



119th Metalcasting Congress Programme

Monday, April 20, 2015

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1:00 PM-4:30 PM

BONUS AFS Additive Manufacturing Workshop - "Printing Your Future in 3D"

Tuesday, April 21, 2015

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7:00 AM-8:00 AM

Author/Chair Breakfast

8:00 AM-9:30 AM

Copper Alloy

Proper Sand Control for Copper Base Alloys (Panel 15-105)

Victor LaFay, IMERYS, Cincinnati, OH

Mark Adamovits, ASK Chemicals, Dublin, OH

Mike Galvin, Buck Co Inc, Quarryville, PA

Melting Methods & Materials

Case Studies on Coreless Furnace Cold Start Procedures to Help Efficiency & Prevent Lining Penetration (Panel 15-110)

Eric Nelson, Dotson Foundry, Mankato, MN

John Oneson, Kohler Co., Kohler, WI

Molding Methods & Materials

Silver Anniversary: Productivity and Ecology Considerations of High Production Cold Box Processes (15-096)

James Archibald, ASK Chemicals L.P., Dublin, OH

Loss on Ignition Using IR (15-092)

Benjamin Binoniemi, Western Michigan University, Kalamazoo, MI

Sam Ramrattan, Professor, Western Michigan University, Kalamazoo, MI

Lost Foam Casting

Using Modeling for Lost Foam Process Improvement (15-168)

Harry Littleton, Alchemcast, Warrior, AL

Lost Foam Investment Casting (15-162)

Brad Skirten, Wescast Industries Inc., Stratford, ON, Canada

9:45 AM-11:15 AM

Cast Iron

Roundtable Discussion - Defects, the Never-Ending Battle (Panel 15-103)

Josh Keller, Bremen Castings Inc, Bremen, IN

Brandon Reneau, Caterpillar, Mapleton, IL

Lizeth Medina-Alatorre, Neenah Enterprises, Inc., Neenah, WI

Ray Staral, Dura-Bar, Woodstock, IL

Kevin Lucas, Goulds Pumps-Itt Industries, Seneca Falls, NY

Andrew Adams, Foseco, Cleveland, OH

Copper Alloy

Refractories for Copper Base Alloys (Panel 15-106)

Peter Satre, Allied Mineral Products Inc, Columbus, OH

Pete Quigley, Quigley Crucible R & S Co Inc., Bridgeport, PA

Jeff Gaber, A Y McDonald Mfg Co, Dubuque, IA

Robert Hornsby, Neptune Technology Group Inc., Tallassee, AL

Molding Methods & Materials

Dynamic Testing of Green Sand (15-091)

Sam Ramrattan, Professor, Western Michigan University, Kalamazoo, MI

Mo Khoshgoftar, Western Michigan University, Kalamazoo, MI

Hiroyasu Makino, Sintokogio Ltd, Aichi, Japan

Low Thermal Diffusivity Investment Casting Molds Using Cenospheres (15-071)

Mingzhi Xu, Missouri University of Science and Technology, Rolla, MO

Simon Lekakh, Department of Materials Science and Engineering, Missouri University of Science and Technology, Rolla, MO

Von Richards, Department of Materials Science and Engineering, Missouri University of Science and Technology, Rolla, MO

Thermal Degradation Kinetics of Epoxy Stereolithography Pattern for Investment Casting Process (15-084)

Hongfang Zhao, Department of Chemistry, Missouri University of Science and Technology, Rolla, MO

Paul Nam, Department of Chemistry, Missouri University of Science and Technology, Rolla, MO

Von Richards, Department of Materials Science and Engineering, Missouri University of Science and Technology, Rolla, MO

Simon Lekakh, Department of Materials Science and Engineering, Missouri University of Science and Technology, Rolla, MO

Melting Methods & Materials

Practical Channel Induction Furnace Operations: System Upgrades, Deregulated Power, Start-Up and Shutdown Procedures (Panel 15-128)

Scott Stiefvater, ABP Induction LLC, N Brunswick, NJ

Steve Heger, Waupaca Foundry Inc, Waupaca, WI

Johnny Hill, Martin Foundry, Dallas, TX

Lost Foam Casting

The Possibilities of Using Lost Foam Patterns in the Novel Ceramic Shell Process (15-169)

