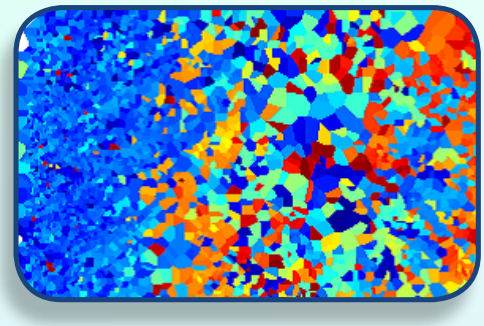
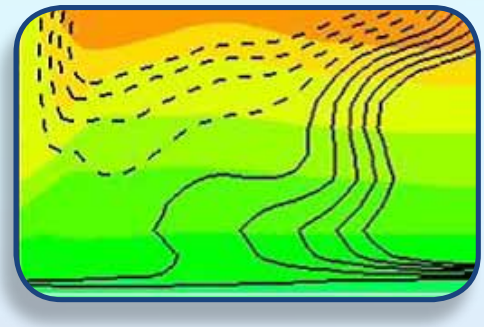
LMPC 2013

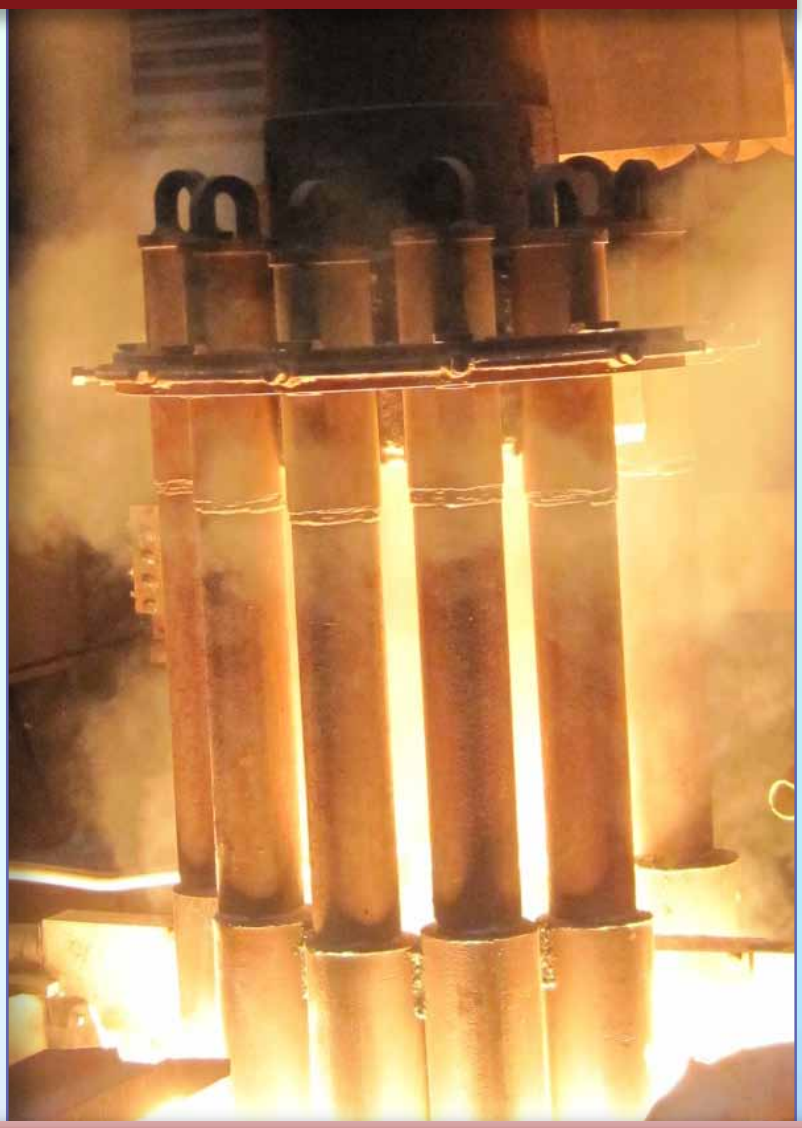
# Liquid Metal Processing & Casting 2013

