

# **HISTORY**

## **OF SYMPOSIUMS AND CONFERENCES ON TRIBOCHEMISTRY**

**UNIVERSITY OF ŁÓDŹ**

**DEPARTMENT OF CHEMICAL TECHNOLOGY  
AND ENVIRONMENTAL PROTECTION**

**from 2011 DEPARTMENT OF TECHNOLOGY AND CHEMISTRY OF  
MATERIALS**

**S. Płaza**

**ŁÓDŹ UNIVERSITY  
POLISH TRIBOLOGY SOCIETY**

**TRIBOCHEMISTRY**

**Proceedings of 1<sup>st</sup> SYMPOSIUM  
6 – 8 September 1993, Łódź, Poland**

# Tribochemistry

In 1919 Ostwald considered mechanical energy influence on chemical reactions and coined the term „mechanochemistry”. However, at that time Ostwald was not able to say anything on the independent character and the importance of this field of chemistry. In Heinicke’s book “Tribochemistry”(1984) this chemistry deals with the relations between work and mass transformation.

*Tribochemistry deals with chemical reactions under the influence of mechanical action on mostly metals and ceramics in the presence of gaseous, liquid or solid lubricants.*

**In boundary lubrication contact between solid surfaces are possible tribophysical phenomena, including high temperature generation, shear stress, nascent surface formation, triboemission. These phenomena initiate tribochemical reactions.**

**Tribochemical reactions usually proceed at room temperature with rates that, in the absence of friction, exist only above 800K. They are particularly pronounced in the tribological behavior of ceramics.**



**In years 1985-1993, Professors Kajdas, Furey and Kulczycki worked on triboemission and activation energy of catalytic processes. Their findings revealed that tribochemical reactions are initiated by the exo-electron-emission-(EEE) process. The Negative-Ion-Radical Action Mechanism (NIRAM) and Hard and Soft Acids and Bases (HSAB) models explain many phenomena of surface polymerization, AW action of some additives in different lubricating oils in friction contacts metals and ceramic. These models had been steadily verified in tribological tests.**

**Tribochemistry play very complicated roles; in some cases tribochemical reaction would result friction reduction and wear to prolong lifetime of materials and energy, while in other cases tribochemistry would accelerate the failure of the sliding materials. Therefore, to probe the tribochemistry mechanism would provide firm foundation knowledge to designing and constructing lubricating materials with proper properties required by the needs. (Q.Xue, 5thICT,2009, Lanzhou, China)**

**For the first time**  
***Symposium on Tribochemistry***  
**was held at**  
**University of Łódź**

# Here the 1<sup>st</sup> Symposium on Tribochemistry was held



**1<sup>st</sup> Symposium on Tribochemistry aimed presenting major Polish research centers at dealing with tribochemistry. Collaborative research contacts with other countries were also considered.**

**Topics included:**

- Friction Physicochemical Phenomena,**
- Mechanisms of Tribological Additive Effectiveness,**
- Tribopolymerisation and Analytical Techniques in Tribochemistry,**
- Some other Aspects of Tribology.**

**The pictures below provide: some  
historical background  
&  
remind some of our activities,  
friendship and smiles.**

















**UNIVERSITY OF ŁÓDŹ  
CRACOW UNIVERSITY OF TECHNOLOGY  
WARSAW UNIVERSITY OF TECHNOLOGY IN PŁOCK  
POLISH TRIBOLOGY SOCIETY**

# **TRIBOCHEMISTRY**

**Proceedings of 2<sup>nd</sup> Symposium  
15 – 17 September 1997, Janowice, Poland**





# **Topics of 2<sup>nd</sup> International Symposium on Tribochemistry**

**Janowice, Poland, September 15-18 1997**

- mechanisms of additives' action under boundary lubrication**
- physicochemical phenomena in rubbing contacts**
- tribopolymerization**
- tribochemistry of ceramics**
- new analytical techniques applied in studying of tribochemical processes**
- other aspects of tribochemistry**

**This Symposium on Tribochemistry follows the first one held at University of Łódź in 1993 and the Satellite Forum of International Workshop on Tribochemistry held in Tokyo in 1995 with Prof. C. Kajdas presentation and Japanese Tribochemists-K.Hiratsuka and K.Nakayama (next 3 slides). It aimed at presenting most recent research concerning tribochemistry and tribophysics, particularly in the USA, Japan, Belarus, Russia and Poland and showing existing collaborative work and/or scientific contacts with other countries.**

## 講演会開催案内

# International Workshop on Tribochemistry

キーワード : Tribology, Catalysis, Polymerization, Surface chemistry  
日時 : 平成16年3月3日 14:00-17:00  
会場 : 応用化学科第一講義室  
プログラム : **Prof. C.Kajdas** (Warsow University of Technology, Poland)  
"Comparison of heterogeneous catalytic and tribo-catalytic processes"

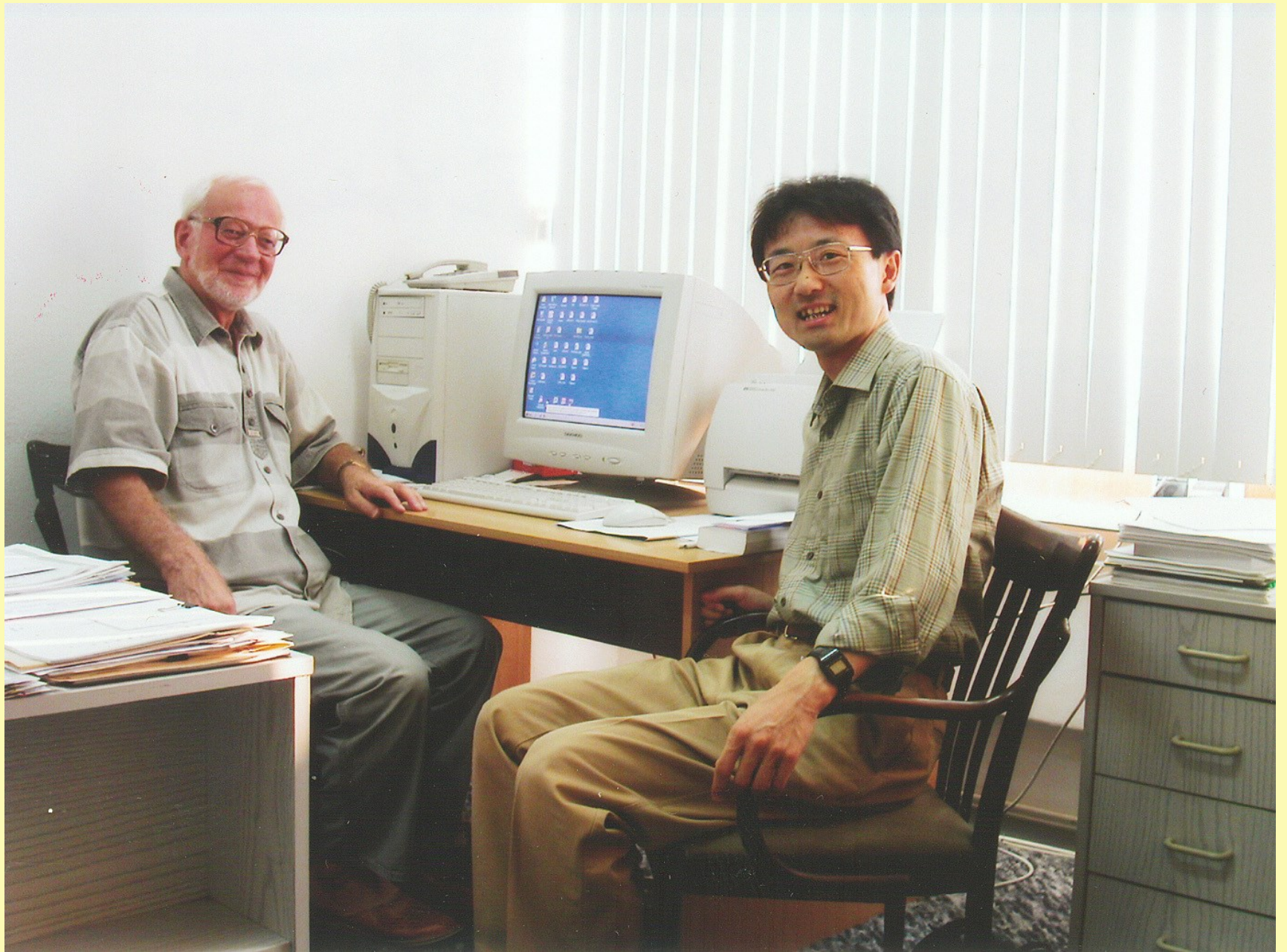
**Prof. K.Hiratsuka** (Chiba Institute of Technology, Japan)  
"Wear and Chemical Reactions"

**Prof. S.Mori** (Iwate University, Japan)  
"Importance of *in situ* analyses at tribological contact"

主催 : 岩手大学工学部  
共催 : 岩手表面技術懇話会  
参加費 : 無料

お問い合わせは、応用化学科 南へ (内線6335, [ichiro@iwate-u.ac.jp](mailto:ichiro@iwate-u.ac.jp))























# **3<sup>rd</sup> International Conference on Tribochemistry**

**10-12 September 2001**

**Cracow, Poland**

**Collegium Maius, Jagiellonian University**

**Organized by University of Lodz,  
Department of Chemical Technology and Environmental Protection**



**As tribochemistry is getting very important part of all the research on tribology - especially on nano- and micro-scale, this Conference was organised at the first time and place with the nano/microtribology to ensure for the participants attending both very closely related events.**

# Some Conference presentatios were published in **TRIBOLOGY LETTERS** Volume 13, Issue 2, 2002 and in **Tribologia** V.34,2,2003 (next slide)

1. [Download PDF \(33KB\)](#)
2. OriginalPaper

## Interactions of *n*-Hexadecane with 52100 Steel Surface Under Friction Conditions

Monika Makowska, Czeslaw Kajdas, Marian Grądkowski Pages 65-70

3. OriginalPaper

## Mechanical and Tribological Properties of Thin Remote Microwave Plasma CVD *a*-Si:N:C Films from a Single-Source Precursor

Dariusz Bielinski, Aleksander M. Wrobel... Pages 71-76

4. OriginalPaper

## Effect of Impregnation of Iodine Complex on Friction of Anodic Oxide of Aluminum

K. Hiratsuka, M. Asakawa, A. Funakoshi, M. Takaya Pages 77-80

5. OriginalPaper

## Tribological Performance of Room-Temperature Ionic Liquids as Lubricant

Weimin Liu, Chengfeng Ye, Qingye Gong, Haizhong Wang, Peng Wang Pages 81-85

6. OriginalPaper

## The Tribochemical Study of Some N-Containing Heterocyclic Compounds as Lubricating Oil Additives

Zhongyi He, Wenqi Rao, Tianhui Ren, Weimin Liu, Qunji Xue Pages 87-93

7. OriginalPaper

## Antiwear Properties of Phosphorous-Containing Compounds in Vegetable Oils

Ichiro Minami, Shota Mitsumune Pages 95-101

8. OriginalPaper

## Tribochemical Conversions of Zinc Dialkylidithiophosphate (ZDDP) Under Extremely Different Pressure Conditions

Waldemar Tuszynski, Jaroslaw Molenda, Monika Makowska Pages 103-109

9. OriginalPaper

## Research on the Mechanism and Activity of Antimony Thioantimonate in Tribological Systems

Dariusz Ozimina Pages 111-117

10. OriginalPaper

## Tribological Properties of AW/EP Additives Under Different Thermal Conditions

Anna Matuszewska, Marian Gradowski Pages 119-124

11. OriginalPaper

## Analysis of Tribochemical Surface Damage by Image Processing (Analysis of Tribochemical Damages)

K.Y. Choi, A. Ya. Grigoriev, N.K. Myshkin Pages 125-129

12. OriginalPaper

## The Nature and Origin of Tribochemistry

Stephen M. Hsu, Jun Zhang, Zhanfeng Yin Pages 131-139

13. OriginalPaper

## Tribochemical Reactions of Cutting-Edge Material During Secondary Wood-Product Cutting

Boleslaw Porankiewicz Pages 141-145

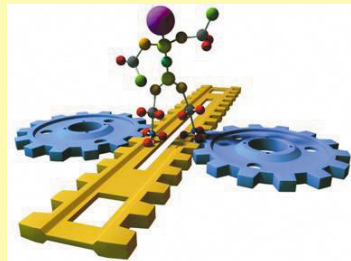
14. OriginalPaper

## An Examination of Thermionic Emission Due to Frictionally Generated Temperatures

Brian Vick, Michael J. Furey, Czeslaw Kajdas Pages 147-153

## CONTENTS

- Xingguo FU, Yinong LIU, Wenzhao YAO  
**The effect of aging process on the formation of carbonate particles during preparation of overbased calcium alkylsalicylates** ..... 11
- Jarosław GROBELNY, Grzegorz CELICHOWSKI, M. CICHOMSKI, Krzysztof KORALEWSKI, Ireneusz PIWOŃSKI  
**Friction force microscopy study of porous methylsilica thin films** ..... 19
- Ken'ichi HIRATSUKA, Makoto YOSHIDA  
**Reduction of carbon dioxide during rubbing of metals** ..... 27
- Andrzej KULCZYCKI, Czesław KAJDAS  
**Influence of surface coarseness on tribochemistry of AW/EP layers produced by gear oils**..... 37
- Leszek MARGIELEWSKI, Renata STANECKA, Krzysztof KORALEWSKI  
**Effect of high temperature and load on antiwear effectiveness of zinc dialkyldithiophosphate in lubrication of partially stabilized zirconia** ..... 55
- Zenon PAWLAK  
**Micellar structure of lubricating oils** ..... 65
- Yu. M. PLESKACHEVSKY, A.L. ZAITSEV, V.P. KIRILENKO  
**Physico-chemistry of phenolic resins wear at sliding friction in water-glycol solutions** ..... 81
- Marian Włodzimierz SULEK, Anita BOCHO-JANISZEWSKA  
**Influence of organic complexes of metals on motion resistance and wear** ..... 95
- Huidong WANG, Zhiqun HAN, Renan WANG, Yonglian ZHANG, Suoqi ZHAO  
**The research on the reaction process of the sediments in hydrotreated lube base oils under ultraviolet radiation conditions** ..... 107
- Tomasz WASILEWSKI, Włodzimierz SULEK  
**Application of mixtures of sorbitan monolaurate/ethoxylated sorbitan monolaurate as lubricant components** ..... 115
- A. PAUSCHITZ, Manish ROY, F. FRANEK  
**On the chemical composition of the layers formed during sliding of metallic alloys at high temperature** ..... 127
- Michał CICHOMSKI, Leszek MARGIELEWSKI, Ewa BARYLSKA, Ireneusz PIWOŃSKI  
**Investigation of nanostructure ordering and nano-frictional properties of O,O,S-methyl polyethoxyglycol triester of dithiophosphoric acid layer on stainless steel and on gold** ..... 145
- Krzysztof CHROBAK, Jarosław GROBELNY, Michał CICHOMSKI, Ireneusz PIWOŃSKI  
**Investigation of LB monolayers of arachidic acid with the use of atomic force microscopy** ..... 159



# **4<sup>th</sup> INTERNATIONAL CONFERENCE ON TRIBOCHEMISTRY**

**October 3 – 5, 2005  
Krakow, Poland  
Collegium Maius,  
Jagiellonian University**



**Organized by the University of Lodz,  
Department of Chemical Technology and  
Environmental Protection**

# TOPICS of 4<sup>th</sup> International Conference on Tribochemistry



**Cracow, Poland, August 31 - September 2 2005**

- **tribochemistry of lubricating base oils and model base fluids**
- **mechanisms of additives' action under boundary lubrication conditions**
- **physical and physicochemical phenomena in rubbing contacts**
- **tribopolymerization related research**
- **tribochemistry of ceramics and other technologically advanced materials**
- **micro/nanotribology**
- **new analytical techniques applied in tribochemistry**
- **tribophysics**
- **tribochemistry of nanoparticles and nanocomposites**
- **tribology of ultrathin films and coatings (LB, SAMs, etc.)**
- **action mechanisms of fuel lubricity additives**
- **other aspects of tribochemistry**



# Scientific Committee

- **M. Furey, Virginia Tech (USA)**
- **K. Hiratsuka, Chiba Institute of Technology (Japan)**
- **S. Hsu, NIST (USA)**
- **C. Kajdas, Central Petroleum Laboratory, (Poland)**
- **W. Liu, Chinese Academy of Science (China)**
- **J. M. Martin, Ecole Centrale de Lyon (France)**
- **K. Nakayama, Mechanical Engineering Lab (Japan)**
- **W. Olejniczak, University of Lodz (Poland)**
- **S. Plaza, University of Lodz (Poland)**
- **W. T. Tysoe, University of Wisconsin-Milwaukee (USA)**
- **L. Wojtczak, University of Lodz (Poland)**
- **Q. Xue, Chinese Academy of Science (China)**
- **E. S. Yamaguchi, Chevron Oronite Company (USA)**

# Organizing Committee

- **S. Plaza (General Chairman)**
- **G. Celichowski**
- **K. Chrobak**
- **W. Goworek**
- **E. Korczak**
- **A. Ilik**
- **M. Makowski**
- **L. Margielewski**
- **I. Piwonski**
- **M. Psarski**
- **R. Stanecka**
- **B. Strombek**





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- **POLISH TRIBOLOGY SOCIETY**



# Some Conference presentatios published in TRIBOLOGY LETTERS V. 24, 3, 2006

Volume 24, Issue 3, December 2006

ISSN: 1023-8883 (Print) 1573-2711 (Online)

In this issue (12 articles)

1. OriginalPaper  
Nano particles' behavior in non-Newtonian slurry in mechanical process of CMP  
C. Haosheng, L. Jiang, C. Darong, W. Jiadao Pages 179-186
2. OriginalPaper  
The effect of ethoxylated esters on the lubricating properties of their aqueous solutions  
M.W. Sulek, A. Bocho-Janiszewska Pages 187-194
3. OriginalPaper  
Effect of surface treatment on the mechanical and tribological performance of Kevlar pulp reinforced epoxy composites  
J. Wu, X.H. Cheng Pages 195-199
4. OriginalPaper  
Multilayered YSZ–Ag–Mo/TiN adaptive tribological nanocomposite coatings  
C. Muratore, A.A. Voevodin, J.J. Hu, J.S. Zabinski Pages 201-206
5. OriginalPaper  
An effect of lubricating additives on tribochemical phenomena in a rolling steel four-ball contact  
W. Tuszynski Pages 207-215
6. OriginalPaper  
Self-healing behavior of a polyelectrolyte-based lubricant additive for aqueous lubrication of oxide materials  
S. Lee, M. Müller, R. Heeb, S. Zürcher, S. Tosatti, M. Heinrich... Pages 217-223
7. OriginalPaper  
Friction of fullerene-like WS<sub>2</sub> nanoparticles: effect of agglomeration  
A. Moshkovith, V. Perfiliev, I. Lapsker, N. Fleischer, R. Tenne... Pages 225-228
8. OriginalPaper  
Tribophysical phenomena on sliding surfaces of polyester composites evaluated by spectroscopic and thermal analysis  
P. Samyn Pages 229-235
9. OriginalPaper  
Plane contact problems involving frictional heating for wavy half-space  
Volodymyr Pauk Pages 237-242
10. OriginalPaper  
ZDDP and MoDTC interactions and their effect on tribological performance – tribofilm characteristics and its evolution  
A. Morina, A. Neville, M. Priest, J.H. Green Pages 243-256
11. OriginalPaper  
Wear of a single asperity using Lateral Force Microscopy  
M.G. Reitsma, R.G. Cain, S. Biggs, D.W. Smith Pages 257-263
12. OriginalPaper  
Studies on friction and transfer layer: role of surface texture  
P.L. Menezes, Kishore, S.V. Kailas Pages 265-273

# **Our collaboration with chinese Tribologists**

**It will start after our personal contacts  
with Professors Q.Xue and W. Liu  
during or shortly after 2<sup>th</sup>  
Tibochemistry Symposium organised in  
Poland, 1977**

# Symposium on Lubricating Materials and Tribochemistry, Lanzhou, October, 1998, probably first visit of polish tribologists group in China





- **Lanzhou, October, 1999, first visit of prof. S. Plaza with his wife in State Key Laboratory of Solid Lubrication (Lanzhou Institute of Chemical Physics, Chinese Academy of Science). Soon before coming to China Professors Xue and Liu have been on piano concerto in Chopin birth-house in Poland. On the right to face of the Lanzhou Institute of Chemical Physics.**





**Presentation of scientific studies in our Department.  
Next slides present touristic attractions of China; Lanhou,  
Xiahe, Xian, Beijing**









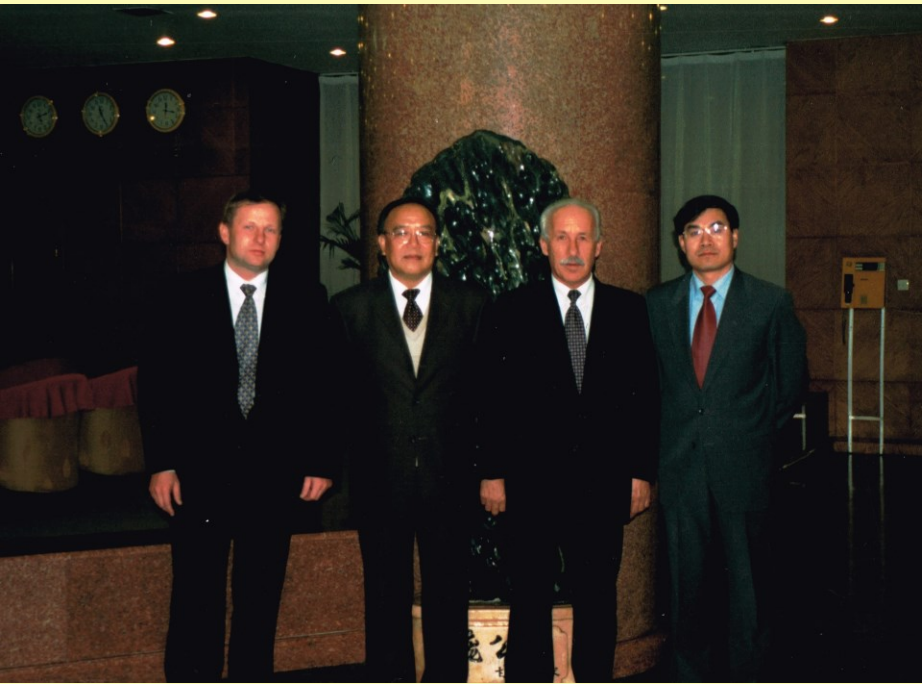




**For Whom this bell tolls, for our future  
successful scientific collaboration**



# Second visit of S. Plaza and G. Celichowski in China, November 15-30, 2002. Scientific discussion and signiture of research and academic cooperation agreement







# Maiji Shan close Tianshui with famous buddhist paintings and sculpture







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**Professor Weimin Liu**  
Director

Lanzhou Institute of Chemical Physics  
of the Chinese Academy of Sciences  
No.18, Tianshui Middle Road, Lanzhou, P.R.China

Łódź, 8 October 2008

Dear Professor Liu,

This year the Lanzhou Institute of Chemical Physics of the Chinese Academy of Sciences is celebrating the 50<sup>th</sup> anniversary of its foundation. This great event allows us to express our sincerest congratulations and respect. We recognize your outstanding scientific and organizational excellence, your effort and diligence, which have led you to your spectacular achievements.

We also appreciate the opportunity we have had to collaborate with you since 1997, when Professor Qunji Xue and Professor Weimin Liu participated in our 2nd Symposium on Tribochemistry in Poland. The cooperation between our two academic societies, represented by the Lanzhou Institute of Chemical Physics of the Chinese Academy of Sciences and the Department of Chemical Technology and Environmental Protection at the University of Lodz, has brought about many mutual benefits, expressed in the exchange of scientific ideas at an outstanding level, scientific staff exchange, participation in Chinese and Polish conferences and common research projects.

The culmination of this cooperation was the official cooperation agreement, signed at the governmental level in 2005. Our future plans include co-organization of the Conference on Tribochemistry in 2009 in Lanzhou.

I am confident that the coming years will see continued scientific and organizational development of the Lanzhou Institute of Chemical Physics, resulting in further fascinating achievements in the field of material science engineering, tribology, nanotechnology and space engineering.

Once again, on behalf of all members of our Department, please accept our congratulations and best wishes for many future successes.

Best regards,

  
Professor Stanislaw Plaza

**In year of 2005, during the 4<sup>th</sup> Tribo-chemistry Conference was decided, that next conference 5<sup>th</sup> would be hold in China. Acknowledgements are made to the financial supports from State Key Laboratory of Solid Lubrication and to Dr Junyan Zhang, Dr Feng Zhou, Dr Junhong Jia and Dr Lipin Wang for their organization. The conference received more seventy abstracts from almost every aspects of tribology, which reflects wide spread interests of tribochemistry to all tribologists.**

**State Key Laboratory of Solid Lubrication worked hard to make the Tribochemistry Conference more recognizable. The Key Laboratory provided an effective platform for tribochemists to share their new research progress. It was very motivating academic forum for tribochemists to share experience and to initiate fast extension of collaborative research. Our colleagues in Poland (Kajdas, Plaza etc) have made all their efforts to let this happen. In fact, as you might see, the International Tribochemistry Conference has come to its fifth birthday.**



**State Key Laboratory of Solid Lubrication (LSL) of Lanzhou Institute of Chemical Physics, Chinese Academy of Science, Lanzhou, China currently is ranked as first of the most distinguishable state key labs of China.**

## **Research areas:**

- Lubricating materials and techniques under special working conditions**
- Friction and wear of materials and surface engineering**
- High-performance lubricating materials and tribochemistry**
- Advanced lubricating and functional protective materials**

- *People*

- **1 academician**
- **30 professors**
- **More than 80 faculties**
- **More than 100 graduate students**

- *Collaborations*

- **Established collaborations and exchanges of researches and scientists with more than 10 foreign institutions and 30 domestic Universities and Organisations**

**Research projects: (completed & currently realized) in our Department 7th Framework Programme „Hybrid organic/inorganic memory elements for integration of electronic and photonic circuitry (HYMEC) from European Commission and 7 other projects**

## **Collaborations**

**5 foreign research centers**

**4 domestic research centers**

**Agreement for cooperation and scholarly exchange**

**between**

**the University of Łódź, Poland and the Lanzhou Institute of Chemical Physics**

**The Chinese Academy of Science**

With the object of promoting cooperation in academic education and research between the University of Łódź, 65 Narutowicza Street, 90-131 Łódź, represented by Rector Prof. dr Włodzimierz Nykiel, and the the Lanzhou Institute of Chemical Physics The Chinese Academy of Science, 18 Tianshui Middle Road, Lanzhou, P.R. China, represented by Director Professor Weimin Liu, the following agreement is established:

**Article 1**

The cooperation may concern any field or subject upon which the parties agree. It will include various activities, such as:

- collaborative research, lectures and symposia,
- exchange of scholars and researchers,
- exchange of doctoral students,
- exchange of scientific publications in fields which are of interest to both parties in order to update information.

**Article 2**

Implementation of exchange or other kinds of cooperation based on this agreement shall be the concern of the Institute of Chemical Physics The Chinese Academy of Science and University of Łódź represented by Department of Technology and Materials Chemistry. On the side of UŁ the responsibility for the implementation of the agreement and financial consequences will be borne by the Faculty of Chemistry. A specific plan may be worked out for each joint activity. This plan shall ensure that appropriate arrangements for studying, working and for living and maintenance expenses are made before the arrival of a faculty member or a student to the host university.

**Article 3**

The persons taking part in the exchange, before their departure to the host country, should be equipped with an individual insurance policy embracing costs of health treatment as well as insurance policy for unforeseen incidents.

**Article 4**

The plan agreed upon by cooperating parties shall be the basis for joint academic ventures, the costs of which shall be borne by both parties.

**Article 5**

Both University and Institute shall seek financing of joint activities from sources available to them.

**Article 6**

All agreements referring to present and future intellectual rights owned by each party, as well as the respective ones that are to arise while performing this agreement, shall be ruled by a separate agreement.

**Article 7**

This agreement is subject to revision, renewal and/or cancellation by mutual written consent.

**Article 8**

This agreement becomes effective from 01.01.2011 and will be valid for a period of five years. During the fourth year renewal for a following five-year-period will be considered.

**Article 9**

This agreement is written in Polish and English, in four originals, all of them of equal validity.

Łódź, 24.11.2010

University of Łódź

Prof. Bogusław Kryczka

Dean of the Faculty of Chemistry

Prof. Włodzimierz Nykiel



Lanzhou, Dec. 6, 2010

Lanzhou Institute of Chemical Physics  
The Chinese Academy of Science





*5th*  
*International*  
*Conference on Tribochemistry*

*September 14~16, 2009, Lanzhou, China*



*Program*

*Organized by:*

*Lanzhou Institute of Chemical Physics, Chinese Academy of Sciences, China*  
*University of Lodz, Poland*

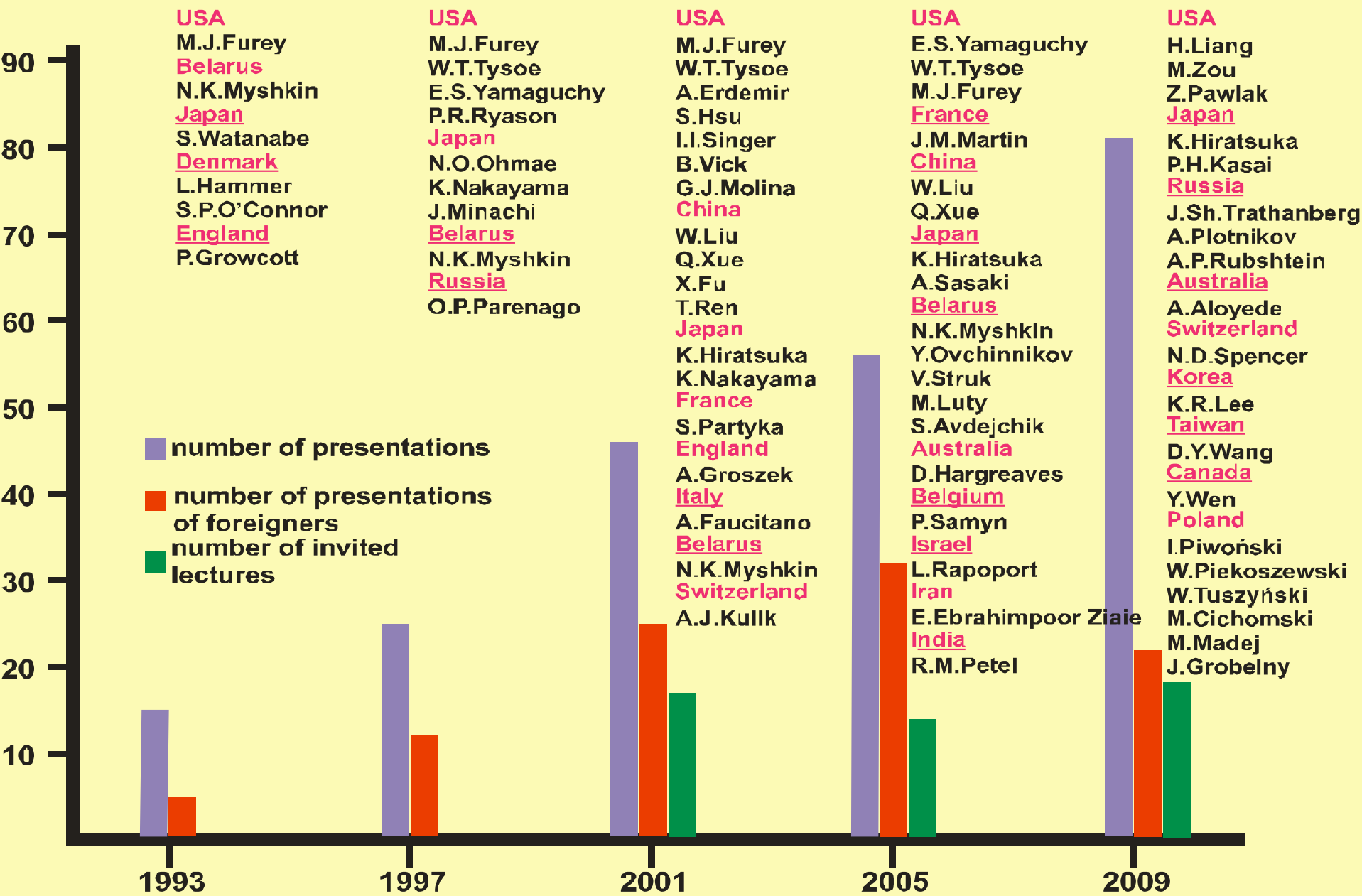


# 5th International Conference on Tribochemistry

Sept.14-16, 2009 Lanzhou, China



# Number of presentations and foreigners participants in Tribochemical Conferences







**6<sup>th</sup> INTERNATIONAL CONFERENCE ON TRIBOCHEMISTRY AND NANOMATERIALS, 4-6 September 2013, Lodz, Poland**



**Results of our researches were published  
in scientific Journals;**

**Langmuir  
Journal of Materials Chemistry  
Advanced Materials  
Macromolecules  
Applied Physics Letters  
Applied Surface Science  
Nanotechnology  
Journal of Chemical Physics  
Applied Organometallic Chemistry  
Tribology Letters  
Wear  
Tribology International**

# Some information about the Department of Technology and Chemistry of Materials

Scientific Staff	Ph.D.	D.Sc.
Prof. dr hab. inż. Stanisław Płaza	1972	1987
Prof. dr hab. Jarosław Grobelny	2003	2010
Prof. dr hab. Grzegorz Celichowski	1997	2011
Dr hab. Michał Cichomski	2005	2013
Dr hab. Ireneusz Piwoński	2000	2013
Dr Renata Stanecka-Badura	2005	
Dr Maciej Psarski	1999	
Dr Aneta Kisielewska	2010	
Dr Leszek Margielewski	1997	

# **Chinese International Symposia on Tribology, Our Department participation**

**The first China International Symposium on Tribology has been organized in Beijing in 1993 and next are happend ever 3 years time. Our Department scientists have been taken first time in the 4th ones at 2004 year in Xian.**

# The 4th China International Symposium on Tribology, November 8-11, 2004, Xian





















# The 5th China International Symposium on Tribology, Beijing, September 24-27, 2008











Chairman







# The 6th China International Symposium on Tribology, August 19-22, 2011, Lanzhou

6<sup>th</sup> China International Symposium on Tribology  
August 19-22, 2011, Lanzhou, CH











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甘A21921



# **Scientific polish-chinese cooperation**

**Professor Weimin Liu was held one month (2007) in our Department as Visiting Professor and supervisor of three polish M.Sc. degree works.**

**On the right - young scientific researcher Zefu Zhang from Lanzhou in our Department during his first visit in the time of Summer Olympic Games in China– happiness of staying in Poland and chinese sportsmens successes.**

**In 2012 the visit of young polish scientists M. Psarski and J. Marczak was held in Lanzhou.**



# **ACKNOWLEDGMENTS**

**I wish to thank my Department Colleagues for their participation in every forms of Conferences activities.**

**Special thanks for dearest Professors:**

**C. Kajdas**

**M. Furey**

**Q. Xue**

**W. Liu**

**W. Tysoe**

**K. Hiratsuka**

**N.K. Myshkin**

**for their friendship, help and contribution in all these Conferences.**



**THANK YOU FOR YOUR  
ATTENTION**



**„time is running out  
eternity waiting...”**

Author has started his education in  
primary school in 1945.