Will Jeffs, Castings Technology International Ltd, United Kingdom

Steel Castings Produced by the Lost Foam Casting (LFC) Method (15-114)

Mark DeBruin, Flowserve Corp, Dayton, OH

Sarah Jordan, DeBruin Consulting, Tipp City, OH

11:30 AM-1:30 PM

Division Recognition Luncheon

1:30 PM-3:00 PM

Copper Alloy

Safety and Personnel in the Foundry Industry (Panel 15-107)

Theodore Schorn, Enkei America Inc, Columbus, IN, US

Harold Harned, Inductotherm Corp., Rancocas, NJ

Joey Leonard, Waupaca Foundry Inc., Waupaca, WI

Cast Iron

Honorary Lecture: Recruiting the Next Generation of Metal Casters. How Do We Prepare for the Future Labor Shortage? (15-118)

Russell Rosmait, Pittsburg State University, Pittsburg, KS

Melting Methods & Materials

Tools for Evaluating and Understanding Performance of the Cupola (Panel 15-129)

Bruce Blatzer, Iron Casting Research Institute, Columbus, OH

David Kasun, Kuttner LLC, Port Washington, WI

Ron Beyerstedt, Mastermelt LLC, Winona, MN

Molding Methods & Materials

Roundtable Discussion: Green Sand System Audit: Best Practices for Operating a Green Sand System (Panel 15-165)

Stephen Neltner, IMERYS, Cincinnati, OH

Mike Slaydon, Rochester Metal Products Corp, Rochester, IN

Brian Rachwitz, EJ USA Inc., East Jordan, MI

Godfrey Sergeant, Grede LLC, New Castle, New Castle, IN

Brad Harris, Bremen Castings Inc, Bremen, IN

Michelle Ring, Pure Power Technologies Metalcastings, Indianapolis, IN

3:15 PM-4:45 PM

Engineering

Identifying and Addressing Sources of Variability in the Metal Casting Process (Panel 15-149)

Roy Stevenson, MAGMA Foundry Technologies, Inc., Schaumburg, IL

AJ Menefee, Eagle Precision Cast Parts Inc, Muskegon, MI

Ronald Baus, C A Lawton Co, De Pere, WI

Copper/Magnesium

Congruent Casting of Copper - Manganese Bronze (15-046)

Kevin Chaput, Purdue University, W. Lafayette, IN

Kevin P. Trumble, Purdue University, West Lafayette, IN

Comparing Tensile Properties of Thin AZ91E Magnesium Sheets and Standard Round Specimens in the As-Cast, T4, T6 and Underaged Conditions (15-097)

Franco Chiesa, Centre de métallurgie du Québec, Trois-Rivières, QC, Canada

Guy Morin, Centre de métallurgie du Québec, Trois-Rivières, QC, Canada

Bernard Duchesne, Collège de Trois-Rivières, Trois-Rivières, QC, Canada

Jocelyn Baril, TMA Inc., Trois Rivières, QC, Canada

Cast Iron

[Non-Destructive Testing on the Shop Floor That Really Works \(Panel 15-151\)](#)

Brandon Reneau, Caterpillar Inc, Mapleton, IL

Charles Monroe, University of Alabama at Birmingham, Birmingham, AL

Pat Hayes, Caterpillar Inc., Decatur, IL

Jason Bush, Waupaca Foundry Inc, Etowah, TN

Dion Birchler, Waupaca Foundry Inc., Tell City, IN

Aluminum

[Roundtable Discussion: Defects and Sources in Aluminum Alloy Castings \(Panel 15-166\)](#)

Brian Began, Foseco, Cleveland, OH

Steve Sikorski, Magma Foundry Technologies Inc., Schaumburg, IL

Steve Robison, AFS, Schaumburg, IL

6:00 PM-10:00 PM

Alumni Dinner

Wednesday, April 22, 2015

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7:00 AM-8:00 AM

Author/Chair Breakfast

7:30 AM-9:00 AM

Women in Metalcasting Breakfast

8:00 AM-9:30 AM

Casting Design & Purchasing

[Total Cost of Doing Business Overseas \(Panel 15-063\)](#)

