

Experts Identify ESSENTIAL READINGS IN MAGNESIUM

Kelly Zappas

For more than a decade, the TMS Magnesium Technology Symposium has offered a recognized forum for presenting the latest advances in a specialized, but significant, sector of the minerals, metals, and materials community. Now, five TMS volunteer members have sifted through the published proceedings of these symposia—more than 1,000 papers in all—to present the best of the best papers from the symposium's first 13 years, all in a single volume.

Essential Readings in Magnesium Technology, published by TMS and John Wiley & Sons in January, compiles papers hand-selected by subject-matter experts from the annual *Magnesium Technology* proceedings series.

TMS held the first Magnesium Technology Symposium at the 2000 TMS Annual Meeting & Exhibition in Nashville, Tennessee. A 56-paper proceedings volume was published in conjunction with the symposium, and a new tradition was born. In the 14 years since that first gathering, Magnesium Technology has evolved into one of the largest symposia held at the TMS Annual Meeting & Exhibition each year.

“Magnesium research and technology has seen a huge surge in the last decade, and this is evident in the expansion of the Magnesium Technology symposium and proceedings, which have grown

from approximately 50 presentations/papers in 2000, to more than 100 presentations/papers in 2012,” said

Suveen N. Mathaudhu, lead editor for the volume.

During that time, the focus of the research presented at the symposium has evolved and trends have shifted. All of this is captured in the *Essential Readings* collection.

“In 1999, the driver for increased use of magnesium was cost reduction,” said Eric Nyberg, who edited the *Magnesium Technology* proceedings from 2008 to 2010. “Today the concerns have less to do with cost and more to do with performance. Can you provide a lower density part, at or near the cost of other materials, while maintaining or improving performance? Magnesium technology, in general, has also accepted the need to become more environmentally friendly. Developments in low-emission primary production are now a recognizable concern and many advances have been achieved that significantly reduce the pollutants released. Similarly, methods to eliminate the use of sulfur hexafluoride (SF₆) greenhouse gas in processes involving molten magnesium have been realized.”

Taken as a whole, the papers

presented in *Essential Readings in Magnesium Technology* play an important role by offering a big-picture view of the magnesium industry—both of the technology's past and its future.

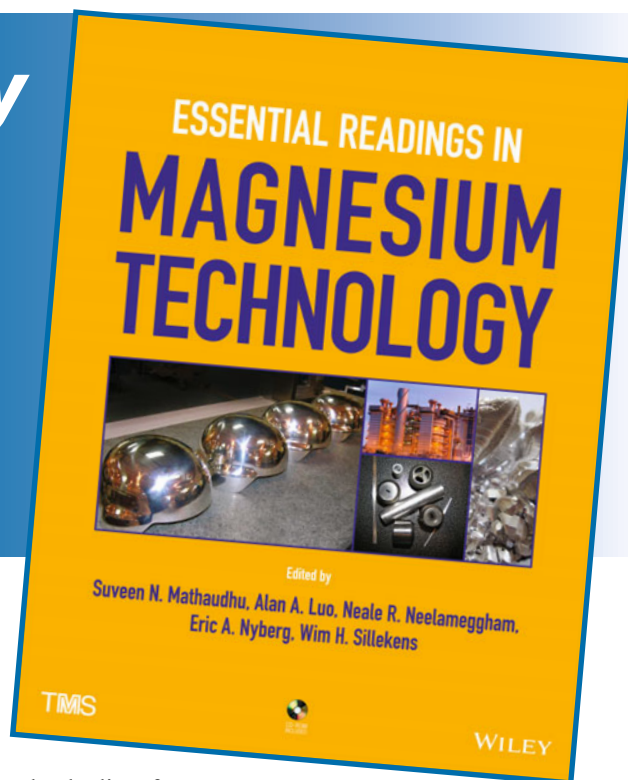
“Future trends have to have a basic understanding of past successes and failures,” said Neale R. Neelameggham, who edited the *Magnesium Technology* proceedings from 2006 to 2012. “This volume of *Essential Readings* is providing that opportunity.”

A Nine-Part Examination of Magnesium Technology

The volume is divided into nine sections—each one focusing on a different area of magnesium technology and each one introduced by a different editor. All of the editors selected for this volume have served as a Magnesium Technology symposium organizer and as editor of past *Magnesium Technology* proceedings.

Essential Readings presents papers in the following nine subject areas:

- Magnesium Technology History and Overview





- Electrolytic and Thermal Primary Production
- Melting, Refining, Recycling, and Life-Cycle Analysis
- Casting and Solidification
- Alloy and Microstructural Design
- Wrought Processing
- Modeling and Simulation
- Joining
- Corrosion, Surface Treatment, and Coating

For more on the section editors and their comments on the development of specific technology areas, see the sidebar article, “Meet the Editors.”

Though each editor focused on different aspects of magnesium technology, they all seemed to agree that the process of editing the book was a learning experience in itself.

“Working on this volume enabled me to review the field from a somewhat different, wider perspective,” said Wim Sillekens, who edited the *Magnesium Technology* proceedings from 2010 to 2012.

For Mathaudhu, the process of editing the book was as educational for him as the editors hope it will be for readers.

“Being the lead editor, but also the youngest of the team of co-editors, it was inevitable that I would learn the history of the field as I was assembling the volume, whereas many of the co-editors have been studying magnesium alloys for decades,” said Mathaudhu. “This ‘new’ knowledge certainly gave me a renewed appreciation of the history and long-lasting implications of the Magnesium Technology symposium. I believe that whether a reader is new to the

field, or well-experienced, there will be something new and interesting to appreciate from the volume.”

What Makes a Paper “Essential Reading”?

The editorial team selected nearly 100 papers, carefully chosen from the more than 1,000 manuscripts published in *Magnesium Technology* between 2000 and 2012, for the volume. Because fewer than 10% of all papers were chosen, three criteria were identified that guided the selection of the papers:

- **General Relevance:** All papers selected as Best Paper Award winners for their years in the student and contributed categories were included, as these manuscripts represented the latest scientific breakthroughs. Many review papers that summarized the state-of-the-art in magnesium technology were also included.
- **Scientific Relevance:** The number of times a paper was cited was also used as a measure to indicate its ‘essential’ value. Highly cited papers were selected for inclusion in this volume.
- **Industrial Relevance:** Also included are Best Paper Award winners in application, a category that was added in 2007 to the student and contributed awards. These manuscripts were selected for inclusion because of their representation of leap-forward advances and novel demonstrations of industrial applications.

Looking to the Future

While the papers provide an in-depth look at past trends in the magnesium industry, they also offer a preview of what lies ahead. The volume’s editors believe that many of the papers presented in this volume will stay relevant far into the future because they deal with topics that are not likely to go away anytime soon.

“Everything will need to be lighter 50 years from now,” said Mathaudhu. “Many, if not most, of the selected manuscripts have some tie to necessary performance requirements in the transportation sector, whether it be strength, high-temperature resistance, formability, castability, or joining, among others. I believe that these papers will stand the test of time as demonstrations of the initial efforts to push magnesium alloys to the property spaces needed for rigorous transportation environments.”

How to Purchase

To purchase *Essential Readings in Magnesium Technology*, visit www.wiley.com or visit the Wiley booth at the TMS 2014 Annual Meeting & Exhibition, February 16 to 20 in San Diego. Remember that TMS members receive a 35% discount off the list price for this and all other products sold by John Wiley & Sons. Visit the Member Reading Room section of the TMS Members Only website (members.tms.org) to acquire the discount code.

Kelly Zappas is the TMS Communications Specialist.



Suveen N. Mathaudhu

Meet the Editors

Suveen N. Mathaudhu, Lead Editor

Affiliation: U.S. Army Research Office

Topic Areas:

Alloy and Microstructural Design
Wrought Processing

On how the volume will impact future study and development:

“I believe that future trends in magnesium alloy development will circulate around recent advancements in computing, and the advanced modeling this enables, as well as high-resolution, in-situ characterization studies. Unlike other metallic materials, such as ferrous alloys, that have been empirically developed over centuries, I believe magnesium alloys and processing strategies will be rapidly developed for specific applications based on computational and experimental tools which only recently have become available. The *Essential Readings* volume highlights many of the early efforts and approaches in these areas.”



Alan A. Luo

Alan A. Luo

Affiliation: The Ohio State University

Topic Areas:

Magnesium Technology History and Overview
Modeling and Simulation



Neale R. Neelameggham

Neale R. Neelameggham

Affiliation: IND LLC

Topic Areas:

Electrolytic and Thermal Primary Production
Melting, Refining, Recycling, and Life-Cycle Analysis

On papers that explore potentially innovative technologies:

“In the Production Technology section, I included a paper on vacuum aluminothermic reduction of magnesium oxide, which shows a method to minimize solid waste effluent, as having potential as an economically sustainable process which generates marketable products from most of its reactants.”



Eric A. Nyberg

Eric A. Nyberg

Affiliation: Pacific Northwest National Laboratory

Topic Area:

Joining

On key milestones in this topic area:

“Key milestones in the joining of magnesium have been the improved understanding of how galvanic reactions can be minimized through the use of solid state joining methods, such as friction stir welding. Being able to demonstrate that mechanical separation techniques are also excellent ways to integrate magnesium into dissimilar metal designs has been a key milestone. The *Corvette*'s magnesium engine cradle is a great example where significant weight savings has been realized through joint isolation.”



Wim H. Sillekens

Wim H. Sillekens

Affiliation: European Space Agency

Topic Areas:

Casting and Solidification
Corrosion, Surface Treatment, and Coating

On papers that will be considered benchmarks in the field:

“With the research community on magnesium technology being relatively small, I feel that it is not so much that particular papers stand out, but rather that certain people have made (and are making) their footprint that may stand the test of time.”

