

Organized by

Leibniz University of Hannover

University of Latvia



**MEP 2014 - International Scientific Colloquium
Modelling for Electromagnetic Processing**

The organizers gratefully acknowledge the sponsorship and financial support received from the following institutions and organizations:

Sponsored by:

Center of Process Analysis and Research GmbH, Riga, Latvia

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International Union for Electricity Application (UIE)

Fluxtrol Inc., Auburn Hills, MI, USA

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Vereinigung zur Förderung des
Instituts für Elektrowärme
der Universität Hannover e.V.



International Scientific Colloquium

Modelling for Electromagnetic Processing

Hannover, September 16 - 19, 2014

Programme

**MEP 2014 - International Scientific Colloquium
Modelling for Electromagnetic Processing**

USEFUL INFORMATION

LOCATION

The Colloquium events will take place in the following locations:

September 16, Tuesday

- **Registration / Welcome Reception** at Leibnizhaus, Holzmarkt 4-6, 30159 Hannover

September 17, Wednesday

- **Late Registration** at Leibnizhaus, Holzmarkt 4-6, 30159 Hannover
- **Colloquium** at Leibnizhaus, Holzmarkt 4-6, 30159 Hannover
- **Dinner** at Restaurant "Festscheune auf Meyers Hof" Zoo Hannover, Adenauerallee 3, 30159 Hannover

September 18, Thursday

- **Colloquium** at Leibnizhaus, Holzmarkt 4-6, 30159 Hannover
- **Citytour of Hannover** Meeting at Leibnizhaus, Holzmarkt 4-6, 30159 Hannover
(Transportation by bus in Hannover)

September 19, Friday

- **Colloquium** at Leibnizhaus, Holzmarkt 4-6, 30159 Hannover

COLLOQUIUM LANGUAGE

English will be the official language of the Colloquium.

**MEP 2014 - International Scientific Colloquium
Modelling for Electromagnetic Processing**

REFERENCE ADDRESS AND TELEPHONE NUMBERS

Address

Institut für Elektroprozessstechnik
Wilhelm-Busch-Str. 4, 30167 Hannover

Telephone Numbers

Secretariat	+49 (0) 5 11 / 7 62 – 28 72
Prof. B. Nacke	+49 (0) 5 11 / 7 62 – 55 33
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Prof. E. Baake	+49 (0) 5 11 / 7 62 – 32 48
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REGISTRATION

Registration of participants will take place on Tuesday, September 16, at Leibnizhaus, Holzmarkt 4-6, 30159 Hannover, between 17.00 and 21.00. Late registration can be done on Wednesday, September 17, at Leibnizhaus between 8.30 and 9.00.

WELCOME RECEPTION

All participants and registered accompanying persons are invited to the Welcome Reception which will take place on Tuesday, September 16, at Leibnizhaus, Holzmarkt 4-6, 30159 Hannover, between 17.00 and 21.00.

DINNER

All participants and registered accompanying persons are invited to the Colloquium Dinner which will take place on Wednesday, 17 September, at the Restaurant "Festscheune auf Meyers Hof", Zoo Hannover, Adenauerallee 3, 30159 Hannover. The dinner starts at 19.30.

Time Schedule

Tuesday September 16	Wednesday September 17	Thursday September 18	Friday September 19
	8.30 - 9.00 Late Registration		
	9.00 - 10.30 Opening Session	9.00 - 10.20 Oral Session 4 Induction Heating I	9.00 - 10.20 Oral Session 8 Induction Heating II
	10.30 - 11.00 <i>Coffee Break</i>	10.20 - 10.50 <i>Coffee Break</i>	10.20 - 10.50 <i>Coffee Break</i>
	11.00 - 12.40 Oral Session 1 Induction Heat Treatment	10.50 - 12.50 Oral Session 5 Microwave Heating	10.50 - 12.50 Oral Session 9 Material Processing
	12.40 - 13.40 <i>Lunch</i>	12.50 - 13.50 <i>Lunch</i>	12.50 - 13.15 Closing Session
	13.40 - 15.20 Oral Session 2 Magnetohydrodynamic I	13.50 - 15.10 Oral Session 6 Induction Melting	13.15 - 14.15 <i>Lunch</i>
	15.20 - 15.50 <i>Coffee Break</i>	15.10 - 15.40 <i>Coffee Break</i>	
	15.50 - 17.30 Oral Session 3 Crystal Growth	15.40 - 17.20 Oral Session 7 Magnetohydrodynamic II	
17.00 - 21.00 Registration and Welcome Reception (*)		17.20 - 18.00 Poster Session	
	19.30 - Dinner (**)	18.15 - 19.45 <i>Start Sightseeing Tour Hannover</i> (***)	