Rex Harrison, Oshkosh Corp., Oshkosh, WI

Harry Moser, Reshoring Initiative, Kildeer, IL

Matt Petersen, A Stucki Co, Moon Township, PA

Molding Methods & Materials

[Comparing Sand Additives for Steel Castings \(15-006\)](#)

Ralph Showman, ASK Chemicals, Dublin, OH

Eric Scheller, ASK Chemicals, Dublin, OH

[Reclaimed Green Sand for Core Room Application \(15-008\)](#)

Victor LaFay, IMERYS, Cincinnati, OH

Cornelis Grefhorst, S & B Industrial Minerals, Mari, Germany

Jeremy Tibbs, S&B Industrial Minerals, Cincinnati, OH

Jerry Thiel, University of Northern Iowa, Metal Casting Center, Cedar Falls, IA

Cast Iron

[Chunky Graphite, Formation and Prevention in Heavy Section Castings \(15-038\)](#)

Oddvar Knustad, Elkem AS, Foundry Products R&D, Kristiansand, Norway

Lena Magnusson Aberg, Elkem AS, Kristiansand, Norway

Andy Plowman, Elkem AS, Kristiansand, Norway

Examination of Nodular Graphite Formation and Austenite Solidification in Ductile Iron (15-072)

*Jingjing Qing, Missouri University of Science & Technology, Rolla, MO
Von Richards, Department of Materials Science and Engineering, Missouri University of Science and Technology, Rolla, MO
David Van Aken, Missouri University of Science and Technology, Rolla, MO*

Brittleness at Medium Temperatures of Spheroidal Graphite, Mixed Graphite, and Compacted Graphite High-Silicon Molybdenum Cast Irons (15-018)

*Delin Li, CanmetMATERIALS, Hamilton, ON, Canada
Clayton Sloss, Wescast Industries Inc, Brantford, ON, Canada*

Aluminum

Novel Mold Filling Technology for Precision Sand Castings in Aluminum (15-058)

*Glenn Byczynski, Nemak Canada, Windsor, ON, Canada
Jay Fritzke, Pyrotek Inc., Spokane, WA*

Use of CALPHAD Modeling in Controlling Microstructure of Cast Aluminum Alloys (15-044)

*Emre Cinkilic, The Ohio State University, Columbus, OH
Weihua Sun, The Ohio State University, Columbus, OH
Andrew Klarner, The Ohio State University, Columbus, OH
Alan Luo, The Ohio State University, Columbus, OH*

Casting ASTM B108 Tensile Test Bars with Improved Repeatability (15-009)

*David Levasseur, Centre de métallurgie du Québec, Trois-Rivières, QC, Canada
Guy Morin, Centre de métallurgie du Québec, Trois-Rivières, QC, Canada
Francis Breton, Rio Tinto Alcan, Jonquiere, QC, Canada*

Engineering

Reviewing your Quality Management System: Now and in the Future (Panel 15-156)

*Ted Schorn, Enkei America Inc., Columbus, IN
Nick Fox, Galesburg Castings, Inc., Galesburg, IL*

9:45 AM-10:45 AM

Molding Methods & Materials

Quantitative Method for Determining the Level of Cure and Wall Thickness in Shell Sand Systems (15-090)

*Hemant Bohra, Graduate Student, Western Michigan University, Kalamazoo, MI
Sam Ramrattan, Professor, Western Michigan University, Kalamazoo, MI*

Use of Sintered Bauxite in Molding Applications (15-075)

Scott Giese, University of Northern Iowa, Cedar Falls, IA, US

Steel

A New Approach to the Casting of Steels and Ni-Base Alloys (15-012)

John Campbell, PhD, OBE, Campbell Technology Limited, Ledbury, United Kingdom

Aluminum

Permanent Mold Castings of High-Strength and High Ductility Ba-Treated Hypo-Eutectic Al-Si Alloys (15-087)

Mohammad Shamsuzzoha, Research Scientist, The University of Alabama, Tuscaloosa, AL

David Weiss, Eck Industries, Inc., Manitowoc, WI

John Berry, Emeritus Professor, Mississippi State University, Starkville, MS

Laurentiu Nastac, The University of Alabama, Tuscaloosa, AL

Effect of Inclusions on the Tensile Properties inside a LPPM A356 Casting (15-002)

