# TABLE OF CONTENTS

## MAGNESIUM CASTING MARKET TRENDS

- **Charting a Course for Magnesium**  
  *Modern Casting, V95, N10, P 39-43, Oct 2005*

- **Magnesium Driving To Permanent Mold**  
  *Modern Casting, V95, N9, P 26-29, Sep 2005*

- **Magnesium Vision 2020: A North American Automotive Strategic Vision for Magnesium**  
  *Transactions of the American Foundry Society, V116, Paper 08-156, P827-839, 2008*

- **Magwerks, Aristocast Prove the Magic of Magnesium**  
  *Metal Casting Design & Purchasing, V14, N5, P30-33, Sept/Oct 2012*

- **Maintaining Competitiveness through Tech Development**  
  *Modern Casting, V96, N2, P41-44, Mar 2006*

## METALLURGY & MICROSTRUCTURE

- **A Microstructural and Mechanical Property Study of an AM50 HPDC Magnesium Alloy**  
  *International Journal of Metalcasting, V 6, II, P15-26, 2012*

- **A Study on Hot-Tear Resistance of Magnesium Diecasting Alloys**  
  *Transactions of the American Foundry Society, V114, Paper 06-092, P729-736, 2006*

- **Casting Characteristics of Permanent Mold Cast Mg-Alloy AZ91E**  
  *Transactions of the American Foundry Society, V110, Paper 02-122, P1181-1189, 2002*

- **Casting Fluidity of Magnesium Alloy AZ91 in Gravity and Low Pressure Casting**  
  *Transactions of the American Foundry Society, V114, Paper 06-107, P747-753, 2006*

- **Comparing Low Pressure and Gravity Permanent Mold Casting of Magnesium AZ91E**  
  *Transactions of the American Foundry Society, V119, Paper 11-002, P441-451, 2011*

- **Developing an Improved Zirconium Grain Refiner for Magnesium**  
  *Transactions of the American Foundry Society, V119, Paper 11-067, P453-459, 2011*
Effect of Aluminum-Titanium-Boron Based Grain Refiners on AZ91E Magnesium Alloy Grain Size and Microstructure

Effect of C2Cl6 on Mechanical Properties and Microstructure of Gravity Permanent Mold Cast AZ91E
Transactions of the American Foundry Society, V112, Paper 04-121, P995-1006, 2004

Effect of Ca Addition on Grain Microstructure Development of Mg Alloy AM60

Effect of Ca and Mn Additions on the Castability and Mechanical Properties of AZ91D Mg Alloy Permanent Mold Castings

Effect of Cooling Rate on Grain Size of Magnesium Alloys Cast in a Permanent Mold

Effect of Cooling Rate on the Microstructure of AZ31 Magnesium Alloy

Effect of Silicon on the Hot Tearing Susceptibility of AZ91E Magnesium Alloy

Electrical Resistivity and Thermal Conductivity of Magnesium Alloy AE42

Electrical Resistivity and Thermal Conductivity of Magnesium Alloy AZ91E by Contactless Measurement Technique

Evaluation of the Hot Tearing Susceptibility of Selected Magnesium Casting Alloys in Permanent Molds

Grain Refinement and Fading of Aluminum-Titanium-Boron Based Refiner on AZ91E Magnesium Alloy

Grain Refinement of AZ91E with TiB2 and Al4C3 Additions

Grain Refinement of Magnesium by Zirconium: Characterization and Analysis
Hardness and Yield Strength in Cast Mg-Al Alloys
*Transactions of the American Foundry Society, V110, Paper 02-001, P1163-1169, 2002*

Influence of Aging Time on the Tensile Properties of AZ91E Alloy Definition of a Quality Index
*Transactions of the American Foundry Society, V116, Paper 08-095, P785-793, 2008*

Influence of Calcium on the Castability, Microstructure and Mechanical Properties of Lost Foam Cast AE42 Magnesium Alloy

The Influence of Potential Grain Refiners on Magnesium Foundry Alloys
*Transactions of the American Foundry Society, V111, Paper 03-141, P1061-1075, 2003*

Influence of Silicon on the Microstructure and Mechanical Properties of Lost Foam Cast AE42 Magnesium Alloy
*Transactions of the American Foundry Society, V118, Paper 10-044, P331-338, 2010*