September 22-25, 2013 • Austin, Texas

# FINAL PROGRAM







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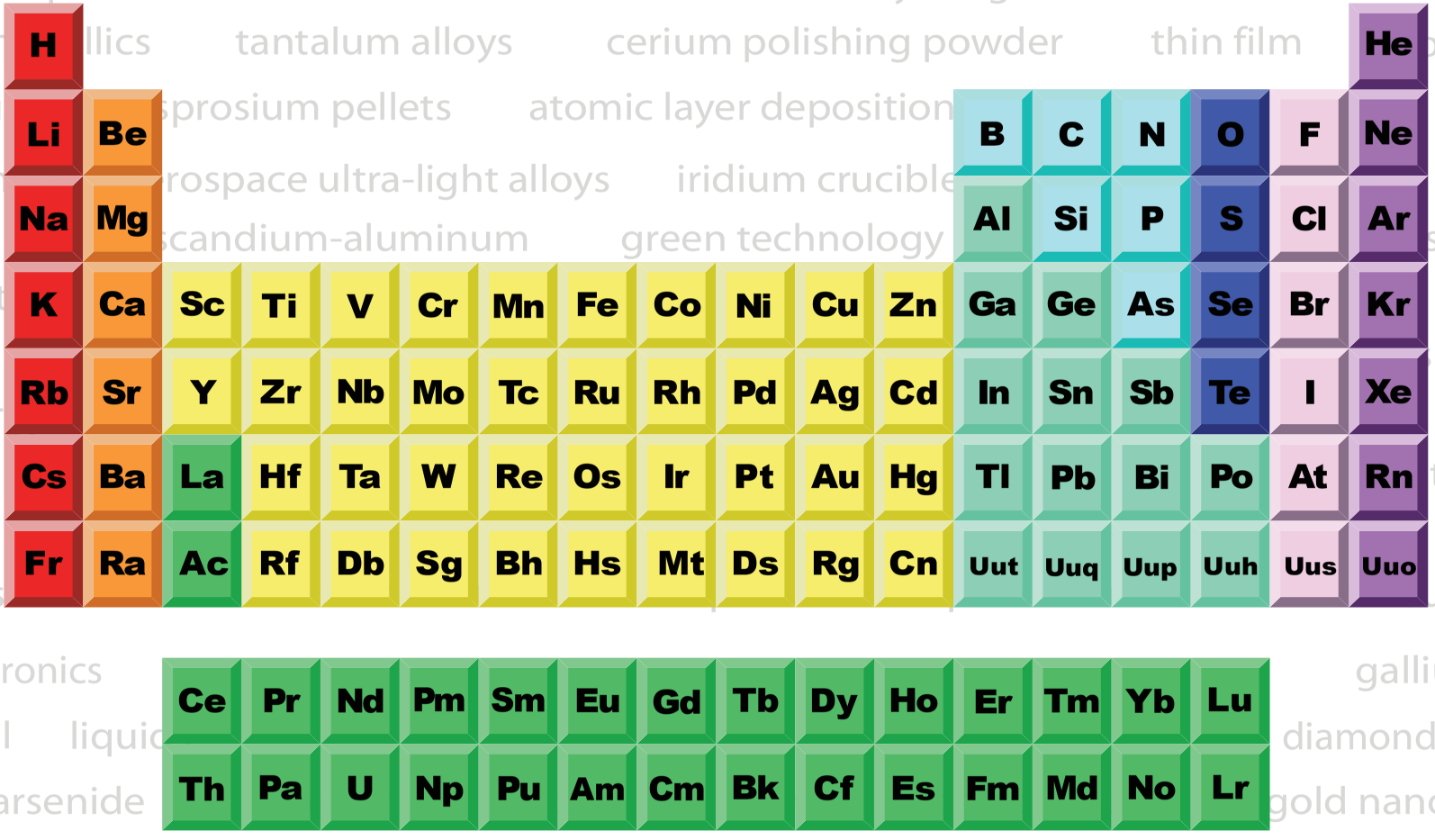


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Welcome to

# Liquid Metal Processing & Casting 2013

September 22–25, 2013 • Austin, Texas

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## SCHEDULE AT-A-GLANCE

| | | | |
|---|---|---|---|
| **Sunday, September 22** | Registration | 4:00 p.m. to 8:00 p.m. | Meeting Level 2 |
| | Welcome Reception | 6:00 p.m. to 8:00 p.m. | Interior Courtyard |
| **Monday, September 23** | Registration | 8:00 a.m. to 6:00 p.m. | Meeting Level 2 |
| | Poster Set-up | 8:00 a.m. to 10:00 a.m. | Classroom 104 |
| | Exhibition Set-up | 8:00 a.m. to 10:00 a.m. | Classroom 104 |
| | Session: Keynote | 8:30 a.m. to 9:20 a.m. | Amphitheater 204 |
| | Session: Electroslag Remelting I | 9:20 a.m. to 12:30 p.m. | Amphitheater 204 |
| | Exhibition | 10:00 a.m. to 7:15 p.m. | Classroom 104 |
| | Break and Poster Viewing | 10:10 a.m. to 10:50 a.m. | Classroom 104 |
| | Lunch | 12:30 p.m. to 2:30 p.m. | On Your Own |
| | Session: Electroslag Remelting II | 2:30 p.m. to 5:45 p.m. | Amphitheater 204 |
| | Break and Poster Viewing | 4:10 p.m. to 4:30 p.m. | Classroom 104 |
| | Poster Viewing and Reception | 5:45 p.m. to 7:15 p.m. | Classroom 104 |
| **Tuesday, September 24** | Registration | 8:00 a.m. to 5:00 p.m. | Meeting Level 2 |
| | Exhibition | 8:00 a.m. to 5:45 p.m. | Classroom 104 |
| | Session: Defects | 8:30 a.m. to 12:30 p.m. | Amphitheater 204 |
| | Break and Poster Viewing | 10:10 a.m. to 10:50 a.m. | Classroom 104 |
| | Lunch | 12:30 p.m. to 2:30 p.m. | On Your Own |
| | Session: Vacuum Arc Remelting | 2:30 p.m. to 4:10 p.m. | Amphitheater 204 |
| | Break and Poster Viewing | 4:10 p.m. to 4:30 p.m. | Classroom 104 |
| | Session: Aluminum Processing | 4:30 p.m. to 5:45 p.m. | Amphitheater 204 |
| | Conference Dinner | 6:30 p.m. to 9:00 p.m. | Lake Austin Riverboats |
| **Wednesday, September 25** | Registration | 8:00 a.m. to 11:30 a.m. | Meeting Level 2 |
| | Exhibition | 8:00 a.m. to 12:00 p.m. | Classroom 104 |
| | Session: Miscellaneous | 8:30 a.m. to 11:50 a.m. | Amphitheater 204 |
| | Break and Poster Viewing | 10:10 a.m. to 10:50 a.m. | Classroom 104 |
| | Exhibition Dismantle | 12:00 p.m. to 2:00 p.m. | Classroom 104 |
| | Poster Tear-down | 11:00 a.m. to 12:00 p.m. | Classroom 104 |

# Greetings from the Organizing Committee

**Dear Attendees,**

Thank you for joining us here in Austin for Liquid Metal Processing & Casting 2013 (LMPC 2013)! As some of you may know, this international forum takes place every two years. It was last held in Nancy, France, in 2011 and in Santa Fe, New Mexico, in 2009.

This unique symposium will showcase the latest technological and scientific advances related to those industrial processes used to cast large ingots of highly alloyed metals. As attendees, you'll benefit from hearing both academic and industrial perspectives on topics including advances in controls and process simulation, ingot defect formation and characterization studies, and process parameter-material properties characterization.