Franco Chiesa, Centre de métallurgie du Québec, Trois-Rivières, QC, Canada

David Levasseur, Centre de métallurgie du Québec, Trois-Rivières, QC, Canada

Guy Morin, Centre de métallurgie du Québec, Trois-Rivières, QC, Canada

Bernard Duchesne, Collège de Trois-Rivières, Trois-Rivières, QC, Canada

Sustainability

Reporting is on the Rise.... Why Metalcasters are Charting out Sustainability (Panel 15-174)

Dana Cooper, Fairmount Santrol, Benton Harbor, MI

Russell Murray, Ohio Cast Metals Assoc., Columbus, OH

Stephanie Salmon, Potomac Government Relations, Washington, DC

11:00 AM-12:00 PM

AFS President's Session: Metalcasting Industry Trends and Issues for 2015 and Beyond

12:00 PM-1:00 PM

Lunch with Exhibitors

1:30 PM-3:00 PM

Engineering

Energy Treasure Hunt Best Practices (Panel 15-098)

Brian Reinke, TDI Energy Solutions, Lemont, IL

Robert Baird, General Motors, Warren, MI

Michael Stowe, Advanced Energy, Raleigh, NC

Chris Leuteritz, Patriot Foundry & Castings, Franklin, NH

James Wiczer, Sensor Synergy Inc., Vernon Hills, IL

Cast Iron

Comparing Late Inoculation Methods and Materials (15-005)

Ralph Showman, ASK Chemicals, Dublin, OH

Mark Beers, ASK Chemicals, Dublin, OH

Increasing the Inoculant Potency of Commercial Inoculating Alloys in Induction Melted Gray Cast Iron (15-016)

Iulian Riposan, POLITEHNICA University of Bucharest, Bucharest, Romania

Ion Cuza Stefan, POLITEHNICA University of Bucharest, Bucharest, Romania

Mihail Ciprian Firican, POLITEHNICA University of Bucharest, Bucharest, Romania

Stelian Stan, POLITEHNICA University of Bucharest, Bucharest, Romania

Rodney Naro, ASI International Ltd., Cleveland, OH

David Williams, ASI International Ltd., Cleveland, OH

Effect of Chromium and Molybdenum Addition and Inoculation Treatments on High-Strength Gray Cast Iron Solidification and Shrinkage Defects (15-043)

Luciana Stuewe, Magma Engineering of Brazil, São Paulo, Brazil

Ricardo Fuoco, Metso Minerals, Sorocaba, Brazil

Wilson Luiz Guesser, UDESC - Santa Catarina University, Joinville, Brazil

Andre Paulo Tschiptschin, USP - São Paulo University, São Paulo, Brazil

Aluminum

Influence of Metallurgical Parameters on the Impact Toughness of Near Eutectic Al-Si Alloys (15-067)

Ossama Elsebaie, Université du Québec à Chicoutimi, Chicoutimi, QC, Canada

Saleh Alkahtani, Salman bin Abdulaziz University, Alkharj, Saudi Arabia

Herbert Doty, General Motors, Pontiac, MI

Fawzy Samuel, Université du Québec à Chicoutimi, Chicoutimi, QC, Canada

Ultrasonic Degassing of Aluminum Foundry Alloys (15-032)

Victor Rundquist, Southwire Company, Carrollton, GA

Kiran Manchiraju, Southwire Company, Carrollton, GA

David Weiss, Eck Industries, Inc., Manitowoc, WI

Influence of Nano-Structured Silanols on the Microstructure and Mechanical Properties of A4047 and A359 Aluminum Casting Alloys (15-080)

Andre Lee, Michigan State University, East Lansing, MI

Yang Lu, Michigan State University, East Lansing, MI

Tsung-Yu Pan, Vinci Technology Corporation, Ypsilanti, MI

Allen Roche, Vinci Technology Corporation, Ypsilanti, MI

Casting Design & Purchasing

Design Analysis - Past Winners of Casting of the Year (Panel 15-136)

