

PROGRAM

Thursday 12th, September

(The First day)

08:30 – 10:00

REGISTRATION

10:00 -10:10

OPENING ADDRESS

K. Nakayama

Chair: T. Yoshinari

SESSION I

TRIBOCHEMISTRY IN IONIC LIQUID

Chairs: S. Hsu & Y. Momose

10:10 -10:35 (25 min)

O-01 On the Lubrication Mechanisms of Non-halogenated Orthoborate Ionic Liquids

Sergei Glavatskih^{1,2} and Mark William Rutland^{3,4} (¹*Department of Machine Design, KTH Royal Institute of Technology, Sweden,* ²*Ghent University, Belgium,* ³*Department of Chemistry, KTH Royal Institute of Technology, Sweden,* ⁴*RISE Research Institutes of Sweden, Sweden*)

10:35 -11:00 (25 min)

O-02 The Role of Relative Humidity in the Lubrication Performance of Steel-on-Steel Contacts with Fluorinated Phosphonium Dicyanamide

Ionic Liquids

Antonella Rossi^{1,2}, Andrea Arcifa¹, Luigi A. Urtis^{1,2}, Marzia Fantauzzi², Peng Zhang^{3,§}, Daniel Rauber⁴, Rolf Hempelmann⁴, Tobias Kraus^{4,5}, and Nicholas D. Spencer¹(¹*ETH Zurich, Switzerland*, ²*University of Cagliari, Italy*, ³*INM - Leibniz Institute for New Materials, Germany*, ⁴*Saarland University and KIST Europe, Germany*, ⁵*Saarland University, Germany*, [§]*Current address: Sun Yat-sen University, China*)

SESSION II SIMULATION ANALYSIS OF TRIBOCHEMICAL DECOMPOSITION IN
DLC AND HYDROCARBON OILS

Chairs: N. Spencer & I. Szlufarska

11:00 - 11:25 (25 min)

O-03 Atomistic Simulations Reveal the Wear Mechanisms of Diamond-like Carbon and Propose Principles on Wear Reduction

Yang Wang^{1,2}, Narumasa Miyazaki¹, Yusuke Ootani¹, Nobuki Ozawa¹,
Koshi Adachi², and Momoji Kubo¹ (¹*Institute for Materials Research, Tohoku
University, Japan*, ²*Department of Mechanical System Engineering, Graduate
School of Engineering, Tohoku University, Japan*)

11:25 - 11:50 (25 min)

O-04 Simulation Analysis of Hydrocarbon Decomposition Caused by Triboplasma Action

Keiji Nakayama¹ and Masaaki Tanaka² (¹*Institute of Mesotechnology, Japan*,
²*PEGASUS Software Inc., Japan*)

Announcement from the Executive Committee

Chair: H. Komiya

< **Lunch (70 min)** >

SESSION III TRIBOCHEMISTRY IN WATER LUBRICATION

Chairs: M. Kalin & S. Loehle

13:00 - 13:25 (25 min)

O-05 Morphology-Dependent Friction on Adsorption Films

Johannes Hörmann¹ and Lars Pastewka^{1,2,3} (¹*Department of Microsystems Engineering, University of Freiburg, Germany*, ²*Freiburg Materials Research Center, University of Freiburg, Germany*, ³*Cluster of Excellence livMatS @ FIT – Freiburg Center for Interactive Materials and Bioinspired Technologies, University of Freiburg, Germany*)

13:25 - 13:50 (25 min)

O-06 Reactive Molecular Dynamics Simulation Study on Tribofilm Formation Process of Silicon Carbide in Water

Yusuke Ootani¹, Jingxiang Xu¹, Fumiya Nakamura¹, Yang Wang¹, Koshi Adachi² and Momoji Kubo¹ (¹*Institute for Materials Research, Tohoku University, Japan*, ²*Graduate School of Engineering, Tohoku University, Japan*)

SESSION IV TRIBOCHEMISTRY IN ZDDP ADDITIVES

Chairs: J. Fontaine & S. Bai

13:50 - 14:15 (25 min)

O-07 Effect of Annealing and Non-hydrostatic Pressures on Reactions of ZDDP Decomposition Products

Martin H. Müser¹ and Sergey V. Sukhomlinov¹ (¹*Saarland University, Germany*)

14:15 - 14:40 (25 min)

O-08 Effect of Hardness of Diamond-like Carbon (DLC) Coatings on Their Tribological Properties in Presence of ZDDP.

V. Salinas^{1,2,3}, M.I. De Barros Bouchet¹, J. M. Martin¹, K. Masenelli-Varlot² and C. Heau³ (¹*EC- Lyon, France*, ²*INSA-Lyon, France*, ³*HEF/IREIS, France*)

14:40 - 15:05 (25 min)

O-09 Investigations on the Reactivity of ZDDP Based Tribofilms Regarding Temperature Effects

Florian Pape¹, Torben Terwey¹, Dennis Mallach², Dieter Lipinsky², Tim Matthias³, Bernd-Arno Behrens³, Heinrich F. Arlinghaus² and Gerhard Poll¹ (¹*Institute for Machine Design and Tribology, Leibniz University Hannover, Germany*,

²Westfälische Wilhelms-Universität Münster, Germany, ³Institute of Forming Technology and Machines, Leibniz University Hannover, Germany)

< **Tea Break (20 min)** >

SESSION V TRIBOCHEMISTRY IN MoDTC TO MoS₂

Chairs: A. Rossi & S. Glavatskih

15:25 - 15:50 (25 min)

O-10 Tribochemistry of Molybdenum Disulfide

Michael Chandross¹, Adam Hinkle¹, John Curry¹, Brandon Krick² and Nicolas Argibay¹ (¹Sandia National Laboratories, USA, ²Lehigh University, USA)

15:50 - 16:15 (25 min)

O-11 From MoDTC to MoS₂ Flakes: a Tribochemical Process

M. Al Kharboutly¹, J. Galipaud¹, P. Gaval², G. Veryasov², C. Camp², A. Quadrelli², B. Reynard³, T. Le Mogne¹, M. Belin¹, M. Cobian¹, J. Fontaine¹ and C. Minfray¹ (¹Université de Lyon - Ecole Centrale de Lyon - LTDS, France, ²Université de Lyon - C2P2, France, ³Université de Lyon - ENS Lyon - LGL, France)

SESSION VI TRIBOCHEMISTRY IN MoDTC ADDITIVES

Chairs: H. Washizu & F. Pape

16:15 - 16:40 (25 min)

O-12 Insights into the Decomposition Mechanism of MoDTC by QM/MM Simulations

Stefan Peeters¹, Paolo Restuccia¹, Sophie Loehlé², Benoit Thiebaut² and M. C. Righi¹ (¹University of Modena and Reggio Emilia, Italy, ²Total Marketing and Services, France)

16:40 - 17:05 (25 min)

O-13 Friction Reduction Mechanism by the Combination Use of MoDTC and Organic Friction Modifiers

Tomoko Hirayama¹ (¹Kyoto University, Japan)

17:05 - 17:30 (25 min)

O-14 Friction Regimes of Water-Lubricated Diamond and Diamond-like Amorphous Carbon

Takuya Kuwahara¹, Gianpietro Moras¹ and Michael Moseler^{1,2} (¹*Fraunhofer Institute for Mechanics of Materials IWM, Germany*, ²*University of Freiburg, Germany*)

17:30 - 17:55 (25 min)

O-15 In Situ Analysis of the Tribochemical Reaction of DLC in Various Gas Atmosphere

H. Hibino¹, Y. Hayashi¹, K. Sasaki¹, N. Inayoshi¹, H. Tanaka² and J. Sugimura² (¹*DENSO CORPORATION, Japan*, ²*Kyushu University, Japan*)

Announcement from the Executive Committee

Chair: H. Koshima

<Break (65 min) >

19:00 - 21:00

WELCOMING RECEPTION

(2 hours)

At Hotel Takubokuktei

Friday 13th, September

(The Second day)

SESSION VIII EFFECTIVE FILM FORMATION IN TRIBOCHEMISTRY

Chairs: K. Nakayama & T. Yoshinari

08:30 - 08:55 (25 min)

**O-16 Tribological Performance and Thermal Film Formation
in the Presence of Phosphate Esters and Calcium Sulfonate
Detergent**

Daichi Ogawa^{1,2}, Antonella Rossi^{1,3} and Nicholas D. Spencer¹ (¹ETH Zurich,
Switzerland, ²Idemitsu Kosan Co., Ltd., Japan, ³University of Cagliari, Italy)

08:55 - 09:20 (25 min)

O-17 Colloid Science in Oil Environment

Hitoshi Washizu^{1,2}, (¹University of Hyogo, Japan, ²Kyoto University, Japan)

09:20 - 09:45 (25 min)

**O-18 Hydrogen Bonding and Dispersity: Their Influence on Lubrication
with Polymer Brushes**

Nicholas D. Spencer¹, Rok Simic¹ and Joydeb Mandal¹ (¹ETH Zurich,
Switzerland)

< **Tea Break (20 min)** >

SESSION IX ROLE OF ADSORPTION IN TRIBOCHEMISTRY

Chairs: R. Crockett & V. Salinas

10:05 - 10:30 (25min)

O-19 Effects of Stearic Acid on Lubrication Conditions in Rolling Bearings

Taisuke Maruyama¹, Masayuki Maeda¹ and Ken Nakano² (¹*NSK Ltd., Japan,*
²*Yokohama National University, Japan*)

10:30 - 10:55 (25 min)

O-20 The Effect of the Additive Adsorption on the Elastohydrodynamic Friction at 25 °C and 100 °C

M. Kus¹ and *M. Kalin¹ (¹*University of Ljubljana, Slovenia*)

SESSION X SURFACE MODIFICATION PROCESS IN TRIBOCHEMISTRY

Chairs: L. Pastewka & T. Yoshinari

10:55 - 11:20 (25 min)

O-21 Multiscale Model of Chemical Aging in Frictional Contacts

Izabela Szlufarska¹ and Zhouhan Li¹ (¹*University of Wisconsin, USA*)

11:20 - 11:45 (25 min)

O-22 Shear-Driven Amorphization and Recrystallization of Silicon and Diamond

Gianpietro Moras¹, Thomas Reichenbach¹, Andreas Klemenz¹, Adrien Gola², Hiroshi Uetsuka³, Michael Moseler¹ and Lars Pastewka² (¹*Fraunhofer IWM, Germany,* ²*University of Freiburg Germany,* ³*Asahi Diamond Industrial Co. Ltd., Japan*)

Announcement from the Executive Committee

Chair: T. Yoshinari

11:45 – 11:55

COMMEMORATIVE PICTURE

11:55 - 13:00

< Lunch (65 min) >

13:00 - 15:00

POSTER SESSION
(2 hours)

(Panel sizes: Width 0.9 m × Height 2.1 m)

Announcement from the Executive Committee

Chair: H. Koshima

< **Break (30 min.)** >

15:30

Buses leave at the Hotel Takubokutei for Old Town.

Tour –Old Town-
(90 min)

16:00-17:30

We walk from ① Perry square on the hill, through ②Motomachi Park→
③Cathoric Motomachi Church → ④Hakodate Orthodox Church→
⑤Hakodate St. John Church →⑥Higashi Honganji Temple.

17:30

Buses leave at the Higashi Honganji Temple for the Restaurant Legato at the summit of Mt. Hakodate.

< **Break at the summit (30 min)** >

Enjoy night view (Sunset at 17:52)

Take pictures

18:30-20:30

AWARD CEREMONY & BANQUET

At The Restaurant Legato (*2 hours*)

(1) AWARD CEREMONY

Chairs: A. Rossi and S. Loehle

“THE TRIBOCHEMISTRY AWARD” is presented to the following three recipients.

Dr. Stephen M. Hsu

(Professor of George Washington University, U.S.A.)

Dr. Jean-Michel Martin

(Emeritus Professor of Ecole Centrale de Lyon, France)

Dr. Hugh A. Spikes*

(Emeritus Professor of Imperial College, U.K.)

**The award ceremony for Prof. Spikes is held separately at 15:30 on September 16, in “Meeting Room 1” in the first floor of the Sendai International Center, the map of which is shown below at the bottom. Please attend to celebrate his award.*

(2) BANQUET

20:40

Buses leave at the summit for the Hotel Takubokutei through the hotels.

Saturday 14th, September

(The Third day)

SESSION XI	ADVANCED TRIBOCHEMISTRY IN LUBRICANT FILM FORMATION	<i>Chairs: M. H. Müser & Y. Ootani</i>
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08:30 - 08:55 (25 min)

O-23 Formulation and Testing of Rail Conditioners for Train Wheel/Rail Contact

Rowena Crockett¹, Andrea Arcifa¹, Franziska Zbinden², Urs Schönholzer², and Nicholas D. Spencer³ (¹*Empa, Switzerland*, ²*SBB, Switzerland*, ³*ETH Zurich, Switzerland*)

08:55 - 09:20 (25 min)

O-24 Superlarge-Scale Molecular Dynamics Simulations on Chemical-Reactions -Induced Wear and Destruction Processes of Materials

Momoji Kubo¹, Yang Wang^{1,2}, Narumasa Miyazaki¹, Yusuke Ootani¹, and Nobuki Ozawa¹ (¹*Institute for Materials Research, Tohoku University, Japan*, ²*Graduate School of Engineering, Tohoku University, Japan*)

< Tea Break (20 min) >

SESSION XII	ADVANCED MEASUREMENT TECHNOLOGY FOR TRIBOCHEMISTRY	<i>Chairs: C. Minfray & M. Chandross</i>
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09:40 - 10:05 (25 min)

O-25 A New High-Resolution Environment-Controlled Tribometer based on a Unique 6-axis Force Sensor to Study Tribochemical Phenomena

Julien Fontaine¹, Matthieu Guibert¹, Jules Galipaud¹, Thierry Le Mogne¹ and Thibaut Durand¹ (¹*Ecole Centrale de Lyon, France*)

10:05 - 10:30 (25 min)

O-26 Possibility of Applied Technology Using Super-Lubrication by Ta-C with Environment-Friendly Lubricant to HEV Engine Component

Makoto Kano¹ and Kentaro Yoshida² (¹KANO Consulting Office, Japan,
²Kanagawa Institute of Industrial Science and Technology, Japan)

10:30 - 10:55 (25 min)

O-27 In-situ Studies of the Competitive Adsorption of Lubricant Additives

M. Dienwiebel^{1,2}, J. Honselmann¹, P. Wilke³ and T. Rühle³ (¹Fraunhofer IWM, Germany, ²Karlsruher Institute for Technology KIT, Germany, ³BASF SE, Germany)

AWARD LECTURE (I) BY THE TRIBOCHEMISTRY AWARD RECIPIENT

Chairs: M. Kubo & M. Moseler

10:55 - 11:25 (30 min)

O-28 Tribocchemistry – Past, Present, and Future

Stephen Hsu¹ (¹George Washington University, USA)

AWARD LECTURE (II) BY THE TRIBOCHEMISTRY AWARD RECIPIENT

Chairs: M. Kubo & M. Moseler

11:25 - 11:55 (30 min)

O-29 Anti-wear Chemistry of ZDDP: a 45 Years Story

Jean-Michel Martin¹ (¹Ecole Centrale de Lyon, France)

AWARD LECTURE (III) BY THE TRIBOCHEMISTRY AWARD RECIPIENT

Chairs: N. Spencer and S. Loehle

15:50 - On September 16 in Sendai

O-30 Tribocchemistry of ZDDP – the Last 15 Years

Hugh A. Spikes¹ (¹Imperial College, U.K.)

This lecture will be given in **Meeting Room 1** in the first floor of the **Sendai International Center**, just after the Award Ceremony for him at 15:30 in the same room, the map of which is shown below at the bottom.

11:55 - 12:05 **CLOSING REMARKS**

K. Nakayama

Chair: H. Koshima

Announcement from the Executive Committee

chair: H. Koshima

< **Lunch & Break (70 min)** >

Take your bag into the trunk of the bus.

13:15 Buses leave at the Hotel Takubokutei for the Goryokaku.

13:45 - 15:00

Tour –Goryokaku-
(Pentagon Fortress)
(75 min)

Take pictures

During the tour, your bag can be kept in the trunk of the bus.

15:00 Buses leave at 15:00 at Goryokaku for the Shin-hakodate-hokuto Sta. in The Shinkansen-Bullet-Train Line

<Time Table of the Shinkansen-Bullet-Train Line>

Shin-hakodate-hokuto		Sendai		Tokyo
16:17	→	18 : 55	→	20:32
17:21	→	19 : 52	→	21:23
18:36	→	21 : 29	→	23:04

POSTER SESSION

Friday 13th, September

(The Second Day)

<13:00-15:00>

P-01 Self-sustained Superlubricity of Glycerol in a Steel/Ta-C Contact

Yun Long¹, Maria-Isabel¹, De Barros-Bouchet¹ and Jean Michel Martin¹ (¹*Ecole Centrale de Lyon, France*)

P-02 Shear-Induced Phase Transitions at Silicon Interfaces

Thomas Reichenbach¹, Gianpietro Moras¹, Andreas Klemenz¹, Hiroshi Uetsuka³, Michael Moseler^{1,4} and Lars Pastewka² (¹*Fraunhofer IWM, Germany*, ²*University of Freiburg, Germany*, ³*Asahi Diamond Industrial Co. Ltd., Japan*, ⁴*University of Freiburg, Germany*)

P-03 Correlation between TAPE and XPS in Iron Surfaces Scratched in Air, Water, and Organic Liquids

Takao Sakurai¹, Yoshihiro Momose² and Keiji Nakayama³ (¹*Ashikaga Institute of Technology, Japan*, ²*Ibaraki University, Japan*, ³*Institute of Mesotechnology, Japan*)

P-04 Facile Method of Surface Modification of Iron Particles with Octadecyltriethoxysilane

Noboru Suzuki¹, Misaki Abe¹ and Masahide Sato¹ (¹*Utsunomiya University, Japan*)

P-05 Enhanced Lubrication Performances by Core-shell TiO₂ Nanoparticles with the Surface Modification using Polyphenol Derived Compounds

Tsufang Hong¹, Francesco Tutino¹ and S. Mani Sarathy¹ (¹*King Abdullah University of Science and Technology (KAUST), Saudi Arabia*)

P-06 Tribological Characteristics and Structure of Organophosphate on Metal Surface

Hiroaki Koshima¹, Yuko Murakami¹, Hiroshi Tokairin¹, Yuki Iike² and Hitoshi Washizu² (¹*Idemitsu Kosan Co.,Ltd, Japan*, ²*University of Hyogo, Japan*)

P-07 Effect of Molecular Structures of Oils on Amounts of Hydrogen Evolution through Decomposition of Oils by Action of Discharge Plasma

Satoshi Nouyama¹, Makoto Hayama¹, Daming Dong¹ and Keiji Nakayama² (¹*Kyodoyushi Co., Ltd., Japan*, ²*Institute of Mesotechnology, Japan*)

P-08 Transfer of Electrons on Scratched Iron Surfaces – The Dependence of Photoelectron Emission on Temperature and Photon Energy–

Yoshihiro Momose¹, Takao Sakurai² and Keiji Nakayama³ (¹*Ibaraki University, Japan*, ²*Ashikaga Institute of Technology, Japan*, ³*Institute of Mesotechnology, Japan*)

P-11 Effect of Tribochemical Reactions on Wear of Diamond-like Carbon in Oxygen and Water Environment: A Molecular Dynamics Simulation Investigation

Jing Zhang¹, Yang Wang¹, Jingxiang Xu¹, Yusuke Ootani¹, Nobuki Ozawa¹, Koshi Adachi², and Momoji Kubo¹ (¹*Institute for Material Research, Tohoku University, Japan*, ²*Department of Mechanical Systems Engineering, Graduate School of Engineering, Tohoku University, Japan*)

P-12 Nanobubble Collapse Simulation for Efficient Chemical Mechanical Polishing of Aluminum Nitride by Molecular Dynamics Method

Sota Kimura¹, Narumasa Miyazaki¹, Yusuke Ootani¹, Nobuki Ozawa¹ and Momoji Kubo¹ (¹*Tohoku University, Japan*)

P-13 Structural Characterizations of Iron Sulfide Tribofilms on Carbon and Stainless Steels

M. Miyajima^{1, 2}, M. Yonemura¹, K. Kitamura¹, K. Matsumoto¹ and K. Yagi² (¹*Nippon Steel Corporation, Japan*, ²*Kyushu University, Japan*)