We hope you make the most of your time at LMPC 2013. Over the next four days, take the opportunity to learn from technical presentations, network at social events, and connect with companies working in your field at the exhibit. This program will act as your guide to all of the meeting's activities, so keep it on hand for reference.

Thank you again for joining us at LMPC 2013 and enjoy your stay in Texas!

Sincerely,
**LMPC 2013 Organizing Committee**

## CONFERENCE POLICIES

### BADGES
All attendees must wear registration badges at all times during the conference to ensure admission to events included in the paid fee such as technical sessions, exhibition and receptions.

### REFUNDS
The deadline for all refunds was August 29, 2013. No refunds will be issued at the conference. Fees and tickets are nonrefundable.

### PHOTOGRAPHY NOTICE
By registering for this conference, all attendees acknowledge that they may be photographed by conference personnel while at events and that those photos may be used for promotional purposes.

### AUDIO/VIDEO RECORDING POLICY
Recording of sessions (audio, video, still photography, etc.) intended for personal use, distribution, publication, or copyright without the express written consent of TMS and the individual authors is strictly prohibited.

### AMERICANS WITH DISABILITIES ACT
The federal Americans with Disabilities Act (ADA) prohibits discrimination against, and promotes public accessibility for, those with disabilities. In support of, and in compliance with ADA, we ask those requiring specific equipment or services to contact TMS Meeting Services at mtgserv@tms.org in advance.

### CELL PHONE USE
In consideration of attendees and presenters, we kindly request that you minimize disturbances by setting all cell phones and other devices on "silent" while in meeting rooms.

## ORGANIZING COMMITTEE

### Technical Organizers

**Matthew J. M. Krane**,
Purdue University, USA

**Alain Jardy**,
Institut Jean Lamour,
CNRS/Universite de Lorraine, France

### Local Organizers

**Joseph J. Beaman**,
University of Texas, USA

**Rodney L. Williamson**,
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**Zhouhua Jiang**,
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**Koji Kajikawa**,
Japan Steel Works, Japan

**Henry Lippard**,
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**Alec Mitchell**,
UBC, Canada

**Ashish Patel**,
TIMET, USA

**Mark Suer**,
Special Metals, USA

**R. Mark Ward**,
University of Birmingham, UK

**Rodney L. Williamson**,
University of Texas at Austin, USA

## ABOUT THE CONFERENCE

### Registration

Your full conference registration includes one copy of the proceedings. Your badge ensures admission to each of these events:

- Technical and Poster Sessions
- Access to the Exhibition
- Sunday Welcome Reception
- Monday Poster Reception
- Tuesday Conference Dinner

### Registration Hours

The registration desk will be located outside of **Amphitheater 204, on Meeting Level 2**.

| | |
|---|---|
| **Sunday** | 4:00 p.m. to 8:00 p.m. |
| **Monday** | 8:00 a.m. to 6:00 p.m. |
| **Tuesday** | 8:00 a.m. to 5:00 p.m. |
| **Wednesday** | 8:00 a.m. to 11:30 a.m. |

### Internet Access

Complimentary internet access is available for LMPC attendees in all guest rooms and meeting rooms.

### Technical Sessions

All oral presentations will be held in Amphitheater 204 of the AT&T Executive Education and Conference Center. All poster presentations will be held in Classroom 104. See the Technical Program on pages 10-12 for room locations.

### Proceedings

Full conference registrants receive one copy of the proceedings as part of the registration fee. Additional copies may be purchased for $115 at **www.wiley.com** (TMS members receive a 35% discount). Approximately six weeks after the meeting, individual papers will be available through the Wiley Online Library: **http://onlinelibrary.wiley.com**.

## KEYNOTE SPEAKER

**Rashmi Bhavsar**,
Global Materials Metier Manager,
Schlumberger

Presentation Title: "*Addressing Material Challenges in Upstream Oil and Gas Production*"

**Abstract:** The rising energy demand and our depleting hydrocarbon reserves have led to oilfield operations being conducted in extreme hostile environments. To bring these high pressure and high temperature (HPHT) reservoirs on-stream, there is a need to develop advanced alloys, where higher strength allows design of critical wall thicknesses necessary to counter burst and collapse of tubular(s) deployed downhole. However, the presence of acid gases coupled with HPHT, poses significant engineering challenges associated with corrosion, environmental cracking (EC) and possible hydrogen embrittlement (H2E), especially of high strength alloys. Various surface treatments are used to increase the system multi-functionality of the tools. As we are well aware, conventional microcrystalline coatings and surface treatments are constrained in their capabilities to provide adequate protection to exposed metal surfaces from downhole corrosive fluids. Nanocrystalline (nc) and ultrafine grained (UFG) metals and alloys are known to frequently outperform their coarse grained microcrystalline counterparts due to superior strength and wear (abrasion) resistance and in corrosion resistance as recently verified. This talk addresses early use of 13Cr ss, Nickel based CRAs, current practices and then technology gaps in alloy requirements for deep-water and sour HPHT. Increasing regulations require better completion designs, smarter tools and reliable equipment for long-term reliable service. This presentation discusses past, present and future material challenges we face in upstream oil and gas production.

**About the Speaker**: Bhavsar has been with Schlumberger for 31 years. He is primarily responsible for materials development and technology road maps for HPHT and deep water markets. His experience involves material selection, corrosion, welding, validation testing, etc. in completion and service tools and is well recognized within the operator and equipment manufacturer's materials community in the exploration and production side of the business.