Randy Brull, Arrowcast Inc., Shawano, WI

Adam Curtis, Signicast Investment Castings, Hartford, WI

Tom Browning, Stahl Specialty Co, Kingsville, MO

Marketing

What One Thing Makes Our Foundry So Competitive (Panel 15-155)

Patricio Gil, Blackhawk de Mexico SA de CV, Santa Catarina, Mexico

Kris Pfaehler, Waupaca Foundry Inc, Waupaca, WI

Jeff Cook, Eagle Alloy Inc., Muskegon, MI

Brad Witte, Signicast Investment Castings, Hartford, WI

3:15 PM-4:45 PM

Cast Iron

Processing Thickness Window for As-cast Ausferritic Castings (15-010)

Urko de la Torre, IK4-AZTERLAN, Durango, Spain

Susana Méndez, IK4-AZTERLAN, Durango, Spain

Ramon Suarez, Veigalan Estudio, Durango, Spain

Pello Larranaga, IK4-AZTERLAN, Durango, Spain

Doru M. Stefanescu, The Ohio State University, Columbus, OH

High Strength Ductile Iron Castings Produced By Engineered Cooling: Phase 2 (15-076)

Simon Lekakh, Department of Materials Science and Engineering, Missouri University of Science and Technology, Rolla, MO



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Aluminum

[Boride Particle Detection in Liquid Aluminum Via Laser Induced Breakdown Spectroscopy \(15-027\)](#)

Shaymus Hudson, Worcester Polytechnic Institute, Worcester, MA

Diran Apelian, Worcester Polytechnic Institute, Worcester, MA

Engineering

[The Right Tools for the Job - How Technology has Helped Deliver the Castings our Customer Wanted \(Panel 15-148\)](#)

Brian McCarthy, Versevo Inc, Hartland, WI

George Kokos, Caterpillar Inc, Dunlap, IL

Marketing

[How Mining Increases Foundry Profits- and You Don't Need a Hardhat! \(15-003\)](#)

Mark Mehling, The Foundry Marketer, Port Orange, FL

Casting Design & Purchasing

[The Ten-Step Program for Casting Defect Analysis \(15-159\)](#)

Kevin Fleischmann, The Institute, Schaumburg, IL

[Rapid Prototyping..."How Fast is Fast and Why do I Need Tooling" \(15-172\)](#)

Dave Rittmeyer, Hoosier Pattern Inc., Decatur, IN

Aluminum

[Degassing and Issues with Hydrogen Pick-Up \(Panel 15-167\)](#)

Geoffrey Sigworth, GKS Engineering Services, Dunedin, FL

Brian Began, Foseco, Cleveland, OH

7:00 PM-10:00 PM

Annual Banquet

Thursday, April 23, 2015

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7:00 AM-8:00 AM

Author/Chair Breakfast

8:00 AM-9:30 AM

Environmental Health & Safety

[EHS Hot Topics \(Panel 15-104\)](#)

Jeet Radia, McWane Inc., Birmingham, AL

Mark Remlinger, Matthews International Corp, Pittsburg, PA

Thomas Slavin, Slavin OSH Group, LLC, Chicago, IL

Jeff Hannapel, The Policy Group, Rockville, MD

Stephanie Salmon, Potomac Government Relations, Washington, DC

Molding Methods & Materials

Design Considerations for Three Dimensional Printed Cores and Molds (15-086)

Kip Woods, Metal Casting Center, University of Northern Iowa, Cedar Falls, IA
Sairam Ravi, University of Northern Iowa, Metal Casting Center, Cedar Falls, IA

Heat Absorption Capacity and Binder Degradation Characteristics of 3D Printed Cores Investigated By Inverse Fourier Thermal Analysis (15-045)

József Tamás Svidró, Jönköping University School of Engineering, Department of Materials and Manufacturing - Foundry Technology, Jönköping, Sweden
Attila Diószegi, Jönköping University School of Engineering, Department of Materials and Manufacturing - Foundry Technology, Jönköping, Sweden
David Stevenson, ExOne GmbH, Augsburg, Germany
Judit Tóth, University of Miskolc, Department of Foundry Technology, Miskolc, Hungary

Steel

Rare Earth Grain Refiner Addition Methods (15-061)

Robert Tuttle, