

# TMS 2014

**143<sup>rd</sup> Annual Meeting & Exhibition**

*February 16-20, 2014 • San Diego Convention Center  
San Diego, California, USA*



## **PROGRAM PREVIEW**

*Linking Science and Technology  
for Global Solutions*



**Register online at [www.tms.org/TMS2014](http://www.tms.org/TMS2014)**



## REGISTRATION AND HOUSING

### JOIN US AT TMS2014!

More than 4,000 scientists and engineers from the minerals, metals, and materials community will gather at the TMS 2014 Annual Meeting & Exhibition in February. Will you be there? With its annual meeting, The Minerals, Metals & Materials Society (TMS) provides a forum where experts in a variety of fields can share research, network, and grow professionally.

### WHO ATTENDS

Scientists and engineers working in industry, academia, and government from nearly 70 countries attend TMS Annual Meetings each year. They represent all areas of the minerals, metals, and materials community and all phases of career development, from students and young professionals to experienced professionals and retired experts.

### WHAT YOUR REGISTRATION PACKAGE INCLUDES

By registering for TMS2014, you'll receive access to:

- Nearly 4,000 technical presentations delivered at 70 symposia
- A three-day pass to the TMS2014 Exhibit
- Networking Meeting of the Membership
- President's Welcome Reception
- Exhibit Hall Happy Hour
- Featured keynotes, honorary symposia, special award lectures, and all poster sessions
- Electronic access to the complete collected proceedings
- 2014 TMS-AIME Awards Ceremony

### HOW TO REGISTER

Register by **January 17** to receive the discounted advance registration rate. Online registration, as well as printable registration forms, are available at [www.tms.org/tms2014](http://www.tms.org/tms2014).

### REGISTRATION FEES

Type	Before January 17	After January 17
Member	\$595	\$730
Nonmember Presenter*	\$745	\$880
Nonmember*	\$780	\$915
Senior Member	\$425	\$560
Student Member	\$100	\$125
Student Nonmember*	\$130	\$155
Daily Registration Member	\$415	\$470
Daily Registration Nonmember *	\$460	\$515
Exhibitor Daily	\$50	\$50

\* Register as a nonmember and your registration will include 2014 membership in The Minerals, Metals & Materials Society. For students, registration will include 2014 Material Advantage membership.

### ABOUT PROCEEDINGS

All attendees who register for the full meeting will receive free online access to the complete published proceedings collection. Pre-registered attendees will receive access to the proceedings approximately one week prior to the event. Attendees will have the option to purchase a DVD of the collected proceedings for an additional \$25 through the TMS2014 registration form.

### RESERVE A HOTEL ROOM

The San Diego Marriott Marquis & Marina is the headquarters hotel for TMS2014. This hotel provides convenient access to the adjacent San Diego Convention Center and will host a number of meeting events. In addition, TMS has reserved rooms at eight additional San Diego hotels: Embassy Suites San Diego Bay; Hampton Inn San Diego Downtown; Hard Rock Hotel San Diego; Hilton San Diego Gaslamp Quarter; Horton Grand Hotel; Omni San Diego Hotel; Westin Gaslamp Quarter; and Wyndham Bayside (Holiday Inn on the Bay).

Book a hotel room for your stay through Travel Planners, the official TMS2014 reservation service, at [www.tms.org/tms2014](http://www.tms.org/tms2014). To ensure the best rates, reserve your room by January 14, 2014. To guarantee a room at your first-choice hotel, however, reserve a room today.







**TECHNICAL PROGRAM**



The TMS 2014 Annual Meeting will present nearly 70 symposia covering a broad range of topics related to minerals, metals, and materials. More than 370 technical sessions have been developed from nearly 4,000 abstracts, organized within the following 11 technical topic tracks:

- Advanced Materials
- Advances in Mechanical Behavior and Characterization
- Advances in Processing and Fabrication
- Biomaterials and Biological Materials
- Computational Modeling and Simulation
- Extraction and Processing
- Light Metals
- Materials for Energy and Sustainability
- Nanomaterials
- Nuclear Materials
- Phase Formations, Transformations, and Stability in Advanced Materials

**SESSION SPOTLIGHTS**

**Materials Science of Shipwrecks**

*Sponsored by the TMS Structural Materials Division*



**Structural Materials Division Luncheon Lecture**

Speaker: **Gerhard Fuchs**, Associate Professor, University of Florida

With the Structural Materials Division (SMD) Luncheon Lecture as its centerpiece, the SMD will present a one-day session examining the materials science of salvage operations, highlighting work on historically significant shipwrecks. In his luncheon lecture, symposium organizer Gerhard Fuchs of the University of Florida will expand on the popular August 2013 *JOM* article, "Cold War Thriller Brings Classroom Theory to Life." The focus of Fuchs's talk is Project Azorian, a real-life espionage tale of a lost Soviet nuclear submarine and one of the most ambitious covert engineering feats of the modern age, made even more complicated by a metallurgical failure. Immediately following the luncheon will be a special showing of the theatrical documentary, *Azorian: The Raising of the K-129*. Kicking off this exploration of ghost ship myth and metallurgy will be The Materials Science of Shipwrecks, a morning session that will feature talks

from experts on the materials and metallurgical issues associated with some of history's most notorious nautical disasters.

The symposium, documentary screening, and Fuchs's lecture are open to all TMS2014 attendees. Tickets must be purchased in advance through the TMS2014 registration form for the luncheon. This \$35 cost includes reserved table seating and a catered lunch.

**Innovation in the Aluminum Industry Supply Chain – How Will We Move on to the Next S Curve?**

*Organized by Barry Sadler, Net Carbon Consulting*

Over several decades, research and development within the aluminum industry has suffered from factors such as cost cutting and "rationalization" following company mergers and take-overs. This leads to a question: How will the industry support the work required to move on to the next innovation S curve? In other words, how do we get to the critical mass of R&D required to achieve the breakthroughs that can lift industry environmental and energy efficiency performance to that required to maximize future growth potential? Relevant to this are issues such as: Who will do the work? What are the possible funding models? What are the roles for international cooperation and government funding? In the plenary session, senior speakers from industry and academia will explore these topics from their various perspectives, including insight from another comparative metals industry. These presentations will then be followed by a panel discussion.

**HONORARY SYMPOSIA**

**A Lifetime of Experience with Titanium Alloys: A Structural Materials Division Symposium in Honor of Jim Williams, Mike Loretto and Rod Boyer**

The successful and widespread industrial use of titanium alloys may be traced in large part to the significant contributions these three gentlemen have made to the field of titanium metallurgy. Their careers spanned several decades in academia and industry where they served as mentors, organizers, advisors, managers, distinguished fellows, directors, and presidents. The first talk of each morning in this three-day, six-session symposium will feature an invited speaker highlighting the lifetime and achievements of each honoree.



*Jim Williams, Mike Loretto and Rod Boyer*



## PROGRAMMING HIGHLIGHTS (CONT.)



### **Celebrating the Megascale:** *An Extraction & Processing Division Symposium in Honor of David G.C. Robertson*

At a time when maintaining metals production is increasingly important to modern society, producers face the challenge of remaining profitable within an unpredictable global economy, while minimizing environmental impact and energy consumption. Economies of scale are becoming increasingly important in this setting, leading to larger and larger plants – some reaching the megascale – and requiring the support of highly skilled professionals. Professor David G.C. Robertson has devoted his career to the education of highly skilled metallurgical professionals and to the engineering of all types and sizes of metallurgical processes, particularly those involving molten metals. His research has focused on transport phenomena of smelting, refining, and solidification processes, particularly mass transfer, kinetics, and fluid dynamics.



### **Dynamic Behavior of Materials VI:** *A Structural Materials Division Symposium in Honor of Professor Marc Meyers*

The dynamic behavior of materials encompasses a broad range of phenomena associated with extreme environment and with relevance to technological applications in military and civilian sectors. The field of dynamic behavior of materials comprises diverse phenomena such as deformation, fracture, fragmentation, shear localization, damage dissipation, chemical reactions under extreme conditions, and processing (combustion synthesis; shock compaction; explosive welding and fabrication; shock and shear synthesis of novel materials). It has evolved considerably and is now at a stage where its significance to all classes of materials including metals, ceramics, polymers, and composites is becoming relevant.



### **Progress Towards Rational Materials Design in the Three Decades Since the Invention of the Embedded Atom Method:** *A Materials Processing & Manufacturing Division Symposium in Honor of Dr. Michael I. Baskes*

This symposium will honor the remarkable contributions of Michael I. Baskes to the field of computational materials science. Along his career Baskes has pioneered the theoretical and numerical development of models of materials behavior, with emphasis on the role played by atomistic defects on the anisotropic behavior of engineering materials. His many contributions have been critical to establishing a strong connection between models and experiments, and to bridging different scales in the pursuit of robust multiscale models with experimental integration.

## DIVISION LUNCHEON LECTURES



All attendees are welcome to attend these lectures. Tickets for the catered luncheon can be purchased for \$35 through the TMS2014 meeting registration form.



### **Extraction & Processing Division/ Materials Processing & Manufacturing Division Joint Luncheon Lecture**

Speaker: **John Allison**, Professor, Materials Science and Engineering, University of Michigan



### **Light Metals Division Luncheon Speaker**

Speaker: **William Joost**, Technology Development Manager, Lightweight Materials, Vehicle Technologies Office, U.S. Department of Energy  
Lecture Title: *"Connecting the Science and Engineering of Vehicle Weight Reduction"*

## AWARD LECTURES



### **2014 William Hume-Rothery Award Lecture**

Speaker: **Rainer Schmidfetzner**, Clausthal University of Technology  
Lecture Title: *"Phase Diagrams - the Beginning of Wisdom"*



### **Extraction & Processing Division Distinguished Lecturer**

Speaker: **Brajendra Mishra**, Colorado School of Mines  
Lecture Title: *"How Critical Is Recycling for Critical Materials' Sustainability?"*



### **Institute of Metals/ Robert Franklin Mehl Award**

Speaker: **Jagdish Narayan**, North Carolina State University  
Lecture Title: *"Frontiers in Thin Film Epitaxy and Novel Nanostructured Materials"*





## NETWORKING SESSIONS

### Networking Meeting of the Membership

Join your TMS colleagues and the officers of the society for an informal opening reception, designed to provide an opportunity for networking with other attendees on the first night of the meeting. Food and drinks will be provided, and participants will have the opportunity to learn about the progress the society has made in the past year, as well as preview plans for the future. While there is no cost to attend, TMS requests that participants sign up for this event on the meeting registration form.

### President's Welcoming Reception

All attendees are invited to meet in the exhibit hall on Monday evening for appetizers, beverages, and networking with exhibitors and other colleagues.

### Women in Science Breakfast

**Cost: \$25 Professionals; \$15 Students**

Organized by the TMS Women in Science Committee, this annual event offers an opportunity to network and discuss issues specific to women in the science and engineering professions.

### Speed Networking & Luncheon



**Cost: \$20 donation to the TMS Foundation**

Significantly enhance your meeting experience with this structured networking event. A match-making system identifies mutually beneficial and knowledge-building relationships among professionals.

### Exhibit Hall Happy Hour

All attendees are invited to gather in the exhibit hall on Tuesday for appetizers, beverages, and networking with exhibitors and other colleagues.

### Why Scientists Are Needed In Policy Making: A Face-to-Face with Congressional Fellows

Meet with TMS/MRS Congressional Science and Engineering Fellows at the TMS Information Center in the exhibit hall. Fellows will be on hand to discuss why policy often requires scientific knowledge to be effective. They will share their experiences of being at the interface between technology, policy, and application in Washington, D.C. and explain why a Congressional Fellowship might be beneficial to your career.

## 2014 TMS-AIME Awards Ceremony and Banquet



The 2014 TMS-AIME Awards Ceremony and Banquet is designed to honor significant professional achievements in minerals, metals, and materials. All meeting attendees are welcome at the ceremony. To attend the banquet, however, you must purchase tickets in advance through the TMS2014 registration form. Tickets are \$95 per person and include admission to the cocktail reception, awards presentations, and three-course dinner with wine and dessert. Dinner guests will also be treated to live entertainment from Scottish fiddle legend Alasdair Fraser and cello ace Natalie Haas.

## FOR YOUNG PROFESSIONALS

The following activities at TMS2014 are specially designed for professionals aged 40 and under.

### Young Professional Luncheon Lecture



Speakers: **Daniel Gianola**, Assistant Professor, University of Pennsylvania, and **Michele Manuel**, Assistant Professor, University of Florida

The Young Professional Luncheon Lecture is open to all meeting attendees. An optional boxed lunch can be purchased for \$48 through the meeting registration form.

### Technical Division Young Professional Poster Contest

Young professionals are invited to submit posters related to each of the five TMS technical divisions. To participate, submit an abstract by November 15, 2013, through the TMS2014 website.

### Meet the Candidate Employment Poster Session

Organized by the TMS Young Leaders Committee, this session allows young professionals to connect with potential employers for post-doctoral, full-time, or faculty positions. Candidates present posters on their qualifications and research interests to potential employers from universities, industries, and national labs.

### Young Professional Happy Hour Reception

Young professionals can network with more experienced TMS members in a relaxed, social atmosphere.



## EVENTS AND ACTIVITIES (CONT.)

### FOR STUDENTS

The following activities are designed specifically for undergraduate and graduate student attendees.

#### TMS2014 Materials Bowl



Students can compete in this materials-themed quiz-show competition, with cash prizes for the winning teams. To enter a team in the competition, apply by December 1, 2013, through the TMS2014 website.

#### Student Poster Contest

Undergraduate and graduate students are invited to submit posters related to each of the five TMS technical divisions. To participate, submit an abstract by November 15, 2013, through the TMS2014 website.

#### Student Mixer

This informal social event allows students to interact with each other and with professional members in a relaxed—and fun—setting. Refreshments are provided. Dancing is optional.

#### Career Forum

This session will feature speakers from various stages of their careers and diverse backgrounds to discuss how to navigate a successful career path.

### TECHNICAL TOUR

#### Quantum Design Manufacturing Facility Tour



#### Cost: \$25 per person

During this one-hour tour, visitors will see Quantum Design's manufacturing and testing facilities, applications laboratory, and newly completed, whole-building, high-pressure helium recovery and liquefaction system. Quantum Design is a privately held corporation that develops and markets automated temperature and magnetic field testing platforms for materials characterization. These systems offer a variety of measurement capabilities and

are in widespread use in the fields of physics, chemistry, biotechnology, materials science, and nanotechnology. Reserve your place in the tour through the TMS2014 meeting registration form.

### TMS2014 EXHIBIT



The TMS2014 Exhibition is a showcase for the latest products, technologies and services in the materials field. To date, more than 70 companies have purchased booths in the TMS2014 Exhibit Hall. All TMS2014 meeting registrants have access to the social events, networking opportunities, and product and service displays available at the exhibition. Spots are still available for exhibiting companies. Visit the TMS2014 website for details on how to join the exhibition.

#### COMIC-tanium: The Super Materials of the Super Heroes



At the TMS2014 Exhibition, the society will debut COMIC-tanium, a museum-quality retrospective of the “super materials of the superheroes.” Developed as a fun, interactive educational experience—of interest to anyone who has ever read a comic book, watched a superhero movie, or wondered at the possibilities of materials technology—COMIC-tanium will be open to all meeting attendees and will be a focal point of the TMS2014 Exhibit Hall.