(*) at Leibnizhaus, Holzmarkt 4-6, 30159 Hannover

(**) at Restaurant "Festscheune auf Meyers Hof", Zoo Hannover, Adenauerallee 3, Hannover

(***) Meeting at Leibnizhaus, Holzmarkt 4-6, 30159 Hannover

Wednesday September 17

Opening Session

September 17, 2014 (Wednesday)

09.00 – 10.30

Opening

Prof. B. Nacke, *Leibniz University of Hannover (Germany)*

Welcome address

Prof. E. Barke, President, *Leibniz University of Hannover (Germany)*

Organisation information

Prof. E. Baake, *Leibniz University of Hannover (Germany)*

Practical use of numerical modeling in the induction heating business

L. Markegård, J. I. Asperheim, *EFD Induction AS (Norway)*

The importance of CFD to metallurgical processes from an industrial point of view

H.-J. Odenthal, *SMS Siemag AG (Germany)*

10.30 - 11.00 **Coffee Break**

Oral Session 1 – Induction Heat Treatment

September 17, 2014 (Wednesday)

11.00 – 12.40

Chairman: Prof. S. Lupi, *University of Padua (Italy)*

1.1 Analysis of coupled electromagnetic and temperature fields in contour induction hardening system for gear wheels

J. Barglik, A. Smagór, A. Smalcerz

Silesian University of Technology (Poland)

1.2 Virtual prototyping of an induction heat treatment of an axle shaft

R. Goldstein*, J. Jackowski*, V. Nemkov*, Z. Li**, B. L. Ferguson**, G. Fett***

Fluxtrol Inc. (USA)*, *DANTE Solutions, Inc. (USA)*, ****Dana Cooperation (USA)*

1.3 Induction heat treatment of automotive components with advanced coil design

A. Ulferts, F. Andrea
Inductoheat Europe GmbH (Germany)

1.4 Experimental validation of numerical model of contour induction hardening

M. Spezzapria, M. Forzan, F. Dughiero
University of Padua (Italy)

1.5 Numerical 3D modelling and verification of inductive surface hardening processes for large bearings

D. Schlesselmann*, A. Nikanorov*, H. Stiele**, B. Nacke*
**Leibniz University of Hannover (Germany), **EFD Induction GmbH (Germany)*

12.40 - 13.40 **Lunch**

Oral Session 2 – Magnetohydrodynamic I

September 17, 2014 (Wednesday)

13.40 – 15.20

Chairman: Prof. A. Jakovics, University of Latvia (*Latvia*)

2.1 Thermo-electric effects on electroconducting particles in liquid metal

E. Humbert*, J. Wang*, O. Budenkova*, ZM. Ren**, Y. Fautrelle*
**SIMaP/EPM Grenoble (France), **Shanghai University (P. R. China)*

2.2 Oscillating and average AC force effects in liquid metal

V. Bojarevics, K. Pericleous, G. Djambazov, B. Lebon
University of Greenwich (UK)

2.3 Liquid metals mixing with permanent magnetic system impact

O. Ben-David, A. Levy, B. Mikhailovich
Ben-Gurion University of the Negev, Beer-Sheva (Israel)

2.4 Numerical modelling of MHD liquid metal 83 Pb-17Li and heat transfer in rectangular duct

Z. Tigrine, F. Mokhtari, A. Bouabdallah, A. Lallaoua
University of USTHB Algiers (Algeria)

2.5 Experimental neutron radiography visualization of dynamics of solid inclusions in liquid metal

M. Ščepanskis*, M. Sarma*, R. Nikoluškins*, K. Thomsen**, A. Jakovičs*, P. Vontobel**, T. Beinerts*, A. Bojarevičs*, E. Platacis*
**University of Latvia (Latvia), **Paul Scherrer Institute (Switzerland)*

15.20 - 15.50 **Coffee Break**

Oral Session 3 – Crystal Growth

September 17, 2014 (Wednesday)

