



## TMS2013 Programming Highlights

Complementing the more than 330 highly focused technical sessions at TMS2013 are special learning opportunities developed to provide context and enhance multi-disciplinary interaction. A few of these are highlighted in the following pages. Check the TMS2013 website regularly at <http://www.tms.org/tms2013> for programming additions and updates.

### TMS2013 Aluminum Keynote Session Examines Impurities in the Aluminum Supply Chain

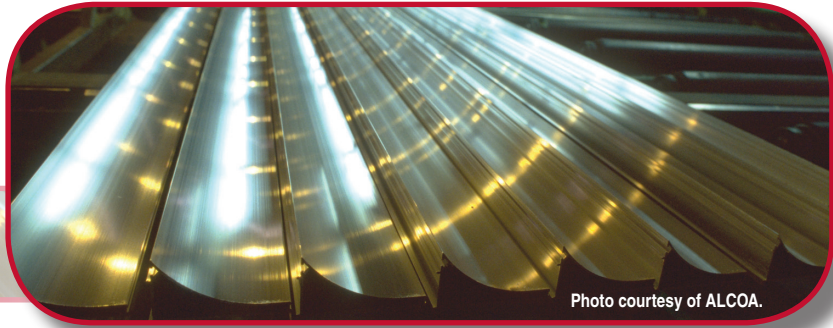


Photo courtesy of ALCOA.

The focus of the TMS2013 Aluminum Keynote Session surfaced during a discussion about common issues facing the industry during a TMS Aluminum Committee meeting. “Whether impurities are introduced through raw materials, in the smelting process or through recycling of aluminum, they have an impact and some are more difficult to deal with than others,” said Les Edwards, vice president of Technical Services, Rain CII Carbon, and session chair.

Reflecting the multi-faceted nature of these challenges, the session will assemble experts representing a range of perspectives on managing impurities in the aluminum supply chain. “The primary goal is to bring people together from the bauxite/alumina, reduction, electrode, and cast house areas to make the point that we need to think about impurities holistically rather than something that affects each area separately,” said Edwards. “Taking this approach can change the way we develop solutions to impurity problems. While we would all like impurities to go away, the reality is that they will not and we need to learn how to deal with them.”

The Aluminum Keynote Session will take place on Monday, March 4, from 8:30 a.m. to 12:15 p.m. in the Lila Cockrell Theatre of the Henry B. Gonzalez Convention Center. Technical papers presented in this session will

be published in the 2013 *Light Metals* proceedings. Speakers and topics slated for the event are:

#### Raw Material Impurities and the Challenge Ahead

**Stephen Lindsay,**  
*Alcoa Inc.*



Stephen Lindsay

As the industry continues to change, impurities—and changes in impurities—will take on greater meaning for process control, metal products, and environment, health, and safety considerations. This presentation will offer an overview and insights on these emerging issues.

#### Impacts of Impurities Introduced into the Aluminum Reduction Cell

**James Metson,**  
*University of Auckland*



James Metson

A focus of this presentation will be impurities entering the aluminum reduction process through both raw materials and operational practices.

Specific issues covered include the declining quality of petroleum cokes, the increasing efficiency in the capture and recycle of pot fumes, and aluminas as sources and contributors to impurities. Impurity reduction strategies and their effectiveness will also be discussed.

#### Changes in Global Oil Refining and Its Impact on Anode Quality Petroleum Coke

**Karl Bartholomew,**  
*KBC Advanced Technologies, Inc.*

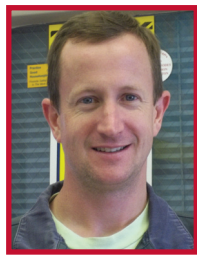


Karl Bartholomew

The global oil refining industry has undergone a dramatic upheaval over the past decade. This presentation will review the main economic drivers for refining, including the impact on petroleum coke production. How the markets (and decisions) have changed over the past decade will be examined, and scenarios of what’s ahead will be covered. Also discussed will be the rapid development of shale oil production, along with changes in global refining capacity (and coking capacity). These factors could soon have profound implications for the quality and quantity of calcinable anode grade petroleum coke.

## Impact of Higher Vanadium Levels on Smelter Operations

**John Gavin,**  
*RTA Sebree*



John Gavin

In early 2011, the RTA Sebree smelter experienced a significant increase (~100ppm) in calcined coke vanadium levels to levels around 410–440ppm. This was driven by crude oil changes at a refinery producing one of the primary cokes used in the coke blend supplied to the smelter. This presentation discusses the impact of the change on carbon consumption and some of the actions taken by the smelter to respond to the change, which was managed effectively with an appropriate understanding of key performance drivers and a focused technical improvement plan.

## Impact on Smelter Operations of Operating High Purity Reduction Cells

**Stewart Hamilton,**  
*New Zealand Aluminium Smelters*

Over the last 15 years, New Zealand



Stewart Hamilton

Aluminium Smelters Limited (NZAS) has developed and implemented technology and operating practices to produce high purity (Al 99.90+) and ultra high purity (Al 99.97+) ingot. The NZAS journey to high purity production and the impact that this strategy has had on the complexity of smelter operations are outlined in this presentation.

## Management of Impurities in the Aluminium Cast House

**Muhammad Akbar Rhamdhani,**  
*Swinburne University of Technology*



Akbar Rhamdhani

The concentration of impurities in raw materials are increasing and testing the ability of cast houses to meet customer chemical specifications. This presentation reviews options for removing impurities in the cast shop.

Classical melt treatment processes of salt fluxing, degassing, and filtration used to remove alkali metals and solid particles are discussed. Current work on the mechanisms of aluminum boride treatment to remove titanium, chromium, and vanadium is also examined, and an investigation into the potential for a melt nickel removal process is recapped.

## An Initial Assessment of the Effects of Increased Ni and V Content in AA6063 and A356 Alloys

**John Grandfield,**  
*Grandfield Technology*



John Grandfield

Changes in calcined coke composition associated with different crude oil sources have caused nickel and vanadium levels in aluminum to rise. To ensure cast product quality is not compromised, an understanding of the effects of these changes is needed. This presentation outlines an initial investigation for two commonly used alloys, AA6060/6063 and A356.

## 2013 International Nickel-Cobalt Symposium Addresses Strategic Metals Challenges



From mining and mineral processing, to final products, to recycling, the organizers of Nickel-Cobalt 2013 intend to offer as complete a picture as possible of the latest developments covering the entire value chain of both metals. The opening session alone will include plenary lectures on nickel laterite pro-



Tom Battle

duction technology, the history of the major alloy utilizing nickel, current developments in the cobalt market, and the recycling of cobalt-containing materials. Said Tom Battle, senior metallurgist, Midrex Technologies, and lead symposium organizer, “This is an exceptional opportunity to bring together the nickel-cobalt community from around the world to learn from each other and to share their knowledge with the entire materials world of TMS.”

Nickel-Cobalt 2013 is the second

in a series of symposia developed as a collaborative effort between TMS and the Metallurgy and Materials Society (MetSoc) of the Canadian Institute of Mining, Metallurgy, and Petroleum. The societies alternate organizing the event every four years, with MetSoc slated to take the lead when the symposium is held at its Annual Conference of Metallurgists in 2017. This year’s symposium is being organized by the TMS Extraction & Processing Division and High Temperature Alloys Committee.

Battle said that, in addition to the symposium's own agenda, potential synergies with TMS2013's other programming in extractive and physical metallurgy will offer value-added opportunities for learning and networking. A short course, Extractive Metallurgy of Nickel and Cobalt (see description later in this article), and a

nickel-cobalt industry section at the TMS2013 Exhibition are also being developed to complement and expand on the symposium's programming.

"Both nickel and cobalt are important strategic metals in the world economy," said Battle. "As with many other strategic metals, they present critical supply and demand

challenges, as well as technology issues—particularly for nickel as extractive industries continue the transition from sulfide ores to laterites. Nickel-Cobalt 2013 is a unique opportunity to bring some of the leading experts in these industries together to examine our progress, and identify potential strategies going forward."

## Get a Head Start on the Learning with TMS2013 Continuing Education Opportunities



Intensive learning experiences focused on practical application of the latest knowledge and techniques highlight the catalog of one- and two-day short courses and workshops slated for TMS2013. The following offers a broad overview of continuing education topics and details, available at press time. For the most current information, and to register for continuing education courses, go to the TMS2013 website at <http://www.tms.org/tms2013>.

### Modeling Electrodeposition in Materials Processing Operations

*Instructor: Adam C. Powell, Metal Oxygen Separation Technologies, Inc.*

This course will cover the basics of modeling transport-limited electrodeposition, including fluid dynamics, for materials processes from molten salt electrolysis, to electrorefining, to electroplating. The focus will be on predicting the variation in deposition rate over the cathode as a function of geometry and process parameters.

The first half of the course will review fundamentals, including elec-

tromigration, diffusion, and convection in the electrolyte, Butler-Volmer charge transfer resistance at the cathode interface, and resistance in the electrodes themselves. Attendees will learn basic scaling rules and analytical calculations, including important dimensionless groups, which enable simple and powerful assessments of importance of transport mechanisms, rate-limiting steps, and deposition uniformity.

The second half of the course will address situations where analytical calculations leave questions unanswered. Attendees will receive hands-on training in finite element analysis (FEA), including basics of fluid flow and heat transfer. Participants are encouraged to bring geometries of parts and electrode leads for electroplating or electrorefining anodes/cathodes to generate electrolyte geometries in STEP or IGES CAD formats.

*Sponsored by the Extraction & Processing Division (EPD) and the Light Metals Division (LMD)*

### New Applications of Small-Scale Mechanical Testing: Fatigue and Fracture of Thin Films and Nanomaterials

*Instructors: Virginia Ferguson, University of Colorado;*

*Sandra Korte, University of Erlangen-Nuremberg; Chris Eberl, Karlsruhe Institute for Technology and Fraunhofer Institute for Mechanics of Materials*



Virginia Ferguson



Sandra Korte



Chris Eberl

This tutorial will cover new advances in small-scale mechanical testing techniques, with an emphasis on measuring environmentally dependent mechanical behavior. In real applications, materials can experience high temperatures and chemically active environments, requiring that the mechanical properties be known in these conditions. Tutorial participants are encouraged to bring applications-related questions for an open panel discussion of testing techniques.

*Sponsored by the Structural Materials Division (SMD)*

## Furnace Systems Technology Workshop

*Instructors: Don Whipple and Jim Checkeye, Bloom Engineering; Deanna Weaver, Robinson Fans; John Sutton, Harbison-Walker Refractories; David Edgerton, Dantherm*

This course offers a comprehensive review of furnace technology and cast shop practices for improving efficiency, quality, and productivity, while minimizing emissions and waste.

Topics include: basics of combustion, heat transfer, burner technology, preheated combustion air, reverberatory furnace design, metal circulation, furnace technology, fundamentals of fans and blowers, reduction of melt loss, refractory selection and installation, and emissions/baghouse issues.

*Sponsored by the EPD and LMD*

## Managing Technical and Financial Risk in a New Technology Project Environment

*Instructors: Mark W. Kennedy, ProVal Partners; Phillip J. Mackey, P. J. Mackey Technology*



Mark W. Kennedy



Phillip J. Mackey

Within the context of a case study analysis of major mining and metallurgical projects, this course will identify the root causes of risk in these initiatives, with an emphasis on those with a high component of new technologies. The instructors will then review standard project management techniques and introduce specific methods to identify and manage risks in new technology projects. A particular focus will be standard financial analysis methods for projects, with the introduction of new mathematical methods to assess financial risk.

Course participants will be equipped with a set of mathematical tools that will allow both engineers and financial professionals to establish a common

level of understanding on risk, and enable a more accurate assessment of projects, better decision making, and enhanced project financial returns.

*Sponsored by the EPD*

## Extractive Metallurgy of Nickel and Cobalt

*Instructors: Michael Moats, Bill Davenport, Maurice Solar, Tim Robinson, Bruce Love, Indie Mihaylov, Ram Ramachandran, Norbert Piret*

This short course will cover the main processing steps in the extractive metallurgy of nickel and ore. Presented by industrial and academ-

ic experts, the program will examine the fundamentals and current trends of the processing used to produce nickel and cobalt from primary and secondary sources. Topics include: concentration of sulfide minerals and upgrading of laterite ores; production of ferro-nickel and matte from laterites; sulfide smelting and converting; laterite pressure leaching and precipitation of intermediates; extractive metallurgy of cobalt from primary sources; re-leaching and solution purification; nickel recovery by electrowinning, hydrogen reduction, and carbonyl processing; and recycling of nickel and cobalt.

*Sponsored by the EPD*

## LEARN FROM THE BEST AT TMS2013 DISTINGUISHED LECTURES

TMS2013 attendees will walk away with perspectives that can only come from great achievement and leadership by attending any or all of the special lectures honoring some of the most accomplished professionals in materials science and engineering today. Event highlights confirmed at press time, include:



Horst Hahn

### Institute of Metals/Robert Franklin Mehl Lecture

**Horst Hahn**, Executive Director, Institute for Nanotechnology, Karlsruhe Institute of Technology

Hahn has had a deep and lasting impact in various research areas of physical metallurgy, leading to major theoretical and experimental advances. He is widely recognized for substantially shaping the science and technology of nanocrystalline metals and ceramics, while also successfully transferring this work to industrial use in such areas as sensors and energy materials in both North America and Europe. His specific research interests encompass the areas of synthesis, characterization, and functional properties of nanostructured materials in the form of thin films, nanoparticles, and bulk materials



Donald Sadoway

### EPD Distinguished Lecture Award

**Donald Sadoway**, John F. Elliott Professor of Materials Chemistry, Massachusetts Institute of Technology

Sadoway's research seeks to establish the scientific underpinnings for technologies that make efficient use of energy and natural resources in an environmentally sound manner. His contributions in the field of molten salt electrochemistry, particularly in the area of metals extraction, is considered groundbreaking.



Alex Zunger

### William Hume-Rothery Award

**Alex Zunger**, Professor, University of Colorado, Boulder

Zunger has made seminal contributions as a theorist working in the area of condensed matter and materials physics, including the development of theory methodologies that enabled prediction of a wide range of properties of solids, even before they were measured. His lecture will offer a retrospective on first principles alloy theory, covering the development of foundational "tools of the trade," through first-principles thermodynamics and computational discovery of new materials, in the areas of metal alloys, semiconductor alloys, and insulator alloys.

## Titanium: History, Science, Technology, and Applications

Instructor: F.H. (Sam) Froes, University of Idaho (Retired)

Offered in conjunction with the TMS2013 symposium, Cost Affordable Titanium IV, this program provides a comprehensive overview of the history, physical metallurgy, cor-



Sam Froes

rosion behavior, cost factors, and current and potential uses of titanium. Specific topics include non-Kroll extraction developments;

optimizing titanium properties, opportunities for cost reductions at various stages of titanium processing; and potential expansion of titanium applications in aerospace, as well as other industries.

*Sponsored by the SMD*

## Introduction to Integrated Computational Materials Engineering (ICME)

Instructor: David Furrer, Pratt & Whitney

Developed as a collaborative effort of TMS and ASM International, this short course offers a primer on the various types of models and simulation methods involved in ICME. It is

aimed at providing a general understanding of the critical issues relative to ICME, with the goal of increasing participants' knowledge of materials and process modeling capabilities and limitations. Linking materials models with process models, and subsequently to component design and behavior analysis models, will be an emphasis area.

*Sponsored by the Materials Processing & Manufacturing Division*

## 9th Annual TMS Lead-Free Solder and Interconnect Technology Workshop

Instructors to be announced.

Through presentations and extensive discussion regarding key topics, this popular workshop will provide a bridge between companies, academic research groups, national laboratories, and consortia that will lead to the materials science fundamentals necessary for further understanding and future industry applications. Specific topics will include reliability in consumer electronics, future directors in new solder alloy compositions, and solder and interconnects in extreme environments.

*Sponsored by the Electronic, Magnetic & Photonic Materials Division*



## MATERIALS INNOVATION PROGRAMS SHOWCASE GREAT IDEAS IN ACTION

Facilitating the communication and collaboration necessary for the development of an effective materials innovation infrastructure supporting the many facets of the materials science and engineering enterprise is the focus of programming being developed for TMS2013 as part of the Materials Innovation @ TMS initiative.

The signature event of this effort—and TMS2013 in general—is the *Acta Materialia* Materials and Society Award Special Symposium: Global R&D Trends—Implications for Material Sciences. Set for Tuesday, March 5, from 2–5 p.m. in the Lila Cockrell Theater, the symposium will feature recognized thought leaders examining the connections between fundamental research and the advancement of new materials technologies in a dynamic global economy. The symposium is being organized in honor of Jeffrey Wadsworth, president and chief executive officer, Battelle Memorial Institute, and the 2013 winner of the *Acta Materialia* Materials and Society Award. (For additional details, read the feature, “Materials Science Thought Leaders Examine Global R&D Trends,” in this issue of *JOM*.)

In addition, the TMS Materials Innovation Committee is organizing an afternoon plenary for Wednesday, March 6, to explore the topic, Innovation in Materials and Manufacturing for Advanced Energy. Following this will be the Federal Funding Workshop, sponsored by the TMS Public & Governmental Affairs Committee. The 2013 workshop will provide an overview of key funding opportunities that support materials innovation concepts, as well as offer a chance to network with funding officers. Also, be sure to visit the Materials Innovation Learning Center, designed as a focal point of the TMS2013 Exhibition.

For updates on Materials Innovation @ TMS learning opportunities at TMS2013, visit the TMS2013 website at <http://www.tms.org/tms2013>.



Materials Innovation @ TMS activities for TMS2013 will build on successful programming from last year, including a networking reception with federal funding officers (above) and a special plenary focused on materials innovation and manufacturing (right).