Following the annual meeting, this traveling exhibit will tour the country, bringing real-life minerals, metals, and materials science and engineering to the public in a fun and interesting way. COMIC-tanium is a major outreach initiative of the TMS Foundation and the Toonseum of Pittsburgh, one of only two museums in the United States dedicated to the cartoon arts.

On Wednesday, February 19, children 18 and under may visit the exhibit hall (accompanied by a parent) to view the COMIC-tanium exhibit from 10:00 a.m. to 11:00 a.m.



Learn a new skill or take an in-depth look at a particular topic with workshops, tutorials, and short courses held in conjunction with the TMS 2014 Annual Meeting & Exhibition. All courses take place on Sunday, February 16. Attending a continuing education course will not conflict with other meeting programming, so begin your week with a high-quality educational experience.

## **10th Annual Lead Free Solder and Interconnect Technology Workshop**

This workshop will provide a bridge between companies, academic research groups, national laboratories, and consortia and will lead to the materials science fundamentals necessary for further understanding and future industry applications.

## **Fundamentals of Friction Stir Welding and Processing**

The goal of this course is to provide participants with the essence of the accumulated Friction Stir Welding/Friction Stir Processing knowledge: both fundamental and practical.

## **Furnace Systems Technology Workshop**

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

## **Grain Refinement of Aluminum and Magnesium Alloys: Theory and Practice**

This course provides knowledge about the grain refinement mechanisms, the different types of grain refiners, the grain refinement treatment process and the methods for the determination of the grain refinement result, i.e. the grain size, to achieve efficient grain refinement.

## **Incorporating Life Cycle Assessment in Operational Decision-Making**

This course will provide participants an introduction to life cycle assessment approaches, an introduction to the ISO Standards and other guidance related to performing life cycle assessment (LCA) studies, an overview of available software tools and datasets, and an example calculation using the OpenLCA software package, as well as case studies and application of LCA in mining, mineral processing, and metal production.

## **Neutron and X-Rays: Tutorial on Sources, Instrumentation, and Scattering**

This two-part tutorial will review neutrons and X-rays, including sources, instrumentation, theories of scattering and diffraction, concept of reciprocal space, Ewald construction, dynamic and kinematic theory, limit to small crystals, nanocrystals, and lattice gradients.

## **Pot Ventilation & Dry Scrubbing Operations for Aluminum Smelters**

This course will focus on the operation of pot ventilation and dry scrubbers in the primary aluminium smelting industry, covering fundamentals/theory of operations, key performance indicators, best practices, and upcoming advancements in technology.

## **Proper Anode Baking Furnace Operations: How and Why**

This course will teach how open top ring furnace(s) should be operated to bake anodes properly and avoid potential issues such as dusting, cracking, airburning, and soft butts, while minimizing fuel consumption.

## **Radiation Effects in Oxide Ceramics and Novel LWR Fuels**

This course will introduce radiation effects in a wide range of oxide ceramics such as uranium dioxide, CeO<sub>2</sub>, and other fluorite derivatives, and model oxides such as MgO and various spinel compounds.

## **Sustainability and Mineral Resources**

This course will examine the development of the concept of sustainability, particularly its environmental aspects, and how the minerals industry is responding to the challenges posed by sustainability.

## **Theory of Constraints: Tools and Tactics for Creating Business Value in Aluminum Smelters and Other Process Industries**

Using a factory simulation based on an aluminum smelter, this course introduces, examines, and tests the principles and tactics of Theory of Constraints.

Register for any of these courses through the TMS2014 meeting registration form at [www.tms.org/tms2014](http://www.tms.org/tms2014).



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## PROGRAM PREVIEW



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- Nearly 4,000 presentations on a broad range of technical topics
- A vibrant exhibition of products and services, including the new exhibit, COMIC-tanium: The Super Materials of the Super Heroes
- Special presentations delivered by leaders in the field
- A broad selection of continuing education courses
- Multiple networking opportunities

**Join your peers in the  
minerals, metals, and materials  
community at TMS2014 for:**

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[www.tms.org](http://www.tms.org)

# TMS