15.50 – 17.30

Chairman: Dr. J. Virbulis, University of Latvia (*Latvia*)

3.1 Experimental results in industrial environment of the i-DSS furnace

F. Dughiero, M. Forzan, C. Pozza, A. Tolomio
University of Padua (Italy)

3.2 Enhanced VGF-GaAs and DS-Si growth using pulsed down-outward TMF

N. Dropka, Ch. Frank-Rotsch
Leibniz-Institute for Crystal Growth Berlin (Germany)

3.3 Transient 2D modeling of Czochralski crystal growth process

A. Sabanskis, K. Bergfeldts, J. Virbulis
University of Latvia (Latvia)

3.4 Pressure field analysis in CZ crystal growth without and with magnetic field

F. Mokhtari, A. Merah, A. Bouabdallah
University of USTHB Algiers (Algeria)

3.5 3D modelling of dopant transport in gas and melt during floating zone growth of silicon

A. Sabanskis, K. Surovovs, A. Krauze, J. Virbulis
University of Latvia (Latvia)

19.30 **Dinner at Restaurant “Festscheune auf Meyers Hof”**

Zoo Hannover, Adenauerallee 3, 30159 Hannover

Thursday September 18

Oral Session 4 – Induction Heating I

September 18, 2014 (Thursday)

09.00 – 10.20

Chairman: Prof. J. Barglik, *Silesian University of Technology (Poland)*

- 4.1 Comparison of different induction heating approaches for hot strip mills in endless operation by using numerical simulation**
M. Langejürgen, R. Jürgens
SMS Elotherm (Germany)
- 4.2 Simulation of induction heating of slabs using ELTA 6.0**
V. Nemkov*, V. Bukanin**, A. Zenkov**, A. Ivanov**
**Fluxtrol, Inc. (USA), **St. Petersburg State Electrotechnical University (Russian Federation)*
- 4.3 Optimisation of an induction heating device in forging industry to improve energy efficiency**
B. Paya*, R. Thomas**, T. Ameye**
**EDF (France), **CETIM (France)*
- 4.4 Multi-objective optimization as an innovative method to design induction heaters**
Yu. Pleshivtseva*, P. Di Barba**, E. Rapoport*, B. Nacke***, A. Nikanorov***, M. Forzan****, S. Lupi****, E. Sieni****
Samara State Technical University (Russian Federation), **University of Pavia (Italy), *Leibniz University of Hannover (Germany), ****University of Padua (Italy)*

10.20 - 10.50 **Coffee Break**

Oral Session 5 – Microwave Heating

September 18, 2014 (Thursday)

10.50 – 12.50

Chairman: Prof. F. Dughiero, *University of Padua (Italy)*

- 5.1 Numerical simulation of microwave assisted combustion synthesis of intermetallics**
P. Veronesi, E. Colombini, R. Rosa, C. Leonelli
University of Modena and Reggio Emilia (Italy)

- 5.2 Simulation of microwave assisted ion exchange in glass**

H. S. Park, A. Rosin, M. Willert-Porada
University of Bayreuth (Germany)

- 5.3 Gap of theoretical prediction and experimental behavior in the microwave heating of liquid**

T. Sumi*, R. Dillert**, S. Horikoshi*
**Sophia University Tokyo (Japan), **Leibniz University of Hannover (Germany)*

- 5.4 A novel temperature control approach of distributed microwave feeding systems**

Y. Sun, T. Kuehner, G. Link, T. Kayser, J. Jelonnek
Karlsruhe Institute of Technology (Germany)

- 5.5 A coupled drying and thermoelastic model of fast microwave heating of concrete**

B. Lepers, G. Link, J. Jelonnek
Karlsruhe Institute of Technology (Germany)

- 5.6 The importance of virtual experimentation in the design of industrial microwave heating systems**

B. Vila
Fricke und Mallah Microwave Technology GmbH (Germany)

12.50 - 13.50 **Lunch**

Oral Session 6 – Induction Melting

September 18, 2014 (Thursday)

13.50 – 15.10

Chairman: Dr. V. Bojarevic, *University of Greenwich (UK)*

- 6.1 Using numerical simulation to optimize the external magnet system needed to improve the residence time distribution of glass melting tanks**

U. Lüdtke, S. Soubeih, B. Halbedel
Technical University Ilmenau (Germany)

- 6.2 The droplet evolution trend in ESR process by superimposing a transverse static magnetic field**

