pm

3286302 ★ Determination of Scuffing and Wear for Materials in Low-Viscosity Fuels

Stephen Berkebile, Nikhil Murthy, 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

3 – 3:30 pm – Break

3:30 – 4 pm

3285127 ★ Research on Mechanism of Cylinder Score of Diesel Engine Based on Starved Lubrication of Piston Ring Pack

Yongqiang Wang, Xuan Ma, Xiqun Lu, Wanyou Li, Tongyang Li, Harbin Engineering University, Harbin, China

4 – 4:30 pm

3318418 ★ An Efficient Approach to Estimate the Groove Pressure at the Piston-Ring and Cylinder-Liner Contact

Lyu Xiuyi, Xuan Ma, Harbin Engineering University, Harbin, China, Abdullah Azam, Anne Neville, University of Leeds, Leeds, United Kingdom

4:30 – 5 pm

3302226 ★ Ionic Liquid-Enhanced Low-Viscosity Engine and Rear Axle Oils in Dynamometer and Vehicle Testing

Jun Qu, Sougata Roy, Chanaka Kumara, Huimin Luo, Oak Ridge National Laboratory, Oak Ridge, TN, Michael Viola, Khaled Zreik, General Motors, Warren, MI, Lake Speed, Driven Racing Oil, Olive Branch, MS

★ Session 8L

TRIBOTESTING IV

Session Chair: TBD

Session Vice Chair: TBD

1:30 – 2 pm

3285906 ★ Tribological Investigation of Nano-Talc as Additive in Oil Nanolubricants

Vinay Saini, Jayashree Bijwe, Indian Institute of Technology (IIT) DELHI, Delhi, India, Sarita Seth, SSV Ramakumar, Indian Oil Corp. Ltd. R&D Centre, Faridabad, Haryana, India

2 – 2:30 pm

3325283 ★ Investigating Thermal Behavior of Lubricants Using Bench Top Tribometers

Deepak Halenahally Veeregowda, Fabio Alemanno, Ducom Instruments Europe B.V, Groningen, Netherlands

2:30 – 3 pm

3340369 ★ A Paradigm Shift in Wear Debris Analysis

Ronn Lawrence, GasTOPS Inc., Huntsville, AL

3 – 3:30 pm – Break

3:30 – 4 pm

3321588 ★ Extracting More Value from Tribofilm Images

Oluwaseyi Ogunsola, Shell Global Solutions (US) Inc., Houston, TX, Chaitanya Pradhan, Aarthi Thyagarajan, Vishal Ahuja, Nitish Nair, Shell India Markets Pvt. Ltd., Bangalore, India

★ Session 8M

NANOTRIBOLOGY V

Session Chair: Praveena Manimunda, Bruker Nano Surfaces, Edina, MN

Session Vice Chair: Behnoosh Sattari Baboukani, University at Buffalo, Buffalo, NY

1:30 – 2 pm

3284603 ★ A Balancing Act: Dispersion and Lubricity Performance of Nanoparticle Additives in Metalworking Fluids

Shilpa Beesabathuni, Yan Zhou, Yixing Philip Zhao, Quaker Houghton, Conshohocken, PA

2 – 2:30 pm

3332656 ★ Formation and Nanomechanical Characterization of Tribofilms Enhanced by Inorganic Nanoparticles as Lubricant Additives

Kora Farokhzadeh, Praveena Manimunda, Steven Shaffer, Bruker Nano Surfaces, San Jose, CA

2:30 – 3 pm

3286629 ★ Synergistic Effect of MoS₂ and SiO₂ Nanoparticles in Reciprocating Steel Contacts

James Firth, Karl Dearn, University of Birmingham, Birmingham, United Kingdom

3 – 3:30 pm – Break

3:30 – 4 pm

3321340 ★ Synergistic Effect of Combining TiO₂ and Montmorillonite Clay Nanoparticles as Lubricant Additives for Milling Processes