Microstructure Evolution of Cast Mg AZ31B Alloy at Low Superheat
*International Journal of Metalcasting, V7, I1, P 39-48, 2013*

Microstructure and Performance of Four Casting Processes for Magnesium Alloy AZ91

Modification of As-Cast Microstructure of AZ91-1Si Magnesium Alloy Using Al-5Ti-1B Master Alloy
*Transactions of the American Foundry Society, V118, Paper 10-070, P347-353, 2010*

Modification of Mg2Si Precipitates in Si Added AZ91 Magnesium Alloy
*Transactions of the American Foundry Society, V114, Paper 06-098, P737-746, 2006*

Observations on Fillability and Metal Velocity of AZ91E Magnesium Alloy Cast by the LFC Process
*Transactions of the American Foundry Society, V113, Paper 05-032, P857-866, 2005*

Optimization of an Aluminum Cylinder Head Alloy of the AlSi7Cu3MnMg Type Reinforced by Additions of Peritectic Elements

Precipitation During the Solidification of Mg-3wt%Al-1wt%Zn-(0.001-1%) Sr Alloys
*Transactions of the American Foundry Society, V113, Paper 10-114, P353-361, 2010*
Prediction of Hot Tear Formation in a Magnesium Alloy Permanent Mold Casting
*International Journal of Metalcasting, V2, II, P41-54, 2008*

Quality Index Charts for Sand-Cast Mg-Al and Mg-Zn Alloys
*Transactions of the American Foundry Society, V109, Paper 01-032, P1-8, 2001*

Real-Time Monitoring of Hot Tearing in AZ91E Magnesium Casting

Reconstruction, Visualization and Characterization of Three-Dimensional Microstructure of High Pressure Die-Cast AE44 Magnesium Alloy
*Transactions of the American Foundry Society, V114, Paper 06-088, P719-727, 2006*

Recycling and Degassing of AZ91E Magnesium Alloy Castings and Its Effects on Mechanical Properties and Microstructure
*Transactions of the American Foundry Society, V120, Paper 12-032, P423-429, 2012*

Reduction of Hot-Tears in Permanent Mold Casting of AZ91D Magnesium Alloy: Effect of Mold Temperature
*Transactions of the American Foundry Society, V116, Paper 08-109, P795-803, 2008*

Semisolid Microstructure of AZ91D Magnesium Alloy Refined by MgCo3
*International Journal of Metalcasting, Winter 2012*

Shrinkage Behavior of AM50, AM60 and AZ91D
*Transactions of the American Foundry Society, V113, Paper 05-028, P849-855, 2005*

Strain Rate as a Predictor of Hot Tearing in AZ 91 Magnesium Alloy
*Transactions of the American Foundry Society V121, Paper 13-1340, P467-473, 2013*

Thermal Gradient Needed for Soundness during Solidification of Various Magnesium Alloys Including AZ91E, AM50, AM60, ZE41 and MRI230D
*Transactions of the American Foundry Society, V114, Paper 06-017, P 683-694, 2006*

Thermophysical properties of Magnesium Alloys AE42, AJ52xand AM60B
*Transactions of the American Foundry Society, V111, Paper 03-098, P1031-1051, 2003*
CASTING PROCESS DEVELOPMENTS

Comparison of Gas Evolution Results from Chemically Bonded Cores In Contact with Magnesium and Aluminum Melts

Comparison of Lost Foam Casting of AM60B Alloy and A356 Alloy

Comparing Low Pressure Permanent Mold Casting of Magnesium AZ91E and Aluminum A356

Conversion of a Machined Aluminum 6061 Housing to a Magnesium AZ91E Sand Casting

Design and V-Process Production of Cast Magnesium Component
Transactions of the American Foundry Society, V113, Paper 05-051, P879-886, 2005

Determination of Optimal Vacuum Condition for Defect-Free Casting of AZ91 and A356 Alloys via the LFC Process

Development of New Coating for Magnesium Permanent Mold Casting
Transactions of the American Foundry Society, V112, Paper 04-094, P971-983, 2004

Effect of EPS Bead Fusion on the Fillability of AZ91D Mg Alloy LFCs

Effect of Processing Parameters on Mold Filling in Magnesium Alloy EPC Process
Transactions of the American Foundry Society, V109, Paper 01-014, P1-14, 2001