## EXHIBITION

### Exhibit Hours

The exhibition will be located in **Classroom 104**.

| | |
|---|---|
| **Monday** | 10:00 a.m. to 7:15 p.m. |
| **Tuesday** | 8:00 a.m. to 5:45 p.m. |
| **Wednesday** | 8:00 a.m. to 12:00 p.m. |
| | |
| **Monday Set-up** | 8:00 a.m. to 10:00 a.m. |
| **Wednesday Dismantle** | 12:00 p.m. to 2:00 p.m. |

TMS would like to thank the following Sponsors and Exhibitors for their gracious support of the event.

## SPONSORS

CONSARC
An Inductotherm Group Company

Consarc Corporation is an Inductotherm Group Company, a strategic part of one of the world's largest groups developing technologies for the melting and processing of high-performance metals and alloys. Consarc is ISO 9001:2008 certified, and with international operations on 5 continents, is well equipped to tackle furnace projects on a global basis. Consarc designs and manufactures furnace systems for a variety of metallurgical processes, including: vacuum arc remelting, electroslag refining, vacuum induction melting, vacuum precision investment casting, induction skull melting, vacuum brazing, and vacuum heating (graphite hot zones, metallic hot zones, and induction heated to 3,000°C).

RETECH

Retech is the world's leading supplier of Electron Beam and Plasma Cold Hearth Furnaces for melting and refining refractory and reactive metals and alloys, as well as rare earths. Retech's advanced vacuum metallurgical systems also include VAR, VAR Consumable (Skull) Casting, Electron Beam and Plasma Consolidation furnaces, Plasma Welders, VIM Precision Investment Casting (DS/SC/EQ), Cold Wall Induction melting

and casting, Vacuum Heat Treating, Gas Atomization, laboratory scale and custom engineered systems. Retech also builds the Plasma Arc Centrifugal Treatment (PACT©) process providing thermal treatment of hazardous and radioactive waste.

VON ARDENNE develops and manufactures advanced vacuum coating equipment and electron beam systems. In 1959, the first 45 kW electron beam furnace for melting reactive and refractory metals was built at the Manfred von Ardenne Research Institute in Dresden. Today, VON ARDENNE provides the most powerful electron beam guns in the industry. Our electron beam systems, which consist of electron beam guns, high-voltage power supplies and beam guidance systems, are constantly adapted to changing technological requirements. More than 400 VON ARDENNE electron beam systems have been installed worldwide and are used for melting, evaporation and heat treatment.

ALD provides primary vacuum melting and remelting furnace solutions to world-class premium melt shops serving the aerospace, oil and gas, energy and process industries. When cleanliness, homogeneity, reproducibility, improved fatigue and fracture toughness of the final product are essential, ALD's VIM/VIDP, VAR, ESR, EB and plasma furnaces are the solution.

## EXHIBITORS

Innovative Research, Inc. provides application-specific software products and engineering services involving computational analysis of flow, heat transfer, and related processes. To the specialized metals melting and processing industry, we offer software products **MeltFlow-VAR™** and **MeltFlow-ESR™** that perform comprehensive analysis of the Vacuum Arc Remelting (VAR) and Electroslag Remelting (ESR) processes. These software tools are being actively used by specialty alloy producers in the United States, Europe, Japan, and Korea for the design and optimization of remelting processes for Titanium alloys, superalloys, and steels. Such industrial use has resulted in significant productivity gains and cost savings for process design, scale-up, and operation, and substantial improvements in the quality of the ingots produced. We also undertake research projects from government agencies and industry involving development and application of computational methods for the analysis of advanced metallurgical processes for the production of high-performance alloys.

Well-established specialist in the design, fabrication and repair of copper crucibles, base plates, power rams, hearths and related equipment for use in VAR, ESR, EBM, PAM and similar processes for the refining of titanium, zirconium, nickel alloys and alloy steels. Extensive shop experience, ongoing dialogue with melt shop personnel and active design collaboration with furnace builders keeps us abreast of the latest trends and problems within the specialty melting community.

Thermo-Calc Software is a leading developer of software and databases for calculations involving computational thermodynamics and diffusion controlled simulations. Thermo-Calc is a powerful tool for performing thermodynamic calculations for multicomponent systems. Calculations are based on thermodynamic databases produced by expert evaluation of experimental data. Databases are available for Al, Mg, steels, Ni-superalloys, Ti, solders and other materials. Programming interfaces are available which enable Thermo-Calc to be called directly from in-house developed software or MatLab. DICTRA is used for accurate simulations of diffusion in multicomponent alloys. TC-PRISMA is a new software package for the simulation of precipitation kinetics in multicomponent alloys.

## NETWORKING & SOCIAL EVENTS

### Welcome Reception
The Welcome Reception will be held on Sunday, September 22 from 6:00 p.m. to 8:00 p.m. in the Interior Courtyard.

### Poster Viewing and Reception
Poster viewing and reception are planned for Monday, September 23 from 5:45 p.m. to 7:15 p.m. following the technical sessions in Classroom 104. Don't miss this great networking opportunity!

### Conference Dinner
The dinner will be held on Tuesday, September 24 from 6:30 p.m. to 9:00 p.m. on Lake Austin.

## MAP OF AUSTIN, TEXAS


: Airport

: AT&T Executive Education and Conference Center

## ABOUT THE VENUE

The AT&T Executive Education and Conference Center at the University of Texas at Austin is situated conveniently in the heart of Austin activity and on the university campus. The center offers views of the university's Tower, the State Capitol, or a serene central courtyard. Walk to exhibits at the Blanton Museum of Art and the University of Texas Visual Art Center or shows from the collections of the Harry Ransom Center or the LBJ Library. Enjoy a performance at the famed Performing Arts Center or explore the Bob Bullock Texas State History Museum, cheer on the Longhorns at Texas Memorial Stadium, catch an edgy art film at the Dobie theatre, or shop on colorful Guadalupe Street—all within walking distance.