Laura Pena-Paras, Demófilo Maldonado, Martha Rodríguez, Marcela Guajardo, Claudia Rico, Gerardo Elizondo, University of Monterrey, San Pedro, Nuevo Leon, Mexico

4 – 4:30 pm

3286669 ★ Nanoparticle Sintered Tribofilm Removal Study: An Experimental Approach

Steven Thrush, Gary Barber, Oakland University, Rochester, MI, Allen Comfort, James Dusenbury, US Army Ground Vehicle Systems Center, Warren, MI

4:30 – 5 pm

3279178 ★ Superlubricity of Fullerene Derivatives Induced by Host-Guest Assembly

Shanchao Tan, Yuhong Liu, Tsinghua University, Beijing, China

5 – 5:30 pm

3278471 ★ Analyzing Lubrication Properties of Magnetic Lubricant Synthesized in Two Lubricating Oils

Kinjal Trivedi, PD Patel Institute of Applied Sciences, Gujarat, India

EARLY CAREERIST POSTERS

3292269 ★ Tribological Performance of Bearing Bushes Made of Lightweight Mg Matrix Composites

Juanjuan Zhu, Rob Dwyer-Joyce, the University of Sheffield, Sheffield, United Kingdom

3285647 ★ Lubricants Tribology Measurements on Different Surfaces

Giulio Assanelli, Claudio Barzaghi, Marcello Notari, Paolo Cambise, Eni S.p.A, Milan, Italy

3281005 ★ Leaf-Surface Wax of Tall Arbor as a Potential Lubricant Additive

Yanqiu Xia, North China Electric Power University, Beijing, China

STUDENT POSTERS

3281017 ★ Identification and Content Prediction of Lubricating Oil Additives Based on Extreme Learning Machine

Xin Feng, North China Electric Power University, Beijing, China

3283538 ★ Effect of Surface Energy on Nanofriction of FCC Metal Asperities Contact

Danyang Yu, Yonggang Meng, Tsinghua University, Beijing, China

3284941 ★ Effect of Surface Structure of Cylinder Liner on Lubrication Performance of Piston Ring-Cylinder Liner Tribo-Pair

Bowen Jiao, Xuan Ma, Xiqun Lu, Tongyang Li, Zhigang Liu, Harbin Engineering University, Harbin, Heilongjiang, China

3285121 ★ The Influence of Asymmetric Piston Skirt Profile on the Secondary Motion of Piston and the Lubrication Characteristics of Piston Skirt

Yongqiang Wang, Xuan Ma, Xiqun Lu, Wanyou Li, Xiangxu Meng, Harbin Engineering University, Harbin, China

3323496 ★ Influence of Interfacial Chemistry and Role of Adsorbed Water on the Tribological Behavior of 2D Material – Steel Interfaces

Taib Arif, Guorui Wang, Rana Sodhi, University of Toronto, Toronto, Ontario, Canada, Guillaume Colas,

3Univ. Bourgogne Franche-Comté FEMTO-ST Institute CNRS/UFC/ENSMM/UTBM, Besançon, France, Tobin Filleter, University of Toronto, Mississauga, Ontario, Canada

3325688 ★ An Investigation on Tribological Failure of Conventionally Oil Lubricated Journal Bearings of Sugarcane Crushing Mills

Prashant Nagare, Amrutvahini College of Engineering, Sangamner, Maharashtra, India, Hari Kudal, SND College of Engineering, Yeola, Maharashtra, India, Vishnu Wakchaure, M.A. Venkatesh, Amrutvahini College of Engineering, Sangamner, Maharashtra, India

3285176 ★ Grease Lubrication Behavior Analysis and Life Prediction at High Temperature Environment

Hyeongju Lee, Byeong Lyul Choi, Byoung-Ho Choi, Korea University, Seoul, Republic of Korea, Jeong Hoon Son, ILJIN Enterprize Co. Ltd., Seoul, Republic of Korea

3285593 ★ The Influence of Hydrothermal Aging on the Dynamic Friction Model of Cylinder Seals

