



**IUVSTA-ASEVA WORKSHOP PROGRAMME-2012**

**IUVSTA WS-66/ASEVA WS-26:  
FRICTION UNDER CONTROLLED ENVIRONMENTS**



**IUVSTA WORKSHOP PROGRAMME-2012**

**WS-66: FRICTION UNDER CONTROLLED ENVIRONMENTS**

**Ávila July 9-12, 2012**

**Hotel Reina Isabel**

**FINAL REPORT**



IUVSTA-ASEVA WORKSHOP PROGRAMME-2012  
IUVSTA WS-66/ASEVA WS-26:  
FRICTION UNDER CONTROLLED ENVIRONMENTS



## CONTAIN

**FOREWORD**

**PROGRAMME DEVELOPMENT**

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**IUVSTA-ASEVA WORKSHOP PROGRAMME-2012**  
**IUVSTA WS-66/ASEVA WS-26:**  
**FRICION UNDER CONTROLLED ENVIRONMENTS**



The workshop was aimed to discuss the current frontiers, present problems and future lines in tribology with special emphasis of the effect of environmental conditions, wear and lubrication on friction. Rapid technological development in many areas such as aerospace, energy production, nanotechnology, medicine, etc. demands efficient and intelligent solutions for tribological problems under extreme conditions of ultrahigh vacuum, very low and high temperatures, corrosive gases and liquids. Despite of long history of tribological research, the very basic principles of energy dissipation and material tribomutation remain yet not well understood. Therefore, the WS of outstanding experts in different Tribological problems was an appropriate forum to discuss about the following topics:

FUNDAMENTALS OF FRICTION AND WEAR

MICROTRIBOLOGY UNDER CONTROLLED ENVIRONMENTS

CRIOGENYC TRIBOLOGY

SURFACE INDUCED REACTIONS.

TRIBOCHEMISTRY

TRIBOELECTROMAGNETIC PHENOMENA

TECHNICAL SESSION: NEW INSTRUMENTS AND METHODS

ADVANCED LUBRICATION: IONIC LIQUIDS

ADVANCED LUBRICATION: NANOMATERIALS

TECHNICAL SESSION: MEASUREMENTS AND RELATED PROBLEMS

ADVANCED HARD COATINGS FOR SOLID

LUBRICATION

GAS DESORPTION DURING FRICTION: EXPERIMENT AND MODELLING

FRICTION RELATED TO BIOLOGICAL

APPLICATIONS



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Discussion about contribution of tribology to the prosthesis implants has been very fruitful for sharing information on the recent developments, establishing new contacts and possible cooperation. There was a general consensus that environment control is a key factor for understand basic mechanisms of friction at atomic level. It is also very important for controlling physical and chemical process, including triboelectromagnetic phenomena and gas-surface reactions, occurring in confined geometry of materials under tribological contact. Development of new generation ultrahigh vacuum tribotesters equipped with techniques for in situ physical and chemical surface characterization significantly stimulated researches and provided technological basis for advance in understanding fundamental process in friction and lubrication.



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# **PROGRAMME DEVELOPMENT**



**IUVSTA-ASEVA WORKSHOP PROGRAMME-2012**  
**IUVSTA WS-66/ASEVA WS-26:**  
**FRICION UNDER CONTROLLED ENVIRONMENTS**



## Time table

	<b>MONDAY, July 9</b>	<b>TUESDAY, July 10</b>	<b>WEDNESDAY, July 11</b>	<b>THURSDAY, July 12</b>
<b>09:00-09:30</b>	J.L. de Segovia Welcome-WS Introduction IUVSTA-ASEVA Presentation R. Nevshupa WS Context			
	<b>SESSION 1: FUNDAMENTALS OF FRICTION AND WEAR</b>  Moderators: J.M. Martin & R. Nevshupa	<b>SESSION 04: SURFACE INDUCED REACTIONS. TRIBOCHEMISTRY</b>  Moderators: M.Scherge & A. Cavaleiro	<b>SESSION 07: ADVANCED LUBRICATION: IONIC LIQUIDS</b>  Moderators: W.Liu & A. Useinov	<b>SESSION 10: ADVANCED MATERIALS AND HARD COATINGS FOR FRICTIONAL SURFACES</b>  Moderators: K. Hiratsuka & M.D. Bermudez
<b>09:30-10:30</b>	S01-MM-INV 01: E. Gneco et al. Recent Developments in Nanotribology	S04-TM-INV-04: J.M. Martin et al. Tribochemical Reactions in Gas Phase: Experimental Modeling	S07-WM-INV-07: W. Liu, F. Zhou Tribological Performance of Lubricants in Simulated Space	S10-ThM-INV-10: A. Kailer Tribology of Ceramic Materials in Different Environment
<b>10:30-11:00</b>	<b>SHORT PRESENTATIONS: S01-MM-IA-01 DISCUSSIONS</b>	<b>SHORT PRESENTATIONS: S04-TM-IA-05 DISCUSSIONS</b>	<b>SHORT PRESENTATIONS: S07-WM-IA-11 S07-WM-IA-12 DISCUSSIONS</b>	<b>SHORT PRESENTATIONS: S10-FM-IA-17 WITHDRAWN S10-FM-IA-18 DISCUSSIONS</b>
<b>11:00-11:30</b>	<b>COFFEE BREAK</b>			
<b>11:30-12:00</b>	<b>DISCUSSIONS (Continued)</b>	<b>DISCUSSIONS (Continued)</b>	<b>DISCUSSIONS (Continued)</b>	<b>DISCUSSIONS (Continued)</b>
	<b>SESSION 02: MICRITRIBOLOGY UNDER CONTROLLED ENVIRONMENTS</b>  Moderators: J.M. Martin & R. Nevshupa	<b>SESSION 05: TRIBOELECTROMAGNETIC PHENOMENA</b>  Moderators: M. Scherge & A. Cavaleiro	<b>SESSION 08: ADVANCED LUBRICATION: NANOMATERIALS</b>  Moderators: W. Liu & A. Useinov	<b>SESSION 11: GAS AD- DESORPTION DURING FRICTION: EXPERIMENT AND MODELING</b>  Moderators: Th. Gradt & A. Mège-Revil
<b>12:00-13:00</b>	S02-MM-INV-02: M. Scherge Advanced Techniques on Microtribology	S05-TM-INV-05: K. Hiratsuka Triboluminescence from Rubbing of some Polymers	S08-WM-INV-08: M. D. Bermudez et al. Tribological Performance and Surface Interactions of New Ionic Nanofluids and Nanomaterials	S11-ThM-INV-11: T. Tokumasu et al. A Molecular Dynamics Simulation of Momentum Transport in a Nanoscale Liquid Bridge
<b>13:00-14:00</b>	<b>SHORT PRESENTATIONS: S02-MM-IA-02 S02-MM-IA-03 DISCUSSIONS</b>	<b>SHORT PRESENTATIONS: S05-TM-IA-06 DISCUSSIONS</b>	<b>SHORT PRESENTATIONS S09-WM-IA-13 DISCUSSIONS</b>	<b>SHORT PRESENTATIONS: S11-ThM-IA-19/S11-ThM-IA-20 DISCUSSIONS</b>
<b>14:00-16:00</b>	<b>LUNCH</b>			



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	<b>SESSION 03:</b> <b>TRIBOLOGY AT HIGH AND LOW TEMPERATURES</b> <b>Moderators:</b> <b>R. Escobar-Galindo &amp; E. Gnecco</b>	<b>SESSION 06:</b> <b>TECHNICAL SESSION: NEW INSTRUMENTS AND METHODS</b> <b>Moderators:</b> <b>A. Igartua &amp; J. A. García</b>	<b>SESSION 09:</b> <b>TECHNICAL SESSION: MEASUREMENTS AND RELATED PROBLEMS</b> <b>Moderators:</b> <b>J. Rodriguez &amp; M. Conte</b>	<b>SESSION 12</b> <b>TRIBOLOGICAL PROBLEMS RELATED TO BIOLOGICAL APPLICATIONS</b> <b>Moderators:</b> <b>A.Kailer &amp; L.N. Rozanov</b>
<b>16:00-17:00</b>	<b>S03-MA-INV-03:</b> <b>Th. Gradt</b> Friction and wear problems in Cryogenic Engineering	<b>S06-TA-INV-06:</b> <b>M. A. Garrido et al.</b> Phenomena Affecting Contact Variables in Micro and Nanotest	<b>S09-WA-INV-09:</b> <b>R.A. Nevshupa, M. Conte</b> Measurement of Forces by Fibre Optical Sensors	<b>S12-ThA-INV-12:</b> <b>R. Rodriguez et al.</b> Friction and Wear in SBF for Biological Applications
<b>17:00-17:30</b>	<b>COFFEE BREAK</b>			
<b>17:30-19:00</b>	<b>SHORT PRESENTATIONS:</b> <b>S03-MA-IA-04</b>  <b>DISCUSSIONS</b>	<b>SHORT PRESENTATIONS:</b> <b>S06-TA-IA-09</b> <b>S06-TA-IA-10</b>  <b>DISCUSSIONS</b>	<b>SHORT PRESENTATIONS:</b> <b>S09-WA-IA-14</b> <b>S09-WA-IA-15</b> <b>S09-WA-IA-16</b> <b>DISCUSSIONS</b>	<b>SHORT PRESENTATIONS:</b> <b>DISCUSSIONS</b> <b>SUMMARY OF THE WORKSHOP CONCLUSIONS AND FINAL REMARKS</b> <b>A: Kailer, R. Nevshupa, J. L. de Segovia</b>



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JULY 9

MONDAY MORNING

09:00-09:30  
R. Nevshupa

J. L. de Segovia Welcome to the WS-66  
WS Context

IUVSTA-ASEVA Presentation

Session 01:

FUNDAMENTALS OF FRICTION AND WEAR

Moderators:

J.M. Martin & R. Nevshupa

09:30-10:30

S01-MM-INV 01:

RECENT DEVELOPMENTS IN NANOTRIBOLOGY

E. Gnecco<sup>1</sup>), M. Kisiel<sup>2</sup>), C. M. Pina<sup>3</sup>), F. Krok<sup>4</sup>), E. Meyer<sup>2</sup>), M. Szymonski<sup>4</sup>)

1)IMDEA. Autónoma University of Madrid, Madrid, Spain. 2) Department of Physics, University of Basel, Klingelbergstrasse 82, Basel, Switzerland  
3) Department of Crystallography and Mineralogy, Complutense University of Madrid, 28040 Madrid, Spain 4) Research Centre for Nanometer Scale Science and Advanced Materials (NANOSAM), Institute of Physics, Jagiellonian University, Reymonta 4, 30-059 Krakow, Poland

10:30-11:00

S01-MM-IA-01:

THE EFFECT OF TRIBOCHEMICAL REACTIONS ON METAL PROPERTIES IN VACUUM AND ATMOSPHERE

E. A. Deulin, E. I. Ikonnikova

Bauman Moscow State Technical University, MT-11, 2nd Baumanskaia st., 5, Moscow, 105005, Russia

C O F F E E B R E A K

11:00-11:30

11:30-12:00

DISCUSSIONS CONTINUES

Session 02:

MICROTRIBOLOGY UNDER CONTROLLED ENVIRONMENTS

Moderators:

J. M. Martin and R. Nevshupa

12:00-13:00

S02-MM-INV-02:

ADVANCED TECHNIQUES ON MICROTRIBOLOGY

M. Scherge

MikroTribologie Centrum, Fraunhofer-Institut für Werkstoffmechanik. Joseph-von-Fraunhofer Straße 7. 76327 Pfinztal

13:00-14:00

S02-MM-IA-02

SHORT PRESENTATIONS AND DISCUSSIONS

TRIBOLOGICAL PROPERTIES OF WS FILMS PREPARED BY MAGNETRON SPUTTERING

J.C. Sánchez-López

Instituto de Ciencia de Materiales de Sevilla (ICMS-CSIC).