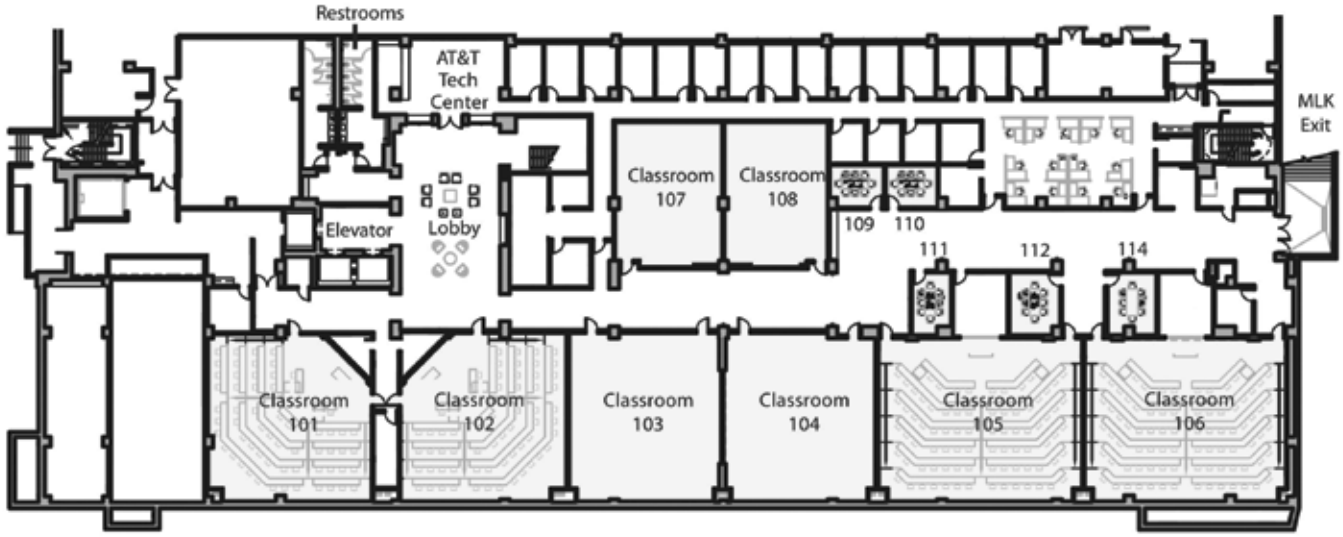
The Center is on the northwest corner of Martin Luther King Boulevard and University Avenue, at the south entrance to The University of Texas at Austin, and is four blocks from the Texas State Capitol and eight miles (25 minutes) from Austin-Bergstrom International Airport.

The hotel does not provide shuttle service, but alternate forms of transportation are available.

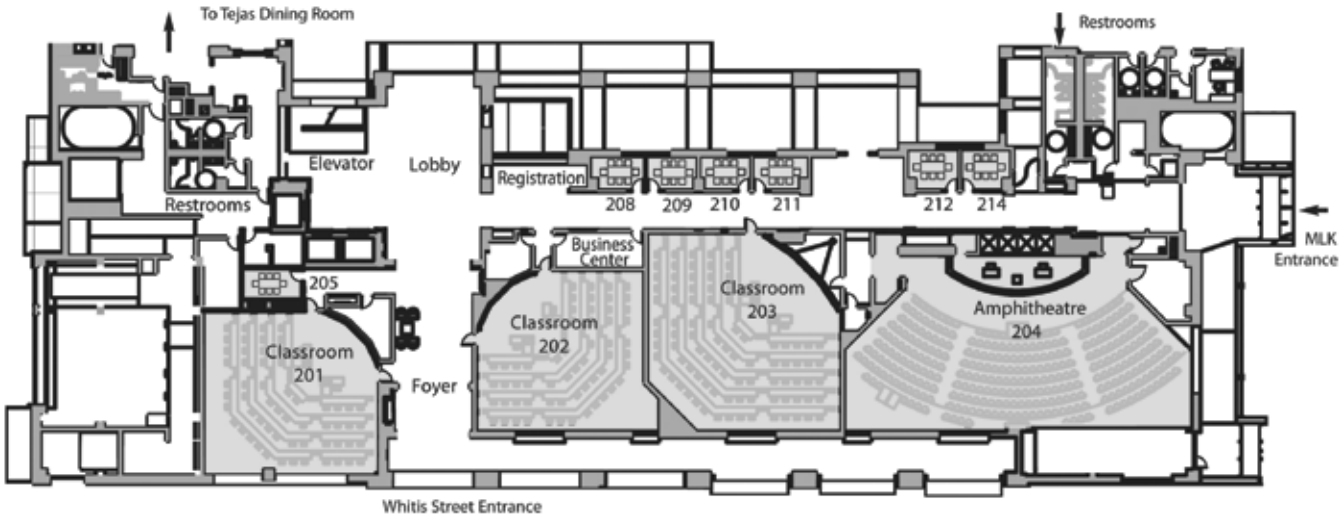
- Yellow Cab: 512-452-9999
- Super Shuttle: 512-258-3826

# *AT&T Executive Education and Conference Center*
## *The University of Texas at Austin*

### MEETING LEVEL ONE - FLOOR PLAN




### MEETING LEVEL TWO - FLOOR PLAN



## Keynote

Monday AM
September 23, 2013

Room: Amphitheater 204
Location: AT&T Executive Education and Conference Center

**8:30 AM**
**Opening Remarks**

**8:40 AM Keynote**
**Addressing Material Challenges in Upstream Oil and Gas Production**
Rashmi Bhavsar, Schlumberger

## Electroslag Remelting I

Monday AM
September 23, 2013

Room: Amphitheater 204
Location: AT&T Executive Education and Conference Center

**9:20 AM**
**Computational Modeling of Electroslag Remelting (ESR) Process Used for the Production of High-Performance Alloys**: *Kanchan Kelkar*[1]; Suhas Patankar[1]; Ramesh Minisandram[1]; David Evans[1]; John deBarbadillo[1]; Richard Smith[1]; Randolph Helmink[1]; Alec Mitchell[1]; Shesh Srivatsa[2]; [1]Innovative Research, Inc.; [2]Srivatsa Consulting LLC