Jian Wu, Hang Luo, Youshan Wang, Xuebo Yuan, Benlong Su, Zhe Li, Harbin Institute of Technology, Weihai, Weihai, Shandong, China

3285623 ★ Bearing Characteristics of Journal Bearing with Micro-Structure Inspired by Dragonfly

Kairi Furukawa, Masayuki Ochiai, Hiromu Hashimoto, Tokai University, Hiratsuka, Kanagawa, Japan

3318443 ★ NMR Investigations (1H, 13C, 31P) of Dithiophosphate/ Dithiocarbamate Ligand Exchange Reactions between Mo and Zn Derivatives

Yu Min Kiw, Philippe Schaeffer, Pierre Adam, University of Strasbourg, Strasbourg, France, Benoit Thiebaut, Chantal Boyer, Géraldine Papin, TOTAL MS, Solaize, France

3318695 ★ Observation of Oil Film of Floating Bush Bearing Using X-ray CT and Examination of Effect of Oil Film Area on Friction Loss

Shinpei Kotani, Masayuki Ochiai, Tokai University, Hiratsuka, Kanagawa, Japan

Education Courses

The 2020 STLE Annual Meeting & Exhibition features 11 industry-specific education courses offered on two days of the conference: Sunday, May 3, and Wednesday, May 6. The schedule is designed to give attendees more flexibility when planning their conference attendance.

All courses are full day (start at 8 am and end at 5 pm).

STLE education courses are \$400 with a full meeting registration (except for the NLG Grease course which is \$800), \$575 for STLE members without a meeting registration and \$775 for a non-member with no meeting registration. If you have questions regarding these courses, please contact Stefan Carrera, education manager at (847) 825-5536, scarrera@stle.org.

****Please note that course titles and content are subject to change. Visit www.stle.org/annualmeeting and see the Program Guide distributed onsite in Chicago for the most up-to-date information and list of course instructors.***

Sunday, May 3

Advanced Lubrication 301: Advanced Additives

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 Tribology 310: Nanotribology

This course is designed to cover some fundamentals as well as industrially-relevant and popular topics with nanotribology, namely tribochemistry, nanoparticles, nanoscale solid lubricants and superlubricity, and nanoscale interactions/mechanics. Each module will cover fundamental knowledge corresponding to their respective topics and some of their implications in the industry.

Basic Lubrication 101

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. This course 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 service, sales, marketing, manufacturing, maintenance and managers who in some way are involved in the industry.

Gears 101

Gears 101 is designed to provide a general understanding of industrial gearing. This course will serve as a guide to establish not only a basic knowledge of gears and their supporting components but also their lubrication. In this course, attendees will learn about gear functions and types, basic gear terminology, the different types of industrial gear lubricants, the factors that affect gear lubrication, industrial gear lubricant requirements and their proper selection, open gear lubrication, gear wear modes and failure analysis, and condition monitoring.

NLGI – Grease 101

(Presented in cooperation with NLGI)

This course is a comprehensive overview of all aspects of lubricating grease. Grease formulation components are thoroughly covered, including base oils and the many different thickener types. Manufacturing technologies are reviewed, as well as grease testing significance and methods. Included is a good discussion detailing how to select the proper grease for different applications, and a variety of examples of both industrial and automotive applications are discussed.

Metalworking 240: Metalworking Fluid Formulation Concepts



This new course is offered in response to the many requests from attendees at STLE's other MWF courses who asked for more specifics on formulation. The course begins with some universal formulating basics, such as experimental design, order of additions for ingredients, and considerations when scaling up from beakers to large blending tanks. Also covered will be base stocks, performance additives, emulsifier selection, HLB, qualification tests, optimization for stability, both in the drum and in use, bioresistance, microbicide selection and use, and recalcitrant functional additives. Finally, instructors will discuss formulating for disposability and for global distribution. While several example formulations will be presented, this course will not be providing specific ready-to-use commercial formulations.

