

Organized by

Leibniz University of Hannover

University of Latvia



International Scientific Colloquium

Modelling for Electromagnetic Processing

Hannover, October 26 - 29, 2008

Programme

MEP 2008 - International Scientific Colloquium Modelling for Electromagnetic Processing

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Sponsored by:

Center of Process Analysis and Research GmbH, Riga, Latvia

Freundeskreis der Leibniz Universität Hannover e.V.

COST Action P17 EPM

Vereinigung zur Förderung des Instituts für Elektrowärme e. V., Hannover



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



**MEP 2008 - International Scientific Colloquium
Modelling for Electromagnetic Processing**

USEFUL INFORMATION

LOCATION

The Colloquium events will take place in the following locations:

October 26, Sunday

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

October 27, Monday

- **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

October 28, Tuesday

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

October 29, Wednesday

- **Colloquium** At Leibnizhaus, Holzmarkt 4-6, 30159 Hannover
- **Sightseeing of Celle** Meeting at Leibnizhaus, Holzmarkt 4-6, 30159 Hannover
(Transportation by bus to Celle)

COLLOQUIUM LANGUAGE

English will be the official language of the Colloquium.

**MEP 2008 - International Scientific Colloquium
Modelling for Electromagnetic Processing**

REFERENCE ADDRESS AND TELEPHONE NUMBERS

Address

Institut für Elektroprozessentechnik
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
	+49 (0) 1 70 / 9 65 83 25
Registration Office	+49 (0) 5 11 / 32 42 28

REGISTRATION

Registration of participants will take place on Sunday, October 26, at Leibnizhaus, Holzmarkt 4-6, 30159 Hannover, between 17.00 and 21.00. Late registration can be done on Monday, October 27, at Leibnizhaus between 8.30 and 9.00.

WELCOME RECEPTION

All participants and registered accompanying persons are invited to the welcome cocktail party which will take place on Sunday, October 26, 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 Monday, 27 October, at the restaurant “Festscheune auf Meyers Hof” Zoo Hannover, Adenauerallee 3, 30159 Hannover. The Dinner starts at 19.30.

Time Schedule

Hannover Sunday, Oct. 26	Hannover Monday, Oct. 27	Hannover Tuesday, Oct. 28	Hannover Wednesday, Oct. 29
	8.30 - 9.00 Late Registration		
	9.00 - 10.30 <u>Opening Session</u>	9.00 - 10.20 <u>Oral Session 4</u> Hardening	9.00 - 10.20 <u>Oral Session 8</u> Optimisation & Control
	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 <u>Oral Session 1</u> Melting I	10.50 - 12.30 <u>Oral Session 5</u> Melting II	10.50 - 12.50 <u>Oral Session 9</u> Material Processing
	12.40 - 13.40 <i>Lunch</i>	12.30 - 13.30 <i>Lunch</i>	12.50 - 13.15 <u>Closing Session</u>
	13.40 - 15.20 <u>Oral Session 2</u> Heating	13.30 - 15.10 <u>Oral Session 6</u> Solidification Processes	13.15 - 14.15 <i>Lunch</i>
	15.20 - 15.50 <i>Coffee Break</i>	15.10 - 15.40 <i>Coffee Break</i>	14.15 - 20.00 <i>Start Sightseeing Tour to Celle (incl. Restaurant) (***)</i>
	15.50 - 17.30 <u>Oral Session 3</u> Crystal Growth	15.40 - 17.00 <u>Oral Session 7</u> Induction assisted Laser Technologies	
17.00 - 21.00 Registration and Welcome Reception (*)		17.00 - 18.00 <u>Poster Session</u>	
	19.30 - <i>Dinner</i> (**)		
			20.00 - End in Hannover

N.B. (*) 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

**MEP 2008 - International Scientific Colloquium
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PROGRAMME

Opening Session

October 27, 2008 (Monday)

09.00 – 10.30

Opening

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

Welcome Address

Prof. J. Osten, Dean of the Faculty of Electrical Engineering and Computer Science,
Leibniz University of Hannover (Germany)