H. Wang, Y. B. Zhong, Q. Li, Y. P. Fang
Shanghai University (P. R. China)

6.3 Cold crucible vitrification process: numerical simulation of pouring of molten glass elaborated in CCIM

E. Sauvage*, P. Brun*, M. Lima-Da-Silva*, J. Lacombe*, Y. Fautrelle**, A. Gagnoud**

*Waste Confinement and Vitrification Commissariat à L'Energie Atomique (France), **SIMaP/EPM Grenoble (France)

6.4 Coupled 3D simulation of free surface dynamics and liquid metal flow in EM levitation melting furnaces

S. Spitans*, E. Baake*, B. Nacke*, A. Jakovics**

*Leibniz University of Hannover (Germany), **University of Latvia (Latvia)

15.10 – 15.40 **Coffee Break**

Oral Session 7 – Magnetohydrodynamic II

September 18, 2014 (Thursday)

15.40 – 17.20

Chairman: Prof. Y. Fautrelle, SIMaP/EPM Grenoble (France)

7.1 Melt pool deformation by magnetic pressure: Analytical and experimental approach

S.T. Mirhoseini, K. Van Reusel, J. Driesen
KU Leuven (Belgium)

7.2 Thermoelectricity driven liquid metal flow for high power density cooling applications

A. Bojarevics, I. Kaldre
University of Latvia, Salaspils (Latvia)

7.3 Experimental flow rate control in liquid metals by electromagnetic force

N. Dubovikova, Ch. Karcher, Y. Kolesnikov
Technical University Ilmenau (Germany)

7.4 Induction pump for liquid sodium

R. Khalilov, I. Kolesnichenko, P. Frick
Institute of continuous media mechanics UB RAS (Russian Federation)

7.5 Frequency dependence of an alternating magnetic field driven flow

A. Cramer, V. Galindo
Helmholtz Center Dresden-Rossendorf (Germany)

Poster Session

September 18, 2014 (Thursday)

17.20 – 18.00

P01 Modelling of the mould filling process in the presence of an electromagnetic field

J. Barglik, S. Golak
Silesian University of Technology (Poland)

P02 Efficiency optimization of a multi source microwave oven: Multiphysics analysis and experimental validation

F. Bressan*, M. Bullo*, D. Desideri*, F. Dughiero*, N. Lanza**, A. Maschio*
*University of Padua (Italy), **Inovalab srl (Italy)

P03 Practice of computer-assisted design of induction installations

V. Vologdin*, Vl. Vologdin, Jr.*, V. Bukanin**, A. Ivanov**
*FREAL Ltd. (Russian Federation), **St. Petersburg State Electrotechnical University (Russian Federation)

P04 Electrical resistivity of a billet in a longitudinal levitator: An identification method

P. Di Barba*, F. Dughiero**, M. Forzan**, E. Sieni**
*University of Pavia (Italy), **University of Padua (Italy)

P05 Small-size permanent magnet system for contactless local velocity measurement in liquid metals

D. Hernández, Ch. Karcher, A. Thess
Technical University Ilmenau (Germany)

P06 Transfer of the magnetic field by a conducting flow of liquid sodium through a toroidal channel

R. Khalilov*, I. Kolesnichenko*, R. Stepanov**
*Institute of Continuous Media Mechanics UB RAS (Russian Federation), **Perm National Research Polytechnic University (Russian Federation)

P07 Mathematical modeling of casting processes in electromagnetic field

A. Minakov*, M. Khatsauk*, V. Demidovich**, M. Pervuhin*
*Siberian Federal University, **St. Petersburg Electrotechnical University (Russian Federation)

P08 Electro-deposition of ZnTe semi-conductor on various substrates and effect of intense magnetic field imposition