Synthetic Lubricants 204: Base stock Selection and Applications

This course provides an introduction to synthetic lubricant base stocks and applications. It compares the use of these synthetic lubricants to petroleum-based products and compares between types of synthetic lubricants. Synthetic Lubricants 204 is a continuation from the Synthetic Lubricants 203: Non-Petroleum Fluids and Their Uses course, however, attendance of the Synthetic Lubricants 203 course is not a prerequisite.



The largest and most useful meeting covering all aspects of tribology and lubrication engineering.”

Wednesday, May 6

Advanced Lubrication 302: Advanced Lubrication Regimes

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.

Automotive Lubrication 202: Gasoline

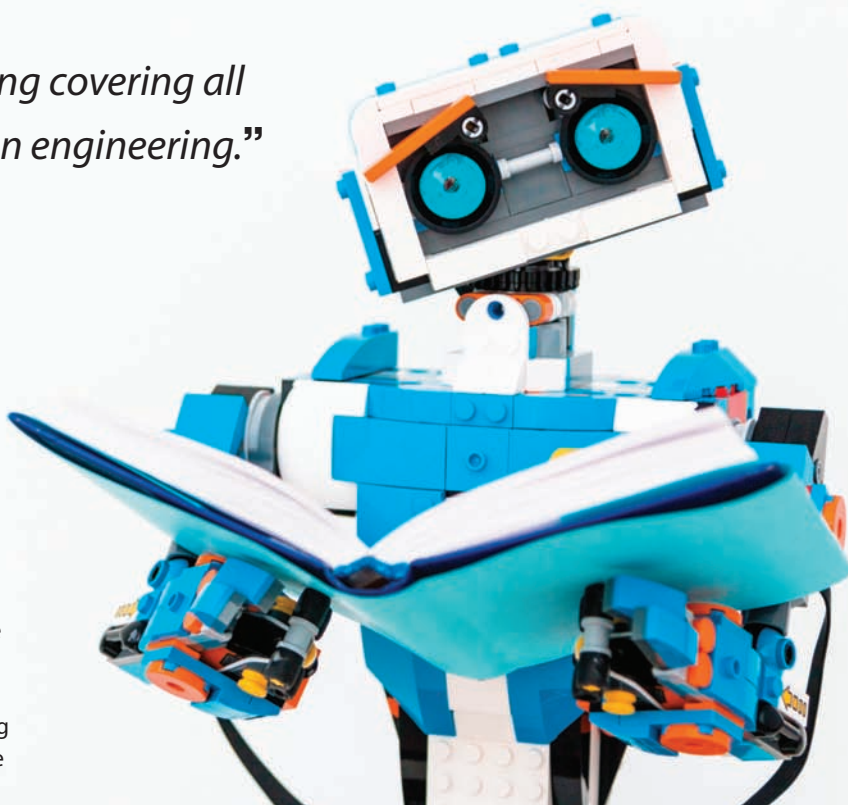
Automotive Lubrication 202 provides an overview of the engine and drivetrain systems and lubrication requirements of these systems. This course will also look at tribology testing of components within these systems, the future of tribology testing for automotive applications and the final module will look at the future of automotive tribology.

Basic Lubrication 102

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. This course is intended for a diverse group, including people involved in technical service, 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 105: Metal Forming Fluids

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. By the end of the course, participants will have gained 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.



STLE *Certification Exams*

Thursday, May 7

All four STLE technical certifications exams: Certified Lubrication Specialist™, Oil Monitoring Analyst I and II™ and Certified Metalworking Fluids Specialist™ will be conducted concurrently on Thursday, May 7, from 9 am to noon. If you are interested in taking an exam during STLE's 2020 Annual Meeting & Exhibition, please contact Gina Cairo at (847) 825-5536 or email certification@stle.org.

Exam Fees:

- **First exam: \$440 (STLE member)
\$590 (Non-member)**
- **Retake exam: \$220 (STLE member)
\$295 (Non-member)**

Networking & Special Events

Please note that all annual meeting events are at the Hyatt Regency Chicago.

Student Networking Reception

Sunday, May 3 • Ticketed Event

Students and young tribologists from around the world gather for an event defined by its networking value, camaraderie and good times. If you're from the next generation of STLE members, come join us for an evening of friendship and relationship building.

Speakers Breakfast

Sunday through Thursday, May 3-7

Lead authors and education course presenters are invited to meet with Session and Paper Solicitation Chairs for a continental breakfast at 7 am on the days of their presentations. This is a great time to review the session schedule and note any last-minute changes. Speakers should plan on attending.



Tribology STEM Camp

Monday, May 4

During STLE's 2020 Annual Meeting, the society is hosting area high school students for its Annual Tribology STEM Camp. Students will have the opportunity to see demonstrations and participate in hands-on experiments, led by STLE members, to learn about areas of research within the fields of tribology and lubrication engineering. The goal of the camp is to engage high school students interested in STEM (science, technology, engineering and mathematics) to careers in tribology and lubrication engineering. If you would like to learn more or to participate, contact Karl Phipps at (847) 825-5536, kphipps@stle.org.



Networking Reception

Monday, May 4

This is the annual meeting's central networking event and a way for you to reconnect with old friends while making new ones. Since people come to STLE's Annual Meeting & Exhibition from around the world, this truly is an international event. Relax, socialize and add to your list of professional contacts through this outstanding networking event.

Exhibitor Appreciation Hour

Back by popular demand, two hours of dedicated exhibit time will occur at this year's show:

Monday, May 4 and **Tuesday, May 5** from 3-4 pm. Refreshments will be served in the trade show. Technical sessions, education courses, Commercial Marketing Forum presentations and all other annual meeting activities will cease at this time. Come support the meeting's exhibitors—and find solutions to your most pressing technical issues.

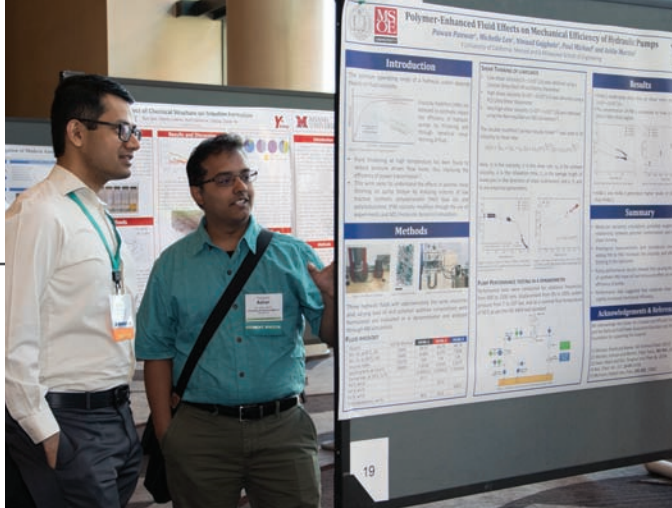
President's Luncheon

Tuesday, May 5 • Ticketed Event

The annual meeting's major business function draws virtually all attendees for a two-hour event honoring STLE's incoming and outgoing presidents, award winners and top volunteers. Come honor 2019-2020 President Mike Duncan with Daubert Chemical Co. Inc. and 2020-2021 President Paul Hetherington with Petro-Canada Lubricants, Inc. A ticket for the Presidents Luncheon is included in your meeting registration and free to STLE Corporate Member representatives (two tickets) and students. Guest tickets for the luncheon are \$50 and can be purchased at the STLE Registration Desk.

STLE is seeking sponsorships for the Networking Reception, President's Luncheon, Welcome Gift, Registration Bags, Education Course Lunches and Refreshment Breaks.

For more information, contact national sales manager Tracy Nicholas VanEe at (630) 922-3459, emeraldcomminc@yahoo.com.