S02-MM-IA-03 :

CORRELATION BETWEEN MICROSTRUCTURE AND TRIBO-MECHANICAL BEHAVIOR OF NITRIDE AND CARBO-NITRIDE COATINGS

R. Escobar Galindo<sup>a</sup>, J.C. Sánchez-López<sup>b</sup>, N. K. Manninenc<sup>c</sup>, M. Henriques<sup>d</sup>, S. Carvalhoc

<sup>a</sup> Instituto de Ciencia de Materiales de Madrid, Cantoblanco, 28049, Madrid, Spain. <sup>b</sup> Instituto de Ciencia de Materiales de Sevilla, Avda. Americo Vespucio 49, 41092 Sevilla, Spain. <sup>c</sup> Universidade do Minho, Campus de Azurém, 4800-058 Guimarães, Portugal. <sup>d</sup> IBB -Institute for Biotechnology and Bioengineering Centre for Biological Engineering Universidade do Minho Campus de Gualtar, 4700-057, Portugal





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**JULY 9**

**MONDAY AFTERNOON**

**SESSION 06: TRIBOLOGY AT HIGH AND LOW TEMPERATURES**

**Moderators: R. Escobar-Galindo and E. Gnecco**

16:00-17:00

**S03-MA-INV-03:**

**FRICTION AND WEAR PROBLEMS IN CRYOGENIC ENGINEERING**

**Th. Gradt**

BAM Federal Institute for Materials Research and Testing,  
Berlin, Germany

17:00-17:30

**C O F F E E B R E A K**

17:30-19:00

**SHORT PRESENTATIONS AND DISCUSSIONS**

**S03-MA-IA-04:**

**INFLUENCE OF THE TEMPERATURE ON PROTECTIVE COATINGS IN CUTTING AND FORMING PROCESSES**

**A. Cavaleiro**

Mechanical Engineering Department, University of Coimbra



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July 10,

TUESDAY MORNING

Session 04:  
Moderators:

**SURFACE INDUCED REACTIONS (INCLUDING Tribochemistry)**  
M. Scherge and A. Cavaleiro

09:30-10:30  
S04-TM-INV-04:

**TRIBOCHEMICAL REACTIONS IN THE GAS PHASE: EXPERIMENTAL  
MODELING**  
J.-M. Martin, M. I. de Barros Bouchet, and Th. Le Mogne  
Laboratory of Tribology and System Dynamics LTDS. Ecole Centrale de  
Lyon, 69131 Ecully, France

10:30-11:00  
S04-TM-IA-05:

**TRIBOLOGY OF BRAKING SYSTEMS**  
A. Mège-Revil  
Laboratoire de Mécanique de Lille – École Centrale de Lille, Lille, France

11:00-11:30  
11:30-12:00  
Session 05:  
Moderators

**C O F F E E B R E A K**  
**DISCUSSIONS CONTINUES**  
**TRIBOELECTROMAGNETIC PHENOMENA**  
M. Scherge and A. Cavaleiro

12:00-13:00  
S05-TM-INV-05:

**TRIBOLUMINESCENCE FROM THE RUBBING OF  
SOME POLYMERS**  
K. Hiratsuka  
Department of Mechanical Science and Engineering, Chiba Institute of  
Technology,  
2-17-1, Tsudanuma, Narashino, Chiba, 275-8588, Japan

13:00-14:00  
SHORT PRESENTATIONS AND DISCUSSIONS  
S05-TM-IA-06:

**CHARACTERISATION OF TRIBOLUMINESCENCE**  
R. A. Nevshupa  
CISDEM-CSIC, C/ Serrano Galvache 4, Madrid 28033, Spain

S05-TM-IA-07:  
14:00-15:00

(Withdrawn)  
LUNCH



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JULY 10

TUESDAY AFTERNOON

SESSION 06

Moderators:

16:00-17:00

S06-TA-INV-06:

TECHNICAL SESSION: NEW INSTRUMENTS AND METHODS

A. Igartua and J. A. García

PHENOMENA AFFECTING CONTACT VARIABLES IN MICRO AND  
NANOSCRATCH TESTS

M.A. Garrido, A. Rico, J. Rodríguez

Departamento de Tecnología Mecánica, Universidad Rey Juan Carlos.  
Tulipán s/n. 28933, Móstoles, Madrid, Spain

17:00-17:30

C O F F E E B R E A K

17:30-19:00

SHORT PRESENTATIONS AND DISCUSSIONS

S06-TA-IA-08:

(Withdrawn)

S06-TA-IA-09:

COMBINED DIAGNOSTICS OF TOPOLOGICAL, MECHANICAL, TRIBOLOGICAL  
AND ELECTRICAL PROPERTIES WITHING THE SINGLE CLOSED MEASURE  
MENT CYCLE

A. Useinov

Technological Institute for Superhard and Novel Carbon Materials. 7a  
Centralnaya str., Troitsk, 142190, Russia

S06-TA-IA-10:

EVALUATION OF COATINGS AND LUBRICANTS FOR UHV ENVIRONMENT

M. Conte<sup>1</sup>), E. Berriozabal<sup>1</sup>), A. Igartua<sup>1</sup>), R. A. Nevshupa<sup>2</sup>)

1) Fundacion Tekniker IK4 (Tribology Unit), Eibar, Spain. 2) CISDEM-CSIC,  
Madrid, Spain

20:00-21:30

Walking guided tour to the town : Meeting point: in front of PUERTA DE  
SAN VICENTE



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**JULY 11**

**WEDNESDAY MORNING**

**SESSION 07:**

**ADVANCED LUBRICATION: IONIC LIQUIDS**

**MODERATORS:**

**W. Liu and A. Useinov**

**09:30-10:30**

**S07-WM-INV-07:**

**TRIBOLOGICAL PERFORMANCE OF LUBRICANTS IN SIMULATED SPACE**

**W. Liu, F. Zhou**

**State Key Laboratory of Solid Lubrication, Lanzhou Institute of Chemical Physics,  
Chinese Academy of Sciences, Lanzhou 730000, China**

**10:30-11:00**

**S07-WM-IA-11:**

**SHORT PRESENTATION AND DISCUSSIONS**

**THE EFFECT OF GAS DESORPTION ON FRICTION IN ATMOSPHERE AND VACUUM**

**E.A. Deulin**

**Bauman Moscow State Technical University, MT-11, 2nd Baumanskaia st.,  
5, Moscow, 105005, Russia**

**S07-WM-IA-12 :**

**Surface Coverage of Stainless Steel with Water Molecules in Vacuum**

**L.N. Rozanov**

**Saint-Petersburg Polytechnical University, Polytechnicheskay Str. 29, Saint-Petersburg, Russia**

**11:00-11:30**

**C O F F E E B R E A K**

**11:30-12:00**

**Session 08:**

**Moderators**

**DISCUSSIONS CONTINUES**

**ADVANCED LUBRICATION: NANOMATERIALS**

**W. Liu and A. Useinov**

**12:00-13:00**

**S08-WM-INV-08:**

**TRIBOLOGICAL PERFORMANCE AND SURFACE INTERACTIONS OF NEW IONIC NANOFLUIDS AND NANOMATERIALS**

**M.D. Bermúdez, F.J. Carrión, A.E. Jiménez, J. Sanes, G. Martínez-Nicolás,  
C. Espejo, T. Espinosa, J. Arias, G. Ojados, N. González, M. Jiménez**

**Grupo de Ciencia de Materiales e Ingeniería Metalúrgica. Departamento de Ingeniería de Materiales y Fabricación. Universidad Politécnica de Cartagena. Campus de la Muralla del Mar, 30202 Cartagena, Spain**