**9:45 AM**
**A Numerical Study on the Influence of the Frequency of the Applied AC Current on the Electroslag Remelting Processes**: *Ebrahim Karimi Sibaki*[1]; Abdellah Kharicha[1]; Menghuai Wu[1]; Andreas Ludwig[1]; Harald Holzgruber[2]; Bertram Ofner[2]; Manfred Ramprecht[2]; [1]University of Leoben; [2]INTECO Special Melting Technologies GmbH

**10:10 AM**
**Break and Poster Viewing**

**10:50 AM**
**A Thermodynamic Database for the $CaF_2$-$Al_2O_3$-CaO System**: *Lina Kjellqvist*[1]; Paul Mason[2]; Qing Chen[1]; Kaisheng Wu[2]; [1]Thermo-Calc Software AB; [2]Thermo-Calc Software Inc.

**11:15 AM**
**Influence of the Polarity on the Cleanliness Level and the Inclusion Types in the ESR Process**: *Armin Paar*[1]; Reinhold Schneider[2]; Peter Zeller[2]; Gerhard Reiter[3]; Stefan Paul[3]; Paul Würzinger[3]; Ingo Siller[3]; [1]Eisenwerk Sulzau-Werfen, R. & E. Weinberger AG; [2]FH-OÖ F&E GmbH; [3]Böhler Edelstahl GmbH & CO KG

**11:40 AM**
**Hot Test and Simulation of ESR Hollow Ingots Formation in Current Supplying Mold with Electrodes Change**: Xu Chen[1]; *Zhouhua Jiang*[1]; Lev Medovar[2]; Fubin Liu[1]; Ganna Stovpchenko[3]; Borys Fedorovskii[2]; Lebid Vitalii[2]; Ximin Zang[4]; Xin Deng[1]; [1]Northeastern University; [2]E.O. Paton Electric Welding Institute of NAS of Ukraine; [3]Elmet-Roll Private Company; [4]University of Science and Technology Liaoning

**12:05 PM**
**Design of ESR Slags According to Requested Physical Properties; Part 2: Density and Viscosity**: *Krzysztof Wroblewski*[1]; Brent DiBiaso[1]; James Fraley[1]; Jerry Fields[1]; Stuart Rudoler[1]; [1]American Flux and Metal

**12:30 PM**
**Lunch Break**

## Electroslag Remelting II

Monday PM
September 23, 2013

Room: Amphitheater 204
Location: AT&T Executive Education and Conference Center

**2:30 PM**
**Predicting Melting Behavior of an Industrial Electroslag Remelting Ingot**: *Jeffrey Yanke*[1]; Kyle Fezi[1]; Mike Fahrmann[2]; Matthew Krane[1]; [1]Purdue Center for Metal Casting Research, School of Materials Engineering, Purdue University; [2]Haynes International, Inc

**2:55 PM**
**Operational Experience of Large Sized ESR Plants and Attainable Quality of ESR Ingots with a Diameter of Up to 2600mm**: *Michael Kubin*[1]; Alexander Scheriau[1]; Matthias Knabl[1]; Harald Holzgruber[1]; Hiroshi Kawakami[2]; [1]INTECO Special Melting Technologies GmbH; [2]Japan Casting & Forging Corporation

**3:20 PM**
**Experimental Research on the Absorption of Fluorine in Gamma-TiAl during Electroslag Remelting**: *Peter Spiess*[1]; Bernd Friedrich[1]; [1]RWTH Aachen University

**3:45 PM**
**A Parametric Study of Slag Skin Formation in Electroslag Remelting**: Jeffrey Yanke[1]; *Matthew Krane*[1]; [1]Purdue Center for Metal Casting Research, School of Materials Engineering, Purdue University

**4:10 PM**
**Break and Poster Viewing**

**4:30 PM**
**Impact of the Solidified Slag Skin on the Current Distribution during Electroslag Remelting**: *Mathilde Hugo*[1]; Bernard Dussoubs[1]; Alain Jardy[1]; Jessica Escaffre[2]; Henri Poisson[2]; [1]Institut Jean Lamour; [2]Aubert & Duval

**4:55 PM**
**Investigation of Slag Compositions and Pressure Ranges Suitable for Electroslag Remelting under Vacuum Conditions**: *Sebastian Radwitz*[1]; Harald Scholz[2]; Bernd Friedrich[1]; [1]RWTH Aachen; [2]ALD Vacuum Technologies GmbH

**5:20 PM**
**Contribution of the Mould Current to the Ingot Surface Quality in the Electroslag Remelting Process**: *Abdellah Kharicha*[1]; [1]University of Leoben

**5:45 PM**
**Poster Viewing and Reception**

## Defects

Tuesday AM
September 24, 2013

Room: Amphitheater 204
Location: AT&T Executive Education and Conference Center

**8:30 AM**
**Numerical Simulation of Macrosegregation in 570-ton Low-alloyed Steel Ingot**: *Tomoki Sawada*[1]; Koji Kajikawa[1]; [1]Japan Steel Works, Ltd.

**8:55 AM**
**Using a Three-phase Mixed Columnar-equiaxed Solidification Model to Study Macrosegregation in Ingot Castings: Perspectives and Limitations**: *Menghuai Wu*[1]; Jun Li[1]; Abdellah Kharicha[1]; Andreas Ludwig[1]; [1]University of Leoben

**9:20 AM**
**Effect of Solidification Front Angle on Freckle Formation in Alloy 625**: *Koji Kajikawa*[1]; Masaru Tanaka[1]; Tomoki Sawada[1]; Shigeru Suzuki[1]; [1]The Japan Steel Works, Ltd.