Call for Student Papers

STLE is seeking student posters at its 2020 Annual Meeting & Exhibition. Event organizers are inviting students from all areas of tribology research to participate in a special session dedicated to student posters. Posters must deal with an aspect of tribology research that can be translated into friction, wear and lubrication. Student poster research topics can be co-authored by faculty and other researchers, but only students may exhibit their posters and discuss their work at the session. The posters will be judged by a conference committee, and awards will be given to the best posters.

Submission criteria & information

- Abstract submission deadline: **March 13, 2020** (via www.stle.org/annualmeeting). Notification of acceptance will be sent to students shortly after this date.
- The poster must present original work by the student during the 2019-2020 academic year.
- The student may submit only one poster as the lead author.
- As the lead author of the poster, the student should have performed the major portion of the work.
- Lead authors must be full-time graduate or undergraduate students registered during the 2019-2020 academic year.
- Posters can be no larger than 48 x 48 inches.
- Posters must be set up Sunday afternoon or Monday morning. The author must be present at the poster display during the judging session on Monday, May 4, during lunch and the scheduled conference break that afternoon.

Award category (*three winners in each category)

- **Platinum:** superior scientific and presentation quality (\$300 prize)
- **Gold:** good technical quality (\$200 prize)
- **Silver:** overall quality worthy to be encouraged (\$100 prize)

***Winners will be announced during the President's Luncheon on Tuesday, May 5.**

For additional questions about the student poster session, please contact Merle Hedland at (630) 428-2133 (STLE Conference office), or email mhedland@stle.org.

Drive 75

Join a growing group of companies helping STLE celebrate its Diamond Anniversary!

STLE is observing its 75th Anniversary with a year of events and activities, culminating in a festive celebration at the 2020 Annual Meeting & Exhibition in Chicago.

To honor the industry's premier technical association and support this momentous event, your company can become a Drive 75 Sponsor and reap a series of benefits throughout the year!

Your Drive 75 sponsorship includes a special \$100 donation in your company's name to a high school STEM program of your choice with matching funds from STLE!

Drive 75 Diamond Sponsors

Acme Hardesty Co.

Afton Chemical Corp.

Anhui Trust Chem Co., Ltd.

Biosynthetic Technologies

ExxonMobil Chemical Co.

KAO Chemicals GmbH

Münzing

Shell Global Solutions (US), Inc.

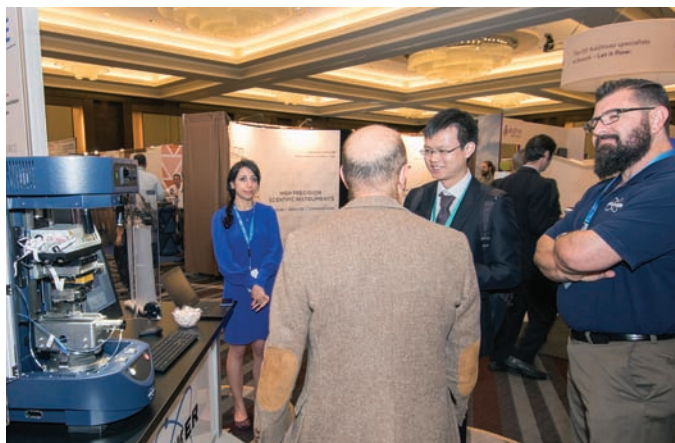
The Lubrizol Corp.

The Timken Corp.

For details, contact Tracy Nicholas VanEe at 630-922-3459 or at emeraldcomminc@yahoo.com.

2020 STLE Annual Meeting Exhibition & Sponsorship Opportunities

Please note that all annual meeting events are at the Hyatt Regency Chicago.



STLE's annual trade show is where you can catch up on the lubricant industry's latest products, services and technologies. Many annual meeting attendees say they have saved thousands of dollars and solved complex lubricant-related problems by making a connection at STLE's trade show.

STLE has several sponsorship and advertising opportunities sure to raise your company's profile in Chicago.

***Booths are 10 x 10 feet and are \$2,675 for STLE Corporate Members and \$3,075 for non-members.**

STLE's exhibition features companies from the following product categories:

- Lubricant additives
- Metalworking fluids and additives
- Environmental services
- Condition monitoring equipment
- Industrial fluids
- Consulting services
- Testing and analysis equipment, supplies and services
- Lubrication management services
- Synthetic lubricants

Commercial Marketing Forum

The Commercial Marketing Forum (CMF) is a series of 30-minute marketing sessions at STLE's 2020 Annual Meeting where participants may promote your company's products and services, something not allowed in the technical sessions. Your CMF session is promoted in the Annual Meeting Program Guide, directing attendees to your presentation. CMF timeslots are sold on a "first-come, first-serve" basis. Pricing for time slots to present is based on membership status and if you are exhibiting at the annual meeting.

Sponsorships

Sponsorships come in all shapes, sizes and prices and are designed to fit everyone's marketing budget.

If you are interested in gaining exposure and raising your company's profile at the annual meeting (thereby reaching some 1,600 members of the lubricants industry), STLE offers several sponsorship opportunities, including:

- Annual Meeting Mobile App **(Sold!)**
- Badge Lanyards **(Sold!)**
- Directional Floor Signs **(Sold!)**
- Education Course Lunches
- Education Course Materials **(Sold!)**
- Exhibitor Appreciation Hour Raffle **(Sold!)**
- Guest Room Keycards **(Sold!)**
- Networking Reception Sponsorships (Monday evening)
- President's Luncheon (Tuesday afternoon)
- Refreshment Breaks Plus Water Stations
- Registration Bags
- Recharging Lounge **(Sold!)**
- Speakers Breakfast **(Sold!)**
- Wi-Fi Service **(Sold!)**
- Welcome Gift

2020 Exhibition Hours

Hyatt Regency Chicago (Riverside Exhibit Hall)

Monday, May 4 • Noon-5 pm

Dedicated hour of trade show time from 3-4 pm. No other annual meeting activity during this time.

Tuesday, May 5 • 9:30 am-Noon & 2-5:30 pm

Trade show closes for two hours for the President's Luncheon & STLE Business Meeting from Noon to 2 pm. Also, there will be a second dedicated hour of trade show time from 3-4 pm. No other annual meeting activity during this time.

Wednesday, May 6 • 9:30 am-Noon

For more information about Annual Meeting exhibit booth reservations, CMF, and sponsorship opportunities, contact national sales manager Tracy Nicholas VanEe at (630) 922-3459, emeraldcomminc@yahoo.com.

Commercial Marketing Forum Pricing:

- \$610 for STLE Corporate Members who exhibit
- \$750 for STLE Corporate Members
- \$890 for individual members
- \$970 for non-members

2020 Annual Meeting Sponsors (As of Dec. 3, 2019)

STLE wishes to thank the following sponsors for their generous support of the 75th STLE Annual Meeting & Exhibition, May 3-7, 2020, at the Hyatt Regency Chicago. Updated signage with sponsors information will be included onsite in Chicago.

◆ These companies also have contributed to **Drive 75** in support of STLE's 75th Anniversary Celebration.

Palladium Plus: More than \$4,000

◆ Afton Chemical Corp.

Guestroom Key Cards

Ergon, Inc.

Badge Lanyards

Focus Chemical

Mobile App

◆ Shell Global Solutions (US), Inc.

Directional Signs

◆ The Lubrizol Corp.

Wi-Fi Service

Titanium Plus: More than \$3,000

Evonik Oil Additives

Exhibitor Appreciation Hour Raffle

Pilot Chemical Co.

Relaxation/Recharging Lounge

Titanium: \$3,000

CRODA Inc.

Educational Course Materials

Platinum: \$2,000

Sea-Land Chemical Company

Networking Reception

Zschimmer & Schwartz

Speakers Breakfast

Gold: \$1,000

American Society of Mechanical Engineers (ASME):

Networking Reception

◆ ExxonMobil Chemical Co.

Networking Reception

◆ The Timken Co.

Networking Reception

Bronze: \$1,000

◆ Acme-Hardesty Co.