Organisation Information

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

**State of the Art of Numerical Modelling for Electromagnetic Processing of
Metallic Material**

Prof. D. Lavers, *University of Toronto (Canada)*

**Numerical Simulation – an Important Tool for Processing of Bulk
Semiconductor Crystals**

Dr. A. Seidl, *Wacker-Schott Solar AG (Germany)*

10.30-11.00 **Coffee Break**

Oral Session 1 – Melting I (COST Action P17)

October 27, 2008 (Monday)

11.00 – 12.40

Chairman: Prof. Y. Fautrelle, *EPM-Madylam, CNRS (France)*

1.1 Theory and Numerical Simulations of the Lorentz Force Flowmeter

A. Thess*, E. Votyakov*, B. Knaepen**, O. Zikanov***

Technical University Ilmenau (Germany), ** Université Libre de Bruxelles (Belgium), * University of Michigan – Dearborn (USA)*

**1.2 High Powered Induction Crucible Furnaces/
Experience with 16 MW Installations**

W. Andree

ABP Induction System (Germany)

1.3 Vacuum Arc Remelting Time Dependent Modeling

V. Bojarevics, G. Djambazov, K. Pericleous

University of Greenwich (United Kingdom)

1.4 Mathematical Modeling of the Flow Field, Temperature Distribution, Melting and Solidification in the Electroslag Remelting Process

A. Rückert, H. Pfeifer

RWTH Aachen University (Germany)

1.5 Numerical Simulation of Mass and Heat Transport in Induction Channel Furnaces

M. Langejürgen*, M. Kirpo**, A. Jakovics**, E. Baake*

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

12.40 – 13.40 **Lunch**

Oral Session 2 – Heating

October 27, 2008 (Monday)

13.40 – 15.20

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

2.1 Characteristics of Installations for the Direct Resistance Heating of Ferromagnetic Bars of Square Cross-section

S. Lupi*, M. Forzan*, A. Aliferov**

**University of Padua (Italy), **Electrotechnological Installations Novosibirsk State Technical University (Russia)*

2.2 An Optimal Method for 3-D Numerical Simulation of Electromagnetic Induction Heating Processes

N. El-Kaddah*, T. Natarajan**

**University of Alabama (USA), **United States Steel Corporation Research and Technology Center (USA)*

2.3 Numerical Analysis of Coupled Physics for Induction Heating of Movable Workpieces

S. Galunin*, M. Zlobina*, K. Blinov*, A. Nikanorov**, T. Zedler**, B. Nacke**

**St. Petersburg Electrotechnical University (Russia), *Leibniz University of Hannover (Germany)*

2.4 Shielding of EM Fields in Induction Heating and Melting Installations

F. Dughiero, M. Forzan, C. Greggio

University of Padua (Italy)

2.5 Aluheat – A Superconducting Approach of Aluminium Billet Heater

A. Ulferts, B. Nacke

Leibniz University of Hannover (Germany)

15.20-15.50 **Coffee Break**

Oral Session 3 – Crystal Growth (COST Action P17)

October 27, 2008 (Monday)

15.50 – 17.30

Chairman: Dr. A. Seidl, *Wacker-Schott Solar AG (Germany)*

3.1 Chrystal Growth in Heater-Magnet Modules – from Concept to Use

P. Rudolph*, Ch. Frank-Rotsch*, F.-M. Kiessling*, W. Miller*, U. Rehse*, O. Klein**, Ch. Lechner**, J. Sprekels**, B. Nacke***, H. Kasjanow***, P. Lange*, M. Ziem*, B. Lux*, M. Czupalla*, O. Root*, V. Trautmann****, G. Bethin*****

Leibniz-Institut for Crystal Growth (Germany), **Weierstrass Institute for Applied Analysis and Stochastics (WIAS) (Germany), *Leibniz University of Hannover, ****Steremat GmbH (Germany), *****Auteam GmbH (Germany)*

3.2 Unsteady 3D LES Modeling of Turbulent Melt Flow with AC Traveling EM Fields for a Laboratory Model of the CZ Silicon Crystal Growth System