**9:45 AM**
**The Behaviour of Entrainment Defects in Aluminium Alloy Castings**: *William Griffiths*[1]; Adrian Caden[1]; Mahmoud El-Sayed[2]; [1]University of Birmingham; [2]Arab Academy for Science and Technology and Maritime Transport

**10:10 AM**
**Break and Poster Viewing**

**10:50 AM**
**Inclusion Behaviour in Steel and Aluminium Making Reactors**: *Jean-Pierre Bellot*[1]; Olivier Mirgaux[1]; Alain Jardy[1]; [1]Ecole des Mines de Nancy

**11:15 AM**
**Modeling the Titanium Nitride (TiN) Germination and Growth during the Solidification of a Maraging Steel**: *Vincent Descotes*[1]; Jean-Pierre Bellot[1]; Sylvain Witzke[2]; Alain Jardy[1]; [1]Institut Jean Lamour - UMR CNRS 7198 - Université de Lorraine; [2]APERAM Alloys Imphy

**11:40 AM**
**Thermodynamics for the Influence of Slag Composition on the Inclusion Control in Semi-killed Liquid Steels**: *Joohyun Park*[1]; Jun Seok Park[2]; [1]Hanyang University; [2]University of Ulsan

**12:05 PM**
**The Influence of Different Melting and Remelting Routes on the Cleanliness of High Alloyed Steels**: *Gerhard Reiter*[1]; Wolfgang Schuetzenhoefer[1]; Angelika Tazreiter[1]; Carlos Martinez[1]; Paul Wuerzinger[1]; Christian Loecker[1]; [1]Bohler Edelstahl GmbH&CoKG

**12:30 PM**
**Lunch Break**

## Vacuum Arc Remelting

Tuesday PM
September 24, 2013

Room: Amphitheater 204
Location: AT&T Executive Education and Conference Center

**2:30 PM**
**Application of a Model for Simulating the Vacuum Arc Remelting Process in Titanium Alloys**: *Ashish Patel*[1]; David Tripp[1]; Daniel Fiore[1]; [1]Timet

**2:55 PM**
**Controlling Liquid Pool Depth in VAR of a 21.6 cm Diameter Ingot of Alloy 718**: *Luis Lopez*[1]; Joseph Beaman[1]; Rodney Williamson[1]; Eric Taleff[1]; Trevor Watt[1]; [1]The University of Texas at Austin

**3:20 PM**
**Simulation of Radiation Heat Transfer in a VAR Furnace Using an Electrical Resistance Network**: *Alexander Ballantyne*[1]; [1]MeltMet Technologies LLC

**3:45 PM**
**Solidification Mapping of a Nickel Alloy 718 Laboratory VAR Ingot**: *Trevor Watt*[1]; Eric Taleff[1]; Joe Beaman[1]; Felipe Lopez[1]; Rodney Williamson[2]; [1]The University of Texas at Austin; [2]Remelting Technologies Consulting LLC

**4:10 PM**
**Break and Poster Viewing**

## Aluminum Processing

Tuesday PM
September 24, 2013

Room: Amphitheater 204
Location: AT&T Executive Education and Conference Center

**4:30 PM**
**Improvement of Mechanical Properties of HPDC A356 Alloy through Melt Quenching Process**: *Shouxun Ji*[1]; Bo Jiang[1]; Wenchao Yang[1]; Zhongyun Fan[1]; [1]Brunel University

**4:55 PM**
**Review of Hot Tearing Studies in Al Alloys during Direct Chill Casting**: *Ashok Kumar Nallathambi*[1]; Pavan Kumar Penumakala[1]; Eckehard Specht[1]; [1]Otto von Guericke University Magdeburg

**5:20 PM**
**Effect of Sonotrode Design on Simultaneous Grain Refinement and Degassing of Al Alloys by Ultrasound**: *Jeong-IL Youn*[1]; Young Ki Lee[1]; Kee Joo Jung[1]; Bong Jae Choi[1]; Young Jig Kim[1]; [1]Sungkyunkwan University

## Miscellaneous

Wednesday AM
September 25, 2013

Room: Amphitheater 204
Location: AT&T Executive Education and Conference Center

**8:30 AM**
**Liquid Metal Engineering by Application of Intensive Melt Shearing**: *Jayesh Patel*[1]; Yubo Zuo[1]; Zhongyun Fan[1]; [1]The EPSRC Centre – LiME, BCAST

**8:55 AM**
**A Simple Experimental Apparatus for Testing Core and Clad Alloy Combinations for Potential Fusion™ Casting Applications**: *Massimo Di Ciano*[1]; [1]University of Waterloo

**9:20 AM**
**Development of a Hot Working Steel Based on a Controlled Gas-metal-reaction**: *Roman Ritzenhoff*[1]; Mohammad Gharbi[1]; [1]Energietechnik Essen

**9:45 AM**
**Nitrogen Control in VIM Melts**: *Paul Jablonski*[1]; Jeffrey Hawk[1]; [1]US Department of Energy

**10:10 AM**
**Break and Poster Viewing**

**10:50 AM**
**Characterisation and Modelling of Microsegregation in Low Carbon Continuously Cast Steel Slab**: *Dayue Zhang*[1]; Martin Strangwood[1]; [1]The University of Birmingham

**11:15 AM**
**The Practical Application of Minor Element Control in Small Scale Melts**: *Paul Jablonski*[1]; Jeffrey Hawk[1]; [1]US Department of Energy

**11:40 AM**
**Concluding Remarks**

## Poster Session

Room: Classroom 104
Location: AT&T Executive Education and Conference Center

**P-1: Mechanisms of Calcium Oxide Dissolution in CaO-$Al_2O_3$-$SiO_2$-based Slags**: *Muxing Guo*[1]; Zhi Sun[1]; Xiaoling Guo[1]; Bart Blanpain[1]; [1]Department MTM, KULeuven