Effects of Solid Fraction and Operating Pressure on the Heat Transfer Coefficient at the Casting/Mold Interface for AZ91D Magnesium Alloy
Transactions of the American Foundry Society, V113, Paper 05-150, P 901-910, 2005

Experience in Casting Magnesium AE44 in Sand and Permanent Molds

First V-Process Casting of Magnesium
Hot Core Distortion Studies during Magnesium Casting
Transactions of the American Foundry Society, V113, Paper 05-032, P867-878, 2005

Hot Tearing in Magnesium AZ91E Bell Housings Produced by the Low Pressure Permanent Mold Process
Transactions of the American Foundry Society, V120, Paper 12-022, P415-422, 2012

Influence of Mold and Pouring Temperatures on Hot Tearing Susceptibility of AZ91D Magnesium Alloy.

Lost Foam Casting of Magnesium Alloys AZ91D and AM50

Low Pressure Casting Process Simulation and Tooling Design for HIMAC’s Magnesium Automotive Control Arm

Low Pressure Casting of Magnesium Alloys AZ91 and AM50

Low Pressure Die Casting of AZ91 and AM50 Magnesium Alloys

Magnesium Casting Process Development: Designing an Engine Cradle for Magnesium Semi-Permanent Mold Casting
Transactions of the American Foundry Society, V113, Paper 05-217, P911-924, 2005

Mould Coatings for Magnesium Permanent Mould Casting

New High-Yield, High-Integrity, Magnesium Permanent Mold Casting Process

Numerical Simulation and Process Development for Low Pressure Diecasting of Magnesium Alloy Wheels

Permanent Mold Casting of Magnesium AZ91E vs. Aluminum A356

Process Development and Characterization of Overcasting Systems
Production of Magnesium Thin-Wall Cellular Castings through Lost Foam Casting

Selection and Application of Permanent Mold Coatings for Magnesium Casting

Simulation Case Histories: Solving Problems While Optimizing Processes
Modern Casting V 91 N 8 P 34-36, Aug 2001

Structural Cast Magnesium Engine Cradle

Ultrasonic Cavitation Based Solidification Processing of Bulk Mg Matrix Nanocomposite

Vacuum Assisted Lost Foam Casting of Magnesium Alloy AZ91E
Magnesium is about 30 % lighter than aluminum (and 60% lighter than steel). Magnesium alloy metal castings can be produced with less weight but comparable strength as aluminum alloy castings. Optimized casting designs can reduce this weight savings even further. This impressive strength to weight ratio is one of magnesium’s greatest benefits as a material for automobiles, trucks, military, aerospace and commercial applications.

Interest in magnesium alloy casting technologies has grown significantly in this decade. Driven primarily by the desire to reduce weight in automotive vehicles (with the subsequent benefit of reduced emissions), the amount of magnesium components in passenger vehicles in the US market has increased to approximately 10 lbs. by 2005 and is forecast to increase to as much as 350 lbs by 2020. In addition to this growing automotive market—produced primarily through high pressure die casting (HPDC)—there remains a strong market for sand cast military and aerospace components, power tools, sporting goods and other commercial castings.

Yet for all this growth, barriers still inhibit the application of magnesium castings. Unstable world wide magnesium prices and U.S. trade tariffs have caused interest in magnesium to wane, and lack of large scale applications in the past resulted in limited research and development activities. Additional limitations include: high cost tooling and inconsistent HPDC functional properties; few alternative casting processes other than HPDC; corrosion and joining issues; lack of enabling infrastructure and science; need for improved magnesium recycling technologies, and the need for additional alloy development. These barriers and others are being addressed through research and development activities lead by the American Foundry Society Magnesium Division and its foundry, academic and research partners. It is our hope that the ongoing developments of these dedicated individuals and groups will lead to sustainable growth for cast magnesium far into the future.

Steve Robison
Senior Technical Director
American Foundry Society
PREFACE

This compilation contains papers that were previously published from 2001 though 2013 in the Transactions of the American Foundry Society, volumes 109-121. Articles from Modern Casting magazine, Metalcasting Design & Purchasing magazine, and the International Journal of Metalcasting were also included.

For more information on this and other metalcasting topics, visit the AFS library, http://www.afslibrary.com.

ACKNOWLEDGMENTS

Special thanks to Sue Thomas and Katie Matticks for gathering the papers and articles used in this compilation.