

Frontiers of Materials Research: A Decadal Survey

TMS2019 featured a special session on *Frontiers of Materials Research: A Decadal Survey*, a new consensus study report released by the U.S. National Academies of Sciences, Engineering, and Medicine. The report was written by a committee of materials scientists and engineers that included 2018 TMS President Kevin Hemker and several TMS members. The study was focused on the development

of materials research (MR) over the past decade and covered topics such as MR fields that could be supported by other disciplines and international trends in MR.

The session opened with an overview of the study by Hemker, who said “it’s been a remarkable paradigm change in advances that have been made in materials research over the past decade.” Hemker attributed much of this shift to advances in computation that have enabled modeling, simulation, and advanced manufacturing.

The panel was moderated by Steven Zinkle, University of Tennessee, and featured (pictured, from left) Ian Robertson, University of Wisconsin; Linda Horton, Department of Energy; Susan Sinnott, Pennsylvania State University; Linda Sapochak, National Science Foundation; and Mark Weaver, University of Alabama, as panelists. The study is available for free download from the National Academies Press at www.nap.edu/25244.



REWAS 2019 Plenary Session

The REWAS 2019 symposium, held as a co-located event with TMS2019, featured a plenary session of seven invited speakers who examined the symposium’s theme of Manufacturing the Circular Materials Economy from a variety of viewpoints.

Toru Okabe, vice president of the University of Tokyo, opened the symposium with a discussion on recycling of critical metals. “When I started my career, no one recognized the importance of smelting or recycling these specialty metals,” said Okabe. “Now everyone does.”

In his talk, David Waggoner, Institute of Scrap Recycling Industries (ISRI), noted that currently a very small

percentage of rare earth materials are recycled. “We need to make them easier to extract if we want to recycle them.”

Ben Jones, a market analyst at CRU International Limited, looked at supply chains for battery materials from the investment side of the issue. The low-carbon transition is happening, he said, and will require new technologies. “Growth means investment, so we need new dollars in these markets,” he said.

Additional talks looked at aluminum recycling, new processes for metals recycling, and the challenges of the circular economy, tying together the main themes of the REWAS symposium.



Pictured are REWAS 2019 organizers and plenary presenters (from left to right): Neale Neelameggham, IND LLC; Camille Fleuriault, Gopher Resource; Toru Okabe, University of Tokyo; Ramana Reddy, the University of Alabama; Adam Powell, Worcester Polytechnic Institute; David Waggoner, Institute of Scrap Recycling Industries, Inc.; Ben Jones, CRU International Limited; Elsa Olivetti, Massachusetts Institute of Technology; Chris Bayliss, International Aluminum Institute; Randolph Kirchain, Massachusetts Institute of Technology; Markus Reuter, Helmholtz-Institute Freiberg for Resource Technology; and Gabrielle Gaustad, Alfred University.



Callie Babbitt discusses a project from the Golisano Institute for Sustainability at the Rochester Institute of Technology that compiles data on a cumulative material footprint for electronic devices in average U.S. households at the REWAS plenary.

Luncheons Bring Divisions Together

Division luncheons offer TMS members the chance for a meal with colleagues working in fields closely related to their own and also provides the opportunity to bestow division-level awards, including scholarships, young leaders professional development awards, and scientific achievements. Each luncheon is topped off by a presentation from an invited speaker.



SMD Luncheon Lecture

Stephen M. Foiles, distinguished member of the technical staff at Sandia National Laboratories, posed the nontraditional questions about molecular dynamics (MD) during his Structural Materials Division (SMD) Luncheon lecture, “Molecular Dynamics: With Great Power Comes Great Responsibility,” on Monday, March 11.

“We’re going to predict stuff, but do we really believe it?” he asked, noting that people increasingly want to use MD to predict materials properties and fundamental atomic-scale mechanisms, but that as a field, “we need to quantify how accurate our predictions are.” Additionally, Foiles stated that the problem of quantification uncertainty within MD is a challenging one. “We need quantitative prediction with error bias,” he said, recalling a simple, yet troubling question once asked of him—“what are the error bars on your calculation?”

Foiles continued that if MD intends to become a predictive tool for making real impacts, not just a qualitative one, problems such as these need to be addressed. “It has always bugged me that as a field, we don’t know how to answer those questions. And as we become more relevant to the engineering field, we need to answer those questions.”

EPD/MPMD Luncheon Lecture

Toru Okabe, vice president of the University of Tokyo, delivered the talk “Recycling Precious Metals and Rare Metals from Scraps” at the TMS Extraction & Processing Division (EPD)/Materials Processing & Manufacturing Division (MPMD) Luncheon on Tuesday, March 12. In his talk, Okabe identified three bottlenecks to rare metal supplies: resource supply restrictions, technology restrictions, and environmental restrictions.

“Most people don’t know that serious environmental destruction occurs when mining or smelting,” said Okabe, who discussed the naturally occurring radioactive materials that can be produced in waste when extracting material from ore and the harmful byproducts produced when extracting useful elements, such as the arsenic that comes along with copper extraction.

Okabe is currently working on processes for recycling of rare earth metals, which don’t generate these types of harmful wastes. “When you factor in the value of nature and the cost of dealing with waste, recycling is less expensive than mining new materials,” said Okabe. “Harmful wastes generated from natural ore can be avoided by recycling.”

LMD Luncheon Lecture

Kevin Anderson, senior technical fellow in the Brunswick Corporation in the Mercury Marine Division, presented the featured lecture, “Technological Advancements on the Secondary Aluminum Industry,” during the Light Metals Division (LMD) Luncheon on Wednesday, March 13. During his talk, Anderson discussed the increasing role of secondary aluminum and reasons why it’s valuable to the economy, such as, weight reduction, cost reduction, energy savings, and better, more sustainable products.

While covering global themes and advancing technologies in secondary aluminum production, Anderson noted that “the old stereotypes of secondary having poor compositional control, poor metal quality, and inferior mechanical properties... those days are gone.” New technologies, he said, are being introduced to plants to eliminate the “old stereotypes” and produce aluminum that is “a highly recyclable, sustainable material with excellent properties.”

Recyclability is key, Anderson concluded, noting that educating every part of the value chain is an important step in this effort. “When you start to think about the design of a product, you also have to think about end of life,” he said. “It really all starts with design, and then everyone along the value chain has to pay attention.”

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TMS2019 HIGHLIGHTS: Plenary, Bladesmithing, Sessions, and More

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- 2040:** Thermally Activated Slip in Rare Earth Containing Mg-Mn-Ce Alloy, ME10, Compared with Traditional Mg-Al-Zn Alloy, AZ31: Vikaas Bajikar, Jishnu J. Bhattacharyya, Nathan Peterson, and Sean R. Agnew
- 2047:** Effects of Solute Atoms on 9R Phase Stabilization in High-Performance Al Alloys: A First-Principles Study: Zhipeng Wang, Qihong Fang, Touwen Fan, Dongchu Chen, Bin Liu, Feng Liu, Li Ma, and Pingying Tang
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