**P-2: Effect of Fluoride Containing Slag on Oxide Inclusions in Electroslag Ingot**: *Yanwu Dong*[1]; Zhouhua Jiang[1]; Yulong Cao[1]; Jinxi Fan[1]; Ang Yu[1]; Fubin Liu[1]; [1]Northeastern University

**P-3: Production of High Quality Die Steels from Large ESR Slab Ingots**: Xin Geng[1]; Zhou-hua Jiang[1]; Hua-bin Li[1]; *Fu-bin Liu*[1]; Xing Li[1]; [1]School of Materials and Metallurgy, Northeastern University

**P-4: A Study of Slag and Steel Leakage Influence Factors during Electroslag Remelting Withdrawing Process**: Ximin Zang[1]; Zhouhua Jiang[2]; Hua Song[1]; Fubin Liu[2]; Xin Deng[2]; Xu Chen[2]; Chong Han[1]; [1]University of Science and Technology Liaoning; [2]Northeastern University

**P-5: Factors Affecting Surface Quality of Ingot Produced by Electroslag Continuous Casting with Liquid Metal**: Xin Deng[1]; Zhouhua Jiang[1]; Ximin Zang[1]; [1]School of Materials and Metallurgy, Northeastern University

**P-6: Mathematical Model of Solidification during Electroslag Casting of Pilger Roll**: Fubin Liu[1]; Huabing Li[1]; Zhouhua Jiang[1]; Xu Chen[1]; Yanwu Dong[1]; Ximin Zang[2]; [1]Northeastern University; [2]University of Science and Technology Liaoning

**P-7: Introducing Carbon Nanoparticles in Titanium during Chamber Electroslag Remelting (ChESR)**: *Anatoliy Ryabtsev*[1]; Bernd Friedrich[2]; Fedir Leokha[1]; Sergii Ratiiev[1]; Peter Spiess[2]; Sebastian Radwitz[2]; Olga Snizhko[1]; [1]Donetsk National Technical University; [2]RWTH Aachen University

**P-8: Evolution of ESR Technology and Equipment for Long Hollow Ingots Manufacture**: Lev Medovar[1]; Ganna Stovpchenko[2]; Grigory Dudka[3]; Alexander Kozminskiy[3]; Borys Fedorovskii[2]; Vitalii Lebid[2]; *Iaroslav Gusiev*[4]; [1]E.O. Paton Electric Welding Institute; [2]Elmet-Roll; [3]Energomash Business Group; [4]E.O.Paton Electric Welding Institute

**P-9: Variation of the Resistance during Electrode Movement in the Electroslag Remelting Process**: *Abdellah Kharicha*[1]; [1]University of Leoben

**P-10: Modeling Macrosegregation During Electroslag Remelting of Alloy 625**: *Kyle Fezi*[1]; Jeffrey Yanke[1]; Matthew Krane[1]; [1]Purdue University

**P-11: Comparision of Arc Slag Remelting vs. P-ESR Melting for High Nitrogen Steels**: *Roman Ritzenhoff*[1]; Lev Medovar[2]; Volodymyr Petrenko[2]; Anna Stovpchenko[3]; [1]Energietechnik Essen; [2]E.O. Paton Welding Institute; [3]Elmet Roll

**P-12: Refinement of Primary and Eutectic Silicon Particles in Hypereutectic Al-Si Alloys Using an Applied Electric Potential**: *Alexander Plotkowski*[1]; Prince Anyalebechi[2]; [1]Purdue University; [2]Grand Valley State University

**P-13: Characterization of Bifilms and Oxide Inclusions in Investment Cast IN100**: *Max Kaplan*[1]; G. E. Fuchs[1]; [1]University of Florida

**P-14: A Two-dimensional Infiltration Dynamics Model of C-SiC Composites**: *Khurram Iqbal*[1]; [1]Dalian University of Technology

**P-15: Investigation of Peculiarities of Deep Deoxidized Steel Interaction with Refractory Lining of Ladle during the Manufacturing of Large Forge Ingots with Mass up to 450 Ton**: Anatoliy Ryabtsev[1]; *Volodymyr Pashynskyi*[1]; Oleksander Troyanskyy[1]; Maxim Efimov[2]; Oleksander Selyutin[2]; Pavel Yavtushenko[2]; [1]Donetsk National Technical University; [2]PJSC (Energomashspetsstal)

**P-16: Characterization of the Interfacial Reaction between Titanium Castings and Alumina Mold Containing the Alpha-case Compounds**: *Seul Lee*[1]; Bong-Jae Choi[1]; Jeong-IL Youn[1]; Young-Jig Kim[1]; [1]Sung Kyun Kwan University

**P-17: Theoretical Design of Continuous Casting Process using Semi Analytical Method**: *Pavan Kumar Penumakala*[1]; Ashok Kumar Nallathambi[1]; Eckehard Specht[1]; [1]Otto von Guericke University Magdeburg

**P-18: Phosphorus Partitioning During EAF Refining of DRI Based Steel**: *Mohammed Tayeb*[1]; Sridhar Seetharaman[2]; Richard Fruehan[2]; [1]Carnegie Mellon University/Sabic; [2]Carnegie Mellon University

# Author Index

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- Degassing and refining under vacuum
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16 ton VIDP 2000 shown. Available to 35 tons.

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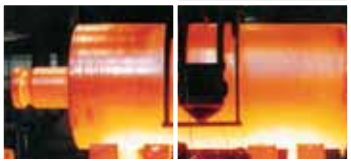
### Production of Slabs and Ingots of

- Ni base alloys
- High strength steels
- Ball-bearing materials
- Tool and die steels
- Material for heavy forgings

165 ton ESR ingot, 2300 mm diameter x 5000 mm long.



# Vacuum Arc Remelting Systems (VAR)

### Production of Ingots of

- Ni base alloys
- Superalloys
- High strength steels
- Tool and die steels
- Reactive metals (Titanium, Tantalum, Zirconium)

30 ton VAR furnace shown.

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