T. Kozuka, S. Asai, M. Kawahara
Kumamoto University (Japan)

- P09 Optimization of technology of natural material destruction in the course of electrohydropulse drilling**
K. Kusaiynov, N.N. Shuyushbaeva, K.M. Turdybekov, B.A. Ahmadiev
E.A. Buketov Karaganda State University (Kazakhstan)
- P10 Computational study of magnetohydrodynamic instability in liquid metal Taylor-Couette flow**
A. Merah, F. Mokhtari, A. Bouabdallah
University Mouloud Maameri de Tizi Ouzou, Algiers (Algeria)
- P11 Breaking the diffraction barrier in three dimensions by 3D diffractive optics**
I. Minin, O. Minin
Siberian State Academy of Geodesy Novosibirsk (Russian Federation)
- P12 Numerical modelling of melt circulation in industrial-size furnaces with power supply by inductor and over electrodes**
S. Pavlovs*, A. Jakovics*, E. Baake**, B. Nacke**, V. Sushkovs*
**University of Latvia (Latvia), **Leibniz University of Hannover (Germany)*
- P13 Modeling of nonlinear processes of electro-pulse processing of technogenic raw materials**
S. Sakipova
E.A. Buketov Karaganda State University (Kazakhstan)
- P14 Temperature dynamics of permittivity of concrete: Implementation for microwave ablation**
S. Soldatov, M. Umminger, A. Heinzl, T. Kayser, G. Link, T. Seitz, S. Layer, J. Jelonnek
Karlsruhe Institute of Technology (Germany)
- P15 Evaluation of concrete solar still with and without energy storage for water desalination**
Z. Tigrine, H. ABurideh, D. Zioui, D. Belhout, S. Hout, Z. Belgroun, R. Bellatreche, M. Abbas, N. Kasbadji Merzouk
UDES /UDER Bou Ismail (Algeria)
- P16 Modelling of a continuous flow reactor for metallic nanoparticles synthesis**
P. Veronesi, E. Colombini, R. Rosa, C. Leonelli
University of Modena and Reggio Emilia (Italy)
- P17 Metal structures influence on electric parameters of current lead of electrotechnological installations**
D. S. Vlasov, A. I. Aliferov, R. A. Bikeev, A. N. Dobrov, V. A. Serikov
Novosibirsk State Technical University (Russian Federation)

- P18 Development of a heating sequence for a new Resource Efficient Forging process Chain - REForCh - with 2D and 3D FEM numerical simulation**
S. Wipprecht, E. Baake
Leibniz University of Hannover (Germany)
- P19 Influence of low-frequency pulsed force of electromagnetic field on the temperature field mixing of the melt in induction crucible furnace**
D. Musaeva*, V. Ilin*, E. Baake**, V. Geza**
*Kazan State Power Engineering University (Russian Federation), **Leibniz University of Hannover (Germany)*
- P20 Multi rotors permanent magnet heater for controlling temperature distribution in aluminum billets**
F. Dughiero*, M. Forzan*, C. Pozza*, M. Zerbetto**
**University of Padua (Italy), **InovaLab srl (Italy)*
- P21 Research and optimization of single-shot coils applied at rotating workpieces**
S. Schubotz
EFD Induction GmbH (Germany)
- P22 Anisotropy of flow and transition between mixing regimes in physical model of directional solidification**
V. Geza*, B. Nacke*, E. Baake*, A. Jakovics**
**Leibniz University of Hannover (Germany), **University of Latvia (Latvia)*
- P23 Dynamic of electromagnetic and thermal processes in the induction systems for strip and slab heating**
K. Blinov*, A. Nikanorov**, B. Nacke**
**St. Petersburg Electrotechnical University (Russian Federation), **Leibniz University of Hannover (Germany)*
- P24 Application of numerical techniques for optimal design of induction heaters**
S. Galunin, Yu. Blinov
St. Petersburg Electrotechnical University (Russian Federation)
- P25 Numerical simulation and investigation of high frequency tube welding process**
A. Nikanorov*, E. Baake*, H. Brauer**, Ch. Weil**
**Leibniz University of Hannover (Germany), **Salzgitter Mannesmann Line Pipe GmbH (Germany)*

- P26 Development and test of an induction heater for temperature cycling of SINQ spallation target's zirconium alloy-lead rods**
V. Geza*, S. Dementjevs**, F. Barbagallo**, M. Donerblics***, S. Joray**
Leibniz University of Hannover (Germany), **Paul Scherrer Institute (Switzerland), *Ventspils University College*
- P27 Analysis of the interaction of arbitrary shaped electromagnetic impulse with the substance using spectral method**
V. Goncharov*, K. Sorokin*, E. Fiskin***, D. Samsonov**, P. Konovalov***
St. Petersburg Electrotechnical University (Russian Federation), **IOFFE Physical Technical Institute (Russian Federation) * Irkutsk State Technical University (Russian Federation),*
- P28 Numerical model for Si single crystal growth by the Si granular crucible method**
R. Menzel, H. Riemann, N. Abrosimov
Leibniz-Institute for Crystal Growth Berlin (Germany)
- P29 3D simulation of feed rod and melt shapes in floating zone silicon crystal growth**
M. Plāte, A. Krauze, J. Virbulis
University of Latvia (Latvia)
- P30 Hydrodynamic of the melt on the base of aluminum oxide in cold crucible at continuous melting and discharging**
V. Geza*, V. Kichigin*, B. Nacke*, I. Poznyak**
**Leibniz University Hannover, **St.Petersburg State Electrotechnical University (Russian Federation)*
- P31 Power losses in cold crucible furnace with different segments shape**
I. Poznyak*, J. Kozeny**, D. Rot**, S. Jirinec**, M. Kresina**
**Research Centre Rez (Czech Republic), **UWB in Pilsen, Czech Republic*

18.15 – 19.45 **Sightseeing Tour of Hannover** by bus
Meeting at Leibnizhaus, Holzmarkt 4-6, 30159 Hannover

Friday September 19

Oral Session 8 – Induction Heating II

September 19, 2014 (Friday)

09.00 – 10.20

Chairman: Prof. F. Bay, *Mines ParisTech (France)*

- 8.1 Numerical design of high power density induction equipments**
A. Walther, A. Umbrasko
ABP Induction Systems GmbH (Germany)
- 8.2 Permanent magnet heater for aluminium strips continuous annealing lines**
F. Dughiero, M. Forzan, C. Pozza, N. Sempredoni
University of Padua (Italy)
- 8.3 Modelling and simulation of multi-frequency induction hardening of steel parts**
T. Petzold, D. Hömberg
Weierstrass Institute for Applied Analysis and Stochastics Berlin (Germany)
- 8.4 Numerical and experimental investigations of induction assisted GMA-Laser hybrid welding**
P. Schaumann*, M. Collmann*, H. Schülbe*, J. Neumeyer**, B. Nacke*, R. Lahdo***, O. Seffer***, A. Springer***, S. Kaierle***
Leibniz University of Hannover (Germany), **CADFEM GmbH (Germany), *Laser Center Hannover (Germany)*

10.20 – 10.50 **Coffee Break**

Oral Session 9 – Material Processing

September 19, 2014 (Friday)

10.50 – 12.50

Chairman: Prof. Yu. Pleshivtseva, *Samara State Technical University (Russian Federation)*

- 9.1 Computational modelling for electromagnetic forming processes**
F. Bay, J. Alves Zapata
MINES ParisTech (France)

9.2 Influence of an EM field on changes in microstructure of bearing Steel

I. Kaldre*, M. Scepanskis*, A. Jakovics*, J. Maniks*, B. Nacke**, W. Holweger***

*University of Latvia (Latvia), ** Leibniz University of Hannover (Germany), ***Schaeffler Technologies GmbH & Co. KG (Germany)

9.3 3D integral method for electromagnetic processes modelling

R. Scapolan, A. Gagnoud, Y. Du Terrail

SIMaP/EPM Grenoble (France)

9.4 Electric impulse technology of producing of ultradispersive material coatings

V. Goncharov*, D. Samsonov**, E. Fiskin***, S. Kahinin*

*St. Petersburg Electrotechnical University (Russian Federation),

**IOFFE Physical Technical Institute (Russian Federation),

***Irkutsk State Technical University (Russian Federation)

9.5 Increasing the competitive capacity of SME's by designing a new energy efficient Forging Process Chain

B.-A. Behrens*, T. Rütter*, J. Langner*, M. Stonis*, G. Güzey**

*IPH – Institut für Integrierte Produktion Hannover gGmbH (Germany),

**Omtas Otomotiv Transmisyon Aksami San. ve Tic. A.S., (Turkey)

9.6 Electro-pulse processing metal containing raw materials for extraction of valuable components

K. Kussaiynov, S. Sakipova, B. Nussupbekov, A. Khassenov, K. Akhmerova

E.A. Buketov Karaganda State University (Kazakhstan)

Closing Session

September 19, 2014 (Friday)

12.50 – 13.15

13.15 – 14.15 **Lunch**