Networking Reception

2020 Chicago Trade Show Floor Plan



Hyatt Regency Chicago Riverside Exhibit Hall

203	205	8'	209	211	213	215
-----	-----	----	-----	-----	-----	-----

204	206	208	210	212	214
-----	-----	-----	-----	-----	-----

305	307	309	311	313	315	0317
-----	-----	-----	-----	-----	-----	------

304	306	308	310	312	314	316
-----	-----	-----	-----	-----	-----	-----

403	405	407	409	411	413	415
-----	-----	-----	-----	-----	-----	-----

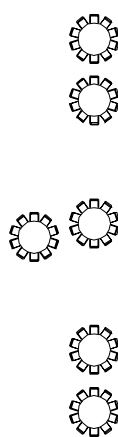
10'-3"

404	406	408	410	412	414	416
-----	-----	-----	-----	-----	-----	-----

503	505	507	509	511	513	20'
-----	-----	-----	-----	-----	-----	-----

10'-3"

504	506	508	510	512	514
-----	-----	-----	-----	-----	-----



937	938	701	703	705	707	709	711	713	715	717	719	721
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

801
803
805
807
809
811
813

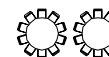
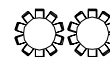
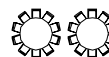
900
902
904
906
908
910
912

901
903
905
907
909
911
913

1000
1002
1004
1006
1008
1010
1012

1001
1003
1005
1007
1009
1011
1013

1100
1102
1104
1106
1108
1110
1112
1113
1115
1117
1119
1121
1123
1125
1127



625
623
622

1214
20'
20'

1206
20'
20'

1200
20'
20'

20'
20'
1300

20'
20'
1308

1314
20'
20'



ENTRANCE

2020 Annual Meeting Exhibitors

More than 120 organizations are expected to display their newest products and services at the 2020 STLE Exhibition. Following is the list of exhibitors as of Dec. 3, 2019. Visit www.stle.org/annualmeeting and see the Program Guide distributed onsite in Chicago for the most up-to-date list.



◆ **Acme-Hardesty Co.**

Advanced Chemical Concepts Inc.

◆ **Afton Chemical Corp.**

ANGUS Chemical Co.

◆ **Anhui Trust Chem Co., Ltd.**

Analytical Instruments

Baron USA, LLC

BASF

Beckman Coulter

◆ **Biosynthetic Technologies**

Bruker

BYK USA Inc.

Calumet Specialty Products Partners L.P.

Cannon Instrument Co.

Chevron Phillips Chemical Co.

Colonial Chemical Inc.

Compass Instruments/Falex Corp.

Ducom Instruments

Eastman

Ele Corp.

Emery Oleochemicals

Ergon, Inc.

Evonik Oil Additives USA, Inc.

◆ **ExxonMobil Chemical Co.**

FedChem, LLC

Fluid Life

Focus Chemical

Functional Products, Inc.

GEO Specialty Chemicals

Italmatch Chemicals

◆ **Kao Chemicals GmbH**

KH Neochem Americas, Inc.

King Industries, Inc.

Koehler Instrument Co. Inc.

LANXESS Corp.

◆ **Münzing**

Napoleon Engineering Services

Oil Filtration Systems

Oleon NV

PCC Chemax, Inc.

Perkin Elmer

Phoenix Tribology Ltd.

Pilot Chemical Co.

PMC Crystal

Polytec, Inc.

Ravago Chemicals

Rtec-Instruments

Sasol Performance Chemicals

Savant Labs & Institute of Materials

Sea-Land Chemical Company

Shanghai Million Chemical Limited

Soltex, Inc.

SONGWON Industrial Group

Tannas Co.

Teknor Apex

The Dow Chemical Corp.

◆ **The Lubrizol Corp.**

Univar Solutions

Vanderbilt Chemicals, LLC

Vantage

Zygo Corp.

◆ **These companies also have contributed to Drive 75 in support of STLE's 75th Anniversary Celebration.**