**13:00-14:00**

**S08-WM-IA-13:**

**SHORT PRESENTATIONS AND DISCUSSIONS**

**TRIBOLOGY FOR MOTOR COMPONENTS**

**A. Igartua**

**Fundación Tekniker IK4, Eibar, Spain**

**14:00-15:00**

**LUNCH**



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**JULY 11**

**WEDNESDAY AFTERNOON**

**SESSION 09**

**TECHNICAL SESSION: MEASUREMENT AND RELATED PROBLEMS**

**Moderators:**

**J. Rodriguez and M. Conte**

**16:00-17:00**

**S09-WA-INV-09:**

**METROLOGICAL ASPECTS OF FORCE MEASURING IN CONTROLLED ENVIRONMENT: FIBRE OPTIC DISPLACEMENT SENSOR**

**M. Conteb, R. A. Nevshupaa**

**a CISDEM-CSIC, C/ Serrano Galvache 4, Madrid 28033, Spain. b Tekniker, Avda. Otaola 20, Eibar 20600, Spain**

**17:00-17:30**

**C O F F E E B R E A K**

**17:30-19:00**

**SHORT PRESENTATIONS AND DISCUSSIONS**

**S09-WA-IA-14:**

**UNCERTAINTIES IN HARDNESS MEASUREMENTS**

**J. L. de Segovia**

**Institute of Material Science of Madrid, CSIC, Madrid, Spain**

**S09-WA-IA-15: OUTGASSING OF STANDARD MASSES BY TRIBODESORPTION**

**J. Zůda, D. Pražák, L. Peksa**

**Institution: Czech Metrology Institute, Okružní 31, 63800 Brno, Czech Republic.**

**S09-WA-IA-16:**

**PROBLEMS BY USING VACUUM SYSTEMS PUMPED WITH DIFFUSION PUMPS IN PIN-ON-DISC MACHINES**

**M. Vite-Torres**

**Sección de Estudios de Posgrado e Investigación (SEPI), Escuela Superior de Ingeniería Mecánica y Eléctrica, Campus Zacatenco, Instituto Politécnico Nacional, Mexico.**



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JULY 12		THURSDAY MORNING
SESSION 10: MODERATORS: K 09:30-10:30 S10-ThM-INV-10:	ADVANCED MATERIALS AND HARD COATINGS FOR FRICTIONAL SURFACES . Hiratsuka and M.D. Bermudez	
	TRIBOLOGY OF CERAMIC MATERIALS IN DIFFERENT ENVIRONMENTS A. Kailer Fraunhofer-Institute for Mechanics of Material IWM, Freiburg, Germany	
10:30-11:00 S10-FM-IA-17: S10-FM-IA-18:	SHORT PRESENTATION AND DISCUSSIONS WIRHDROWN TRIBOLOGICAL CHARACTERIZATION OF TRANSITION METAL NITRIDE THIN FILMS UNDER HIGH VACUUM E. Berriozabal*, L. Mendizabal, M. Conte, A. Igartua, J. Barriga . IK4 Fundación Tekniker, Eibar, Spain	
11:00-11:30	COFFEE BREAK	
11:30-12:00 Session 11: Moderators: 12:00-13:00 S11-ThM-INV-11:	DISCUSSIONS CONTINUES GAS AD-DESORPTION DURING FRICTION: EXPERIMENT AND MODELING Th. Gradt and A. Mège-Reville  A MOLECULAR DYNAMICS SIMULATION OF MOMENTUM TRANSPORT IN A NANOSCALE LIQUID BRIDGE T. Tokumasua, M.-H. Meurisse b , N. Fillotb and Ph. Vergneb . a Institute of Fluid Science, Tohoku University, Sendai, Japan .b Université de Lyon, CNRS, INSA-Lyon, LaMCoS UMR5259, Villeurbanne, France	
13:00-14:00	SHORT PRESENTATIONS AND DISCUSSIONS	
S11-ThM-IA-19:	GAS EMISSION STIMULATED BY FRICTION: PHENOMENOLOGY AND APPLICATIONS R. A. Nevshupaa, E. Roman b, J.L. de Segovia b . a CISDEM-CSIC, C/ Serra no Galvache 4, Madrid 28033, Spain. b ICMC-CSIC, C/ Sor Juana Inés de la Cruz 3, Madrid 28049, Spain	
S11-ThM-IA-20:	DIAMOND-LIKE-CARBON COATINGS WITH LOW WEAR UNDER HIGH HUMIDITY ENVIRONMENT D. Canoa, L. Martinez de Olcoza, J. Estevea, A. Lousaa, C. Colominasb and F. Muntalàc a) Universitat de Barcelona, Martí I Franquès 1, Barcelona 08028, Spain b) Institut Químic de Sarrià, Universitat Ramón Llull, Barcelona 08017, Spain. c) FLUBETECH, S.L. IPCT, Ctra. N-150, Km 14,5 , Terrassa 08227, Spain	
14:00-15:00	LUNCH	



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JULY 12

THURSDAY AFTERNOON

SESSION 12

TRIBOLOGICAL PROBLEMS RELATED TO BIOLOGICAL APPLICATIONS

Moderators:

A. Kailer and L. N. Rozanov

16:00-17:00

S12-ThA-INV-12:

FRICTION AND WEAR IN SBF FOR BIOMEDICAL APPLICATIONS

J.A. García, J. Rodrigo, R. Rodríguez , J. Díaz , G. G. Fuentes

AIN Centro de Ingeniería Avanzada de Superficies, Cordovilla-Pamplona,  
Spain

17:00-17:30

C O F F E E B R E A K

17:30-18:00

SHORT PRESENTATIONS AND DISCUSSIONS

18:00-19:00

SUMMARY OF THE WS-66, CONCLUSIONS AND FINAL REMARKS

A. Kailer, R. Nevshupa and J. L. de Segovia

21:00-23:30

WORKSHOP DINNER (Hotel Reina Isabel)



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# CONCLUSIONS





IUVSTA-ASEVA WORKSHOP PROGRAMME-2012  
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## HIGHLIGHTS OF THE WORKSHOP

Nanotribology: was an interesting topic with many discussions including the following :

- Fundamental mechanisms of friction related with atomic corrugation of solids and electronic interaction between mating surfaces
- Conditions for frictionless sliding
- Effect of temperature on atomic-scale friction

Tribochemistry: This topic was the central one on the workshop and was discussed in several sessions including microtribology, surface induced reactions, and gas ad- desorption at friction:

- Tribomutation on contact surfaces of engine components
- Tribochemistry of carbon materials (soot, diamond-like coatings)
- Effect of plastic deformation on chemical activity of solids
- Surface chemical modification for super-low friction and wear in vacuum

Advanced Lubrication and Ionic Nanofluids were the point of exciting due to the importance for high and low temperature applications and for space tribology. The topics of special interest were:

- Low-corrosive ionic liquids for space applications
- Advanced solid lubricants for pumps of liquid O<sub>2</sub> and H<sub>2</sub>, and superconducting cables
- Combination of low toxic ionic liquids with nanomaterials (graphene, diamond-like carbon, carbon nanotubes, etc.) for advance lubrication of polymers



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## **HIGHLIGHTS OF THE WORKSHOP**

**Tribology of new ceramic materials. Very interesting discussion was centered on wear reduction of oxide ceramics in aqueous solutions under applied electric potential – the phenomenon not yet well understood. Another topic was related with the damage mechanisms of ceramics under dry friction and high temperatures.**

**The Technical sessions were really very interesting with discussion on:**

**Influence of temperature in cutting and forming tools**

**Temperature in breaking systems**

**New experimental techniques for material characterisation based on tribodesorption of gases**

**Uncertainties in measurements and influence on standard masses**



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**Acknowledgement to IUVSTA:** All participant agreed to comment and transmit To IUVSTA the excellent WS programmes in witch promoting of workshops in the frontier of science, as this workshop has been, are of high impact in Science and Technology



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# LIST OF PARTICIPANTS



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**Fiancial Report of the IUVSTA WS-66**

<b>Fiancial Report of the IUVSTA WS-66</b>				
<b>1. PARTICIPATION</b>				
1.2	Numer of invited speakers	12		
1.3	Espected number of participants	17		
<b>1.</b>	<b>Expenses</b>			<b>invited speakers</b>
(1.1).	Acomodación	9.450,00		3.024,00
(1.2).	Coffe breaks	2.300,00		725,76
(1.3).	Meals	3.472,00		1.344,00
(1.4).	Social events	2.418,00		936,00
(1.5).	Travel expenses	0,00		0,00
			<b>17.640,00</b>	<b>6.029,76</b>
<b>2.</b>	<b>Overhead</b>			
(2.1).	Secretaria	1.200,00		
(2.2).	Imprenta, Programas etc.	300,00		
(2.3).	Correo y telefonía	100,00		
(2.4).	Documentación	500,00		
(2.6).	Gastos Chairmen	500,00		
			<b>2.600,00</b>	
	Total expenses		<b>20.240,00 €</b>	
	Income			
	Registration feees	12.750,00		
	Expected IUVSTA support	6.000,00		<b>6.000,00</b>
	ASEVA support	1.490,00		
	<b>Total income</b>		<b>20.240,00 €</b>	