A. Krauze*, A. Rudevics*, A. Muiznieks*, A. Sabanskis*, N. Jekabsons*, B. Nacke**

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

3.3 Numerical Simulations of the Influence of a Traveling Magnetic Field, Generated by an Internal Heater Magnetic Module, on Czochralski Crystal Growth

O. Klein*, Ch. Lechner*, P.-É. Druet*, P. Philip**, J. Sprekels*, Ch. Frank-Rotsch***, F.-M. Kießling***, W. Miller***, U. Rehse***, P. Rudolph***

Weierstrass Institute for Applied Analysis and Stochastics (WIAS) (Germany), **Ludwig-Maximilians University (Germany), *Leibniz-Institut for Crystal Growth (Germany)*

3.4 Crucible-Free Crystal Growth of Silicon and Germanium – Numerical Simulation and Check by Experiment

M. Wünscher, A. Lüdge, H. Riemann

Leibniz-Institut for Crystal Growth (Germany)

3.5 Using Open Source Code Library OpenFOAM for 3D Magneto Hydrodynamic Calculations in Semiconductor Crystal Growth Technologies

A. Rudevics*, K. Lacis*, A. Muiznieks*, N. Jekabsons*, B. Nacke**

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

17.30 **End of 1st day**

19.30 **Dinner at Restaurant “Festscheune auf Meyers Hof” Zoo Hannover, Adenaueralle 3, 30159 Hannover**

Oral Session 4 – Hardening

October 28, 2008 (Tuesday)

09.00 – 10.20

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

4.1 Numerical Modeling of Induction Hardening of Steel Bodies

J. Barglik*, J. Arendarska**, D. Dołęga*, A. Smagór*

**Silesian University of Technology (Poland), **Association of the Polish Electrical Engineers (Poland)*

4.2 Electromagnetic Thermal Metallurgical Models for Induction Hardening

F. Dughiero, M. Forzan

University of Padua (Italy)

4.3 Investigation of Relative Magnetic Permeability as Input Data for Numerical Simulation of Induction Surface Hardening

T. Zedler, A. Nikanorov, B. Nacke

Leibniz University of Hannover (Germany)

4.4 Thermo-Mechanical Fatigue Life Estimation of Induction Coils

K. Svendsen, S.T. Hagen

Telemark University College (Norway)

10.20 – 10.50 **Coffee Break**

Oral Session 5 – Melting II (COST Action P17)

October 28, 2008 (Tuesday)

10.50 – 12.30

Chairman: Prof. D. Lavers, *University of Toronto (Canada)*

5.1 Mathematical Analysis of the Oscillations of a Liquid Metal Drop Submitted to Low Frequency Magnetic Fields

K. Spragg*, A. Sneyd**, Y. Fautrelle*

**SIMAP/EPM laboratory (France), ** University of Waikato (New Zealand)*

5.2 Control of Free-Surface Instabilities during Electromagnetic Shaping of Liquid Metals

C. Karcher, V. Minchenya

Technical University Ilmenau (Germany)

5.3 Thermoconvectives Instabilities of Molten Glass Heated by Direct Induction in a Cold Crucible

E. Sauvage*, A. Gagnoud**, Y. Fautrelle**, P. Brun, J. Lacombe

**SIMAP - EPM laboratory, **CEA – CNRS (France)*

5.4 Modelling of Levitation Melting Using a Fixed Mesh Method

D. Hectors, E. Toorman, K. Van Reusel
Katholieke Universiteit Leuven (Belgium)

5.5 Electromagnetic Stirring Effect on Thermal Conductivity of a Levitated Sample

P. Schetelat, J. Etay
CNRS (France)

12.30 – 13.30 **Lunch**

Oral Session 6 – Solidification Processes (COST Action P17)

October 28, 2008 (Tuesday)

13.30 – 15.10

Chairman: Prof. V. Fireteanu, *Polite University of Bucharest (Romania)*

6.1 A Dual EMS System for Stirring Liquid Metals at an Advanced Solidification Stage

D. Lavers*, L.S. Beitelman**, G.R. Tallbäck**, C.P. Curran***
University of Toronto (Canada)*, *ABB JME Division (Canada)*,
****formerly of ABB Automation Systems*