- P-14 Imitating Articular Cartilage Using Acrylamide-Based Block-Copolymer Brushes**
Joydeb Mandal¹, Rok Simic¹, Andrea Arcifa¹ and Nicholas D. Spencer¹ (¹*ETH Zurich, Switzerland*)
- P-15 Weakening Effects of Water on Shear Failure Strength of Rocks: Reactive Molecular Dynamics Simulation**
Shuro Yamashita¹, Fumiya Nakamura¹, Narumasa Miyazaki¹, Yusuke Ootani¹, Nobuki Ozawa¹ and Momoji Kubo¹ (¹*Tohoku University, Japan*)
- P-16 Tribochemistry and Friction Mechanism of Oxidized Diamond-like Carbon Films Using Reactive Molecular Dynamics Method**
Shandan Bai¹, Nobuki Ozawa² and Momoji Kubo² (¹*Kyocera Corporation, Japan*, ²*Tohoku University, Japan*)
- P-17 Effect of Chain Topologies on the Wear Mechanism of Polymer Brush: Coarse-Grained Molecular Dynamics Study**
Zhongmin Liu¹, Shuichi Uehara¹, Narumasa Miyazaki¹, Yusuke Ootani¹, Nobuki Ozawa¹ and Momoji Kubo¹ (¹*Tohoku University, Japan*)
- P-18 Evaluation of Dynamic Behaviour of Additive Adsorption by Surface-Enhanced Raman Spectroscopy**
Naoki Yamashita¹ and Tomoko Hirayama¹ (¹*Kyoto University, Japan*)
- P-19 Observation of Competitive Adsorption of Alkyl Imidazoline and Water by Using SEIRAS**
Masaki Tamaki¹, Naoki Nagase¹ and Kenta Motobayashi² (¹*Idemitsu Kosan Co., Ltd, Japan*, ²*Nagoya Institute of Technology, Japan*)
- P-20 Study on Surface Film Formation and Tribological Properties by Using Ashless DTC**
Kanako Takahara¹, Kazunori Miyake¹, Kouji Yoshizaki¹ and Toshiaki Wakabayashi² (¹*JTEKT CORPORATION, Japan*, ²*Kagawa University, Japan*)
- P-21 Evaluation of Friction Properties of Solid Lubricant Coating**

Containing Silver Nanoparticles (AgNPs)

Pius Gibulobe¹, Tomoko Hirayama² and Hiroshi Kakiuchi³ (¹*Doshisha University, Japan*, ²*Kyoto University, Japan*, ³*Daiken Chemical Co., Ltd, Japan*)

P-22 Interfacial Structure and Nanotribological Properties of New Polyacrylate-Type Friction Modifiers Having Poorly-Oil-Soluble Units

Yuto Nakasui¹, Naohiro Kikuchi¹, Tomoko Hirayama², Honami Watanabe³, Ko Onodera³ and Takehisa Sato³ (¹*Doshisha University, Japan*, ²*Kyoto University, Japan*, ³*EMG Lubricants Godo Kaisha, Japan*)

P-23 Functionalized Copolymers and their Use as Oil-Compatible Friction-Modifier Additives: the Role of Polymer Architecture

Tobias A. Gmür¹, Joydeb Mandal¹ and Nicholas D. Spencer¹ (¹*ETH Zürich, Switzerland*)

P-24 Influence of Young's Modulus of Thickeners on Grease Lubrication

Takahiro Nakamura¹, and Jusei Maeda¹ (¹*Nippon Grease Co. Ltd., Japan*)

P-25 The Mechanism of Glyceride Ester Friction Reduction

Ben Fry¹, Hugh Spikes¹ and Janet Wong¹ (¹*Imperial College, UK*)

Monday 16th, September

<“Meeting Room 1” in the first floor of the Sendai International Center>

AWARD CEREMONY

Chairs: N. Spencer and S. Loehle

15:30 -

“THE TRIBOCHEMISTRY AWARD” is presented to

[Dr. Hugh A. Spikes](#) (*Emeritus Professor of Imperial College, U.K.*)

AWARD LECTURE (III) BY THE TRIBOCHEMISTRY AWARD RECIPIENT

Chairs: N. Spencer and S. Loehle

15:50 -

O-30 **Tribochemistry of ZDDP – the Last 15 Years**

[Hugh A. Spikes](#)¹ (*Imperial College, U.K.*)