6.2 Influence of a Rotating Magnetic Field to the Microstructure of Directional Solidified Aluminium – Silicon Alloys- Comparison of Experiment and Simulation

J. Dagner, J. Friedrich, G. Müller
Fraunhofer IISB (Germany)

6.3 Numerical Investigations of the Influence of Forced Convection Induced by a Travelling Magnetic Field during Solidification of Metallic Alloys

A. Noepfel*, O. Budenkova**, Y. Fautrelle*
CNRS/INP (France)*, *on leave A.F.Ioffe PTI, St. Petersburg, RAS (Russia)*

6.4 Undercooling and Solidification of Liquid Metals under Different Conditions

S. Binder*, D. M. Herlach*, J. Gao**
DLR, Ruhr-Universität Bochum (Germany)*, *Northeastern University (China)*

6.5 Effect of Intense Magnetic Field on Electro-deposited Thin Film of CdTe

T. Kozuka, K. Shimomai, T. Kenjo, M. Kawahara
Kumamoto University (Japan)

15.10 – 15.40 **Coffee Break**

Oral Session 7 – Induction Assisted Laser Technologies

October 28, 2008 (Tuesday)

15.40 – 17.00

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

- 7.1 Induction Assisted Laser Beam Welding of HSLA Steel Sheets**
A. Jahn, M. Krätzsch, B. Brenner
Fraunhofer IWS Dresden (Germany)
- 7.2 Weldability and Mechanical Behaviour of Induction Assisted Thick Welds in High Strength Steel**
S. Sorrentino
Centro Sviluppo Materiali S.p.A. (Italy)
- 7.3 Laser Welding of Heat Treatable Steel during Induction Hardening**
R. Rosenfeld, D. Herzog, A. Ostendorf, H. Haferkamp
LZH (Germany)
- 7.4 Modelling and Optimization of Induction Assisted Welding Processes**
M. Mach, H. Schülbe, B. Nacke
Leibniz University of Hannover (Germany)

Poster Session

October 28, 2008 (Tuesday)

17.00 – 18.00

- P01 Modelling Convective and Radiative Heat Transfer in a Glass Melting Model Crucible**
D. Cepite*, A. Jakovics*, B. Halbedel**
**University of Latvia (Latvia), **Technical University Ilmenau (Germany)*
- P02 Estimation of Temperature Difference and Integral Flow through Channel of ICF**
V. Frishfelds*, A. Jakovics*, B. Nacke**, E. Baake**
**University of Latvia (Latvia), **Leibniz University of Hannover (Germany)*
- P03 Heat Exchange and Operating Gas Flow Influence on Radiation Resistant Pressure Sensor Properties**
V. Geza*, A. Jakovics*, K. Thomsen**
**University of Latvia (Latvia), **Paul Scherrer Institut (Switzerland)*

- P04 Calibration of Lorentz Force Flowmeter**
V. Minchenya, Ch. Karcher, Y. Kolesnikov, A. Thess
Technical University Ilmenau (Germany)
- P05 Electrodynamic Interactions in Arc Furnaces of a Direct Current**
Y. M. Mironov
Chuvash State University (Russia)
- P06 Unsteady 3D and Analytical Analysis of Segregation Process in FZ Si Single Crystal Growth**
K. Lacis*, A. Muiznieks*, N. Jekabsons**, A. Rudevics*, G. Ratnieks***, B. Nacke****
University of Latvia (Latvia), **Jekabsons Engineering Systems, IK (Latvia), *Siltronic AG (Germany), ****Leibniz University of Hannover, (Germany)*
- P07 Transient Phenomena in Electromagnetic Forming Process**
S. Pasca*, T. Vesselenyi*, V. Fireteanu**
**University of Oradea (Romania), **Politehnica University of Bucharest (Romania)*
- P08 Liquid Phase Synthesis of Lanthanum Chromite at Induction Furnace with Slitted Copper Crucible**
I. Pozniak*, A. Pechenkov*, S. Suvorov**, A. Zuev**, B. Nacke***, B. Niemann***, M. Kudryash***
St. Petersburg Electrotechnical University (Russia), **St. Petersburg State Technological Institute (Russia), *Leibniz University of Hannover (Germany)*
- P09 Thermal Modeling of an Induction Coil; Model vs. Experiment**
K. Svendsen, S. T. Hagen
Telemark University College (Norway)
- P10 Melt Flow and Skull Formation Modelling Possibilities for TiAl Melting Process in Induction Furnace with Cold Crucible**
A. Umbrashko*, E. Baake*, B. Nacke*, A. Jakovics**
**Leibniz University of Hannover (Germany), **University of Latvia (Latvia)*
- P11 Calculation of Energy Characteristic of the Inductor with Reactive Power Self-compensation**
A. Izhikova, I. Zakharov, B. Utegulov, G. Demessinova
Pavlodar State University (Kazakhstan)

P12 3D Electrical and Thermal Simulation of a Resistance Heated EFG System

S. Wipprecht, H. Kasjanow, B. Nacke

Leibniz University of Hannover (Germany)

P13 Adaptive Induction System for Heating of Aluminium Billet by Rotation in DC Magnetic Field

M. Zlobina*, B. Nacke**, A. Nikanorov**

St. Petersburg Electrotechnical University (Russia), Leibniz University of Hannover (Germany)

18.00 End of 2nd day

Oral Session 8 – Optimisation & Control

October 29, 2008 (Wednesday)

09.00 – 10.20

Chairman: Prof. Y. Blinov, *St. Petersburg Electrotechnical University (Russia)*

8.1 Optimal Parameters of One-side Traveling Field Inductors for Stirring and Pumping Applications

V. Fireteanu*, M. Popa**, S. Pasca**

**University Politehnica of Bucharest (Romania), **University of Oradea (Romania)*

8.2 Special Method of Parametric Optimization of Induction Heating Systems

Yu. Pleshivtseva*, E. Rapoport*, A. Efimov*, B. Nacke**, A. Nikanorov**

**Samara State Technical University (Russia), **Leibniz University of Hannover (Germany)*

8.3 Induction Billet Heaters with Enthalpy Controlled Zone Heating

A. Walther

ABP Induction Systems (Germany)

8.4 Electromagnetic Strip Stabilization in Galvanizing Lines

R. Jürgens

SMS ELOTHERM (Germany)

10.20 – 10.50 **Coffee Break**

Oral Session 9 – Material Processing (COST Action P17)

October 29, 2008 (Wednesday)

10.50 – 12.50

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

9.1 Particle Transport in Recirculated EM Driven Melt Flows

M. Kirpo*, A. Jakovics*, E. Baake**, B. Nacke**

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

9.2 Model Experiments on Macroscopic Thermoelectromagnetic Convection

A. Cramer, X. Zhang, G. Gerbeth

Forschungszentrum Dresden-Rossendorf (Germany)

9.3 TMF's in a Crystal Growth and Solidification of Semiconductors, Oxides and Fluorides

N. Dropka, Ch. Frank-Rotsch, W. Miller, U. Rehse, P. Rudolph
Leibniz-Institut for Crystal Growth (Germany)

9.4 3D Modeling of Electromagnetic Processes in Induction System with Cold Crucible

I. Pozniak*, A. Pechenkov*, M. Kydryash**, B. Nacke**
**St. Petersburg Electrotechnical University (Russia), **Leibniz University of Hannover (Germany)*

9.5 Crossed EM-Field Driven Weak Conducting Melt Flow in Annular Cylinder

A. Jakovics*, V. Geza*, B. Halbedel**
**University of Latvia (Latvia), **Technical University Ilmenau (Germany)*

9.6 Investigation of Mass and Heat Transfer of Molten Glass in the Inductor-Crucible

B. Niemann, B. Nacke, M. Kudryash
Leibniz University of Hannover (Germany)

Closing Session

October 29, 2008 (Wednesday)

12.50 – 13.15

13.15 **End of Colloquium**

13.15 – 14.15 **Lunch**

14.15 – 20.00 **Sightseeing Tour to Celle (incl. Restaurant)**

Meeting at Leibnizhaus, Holzmarkt 4-6, 30159 Hannover

20.00 – **End in Hannover**

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NOTES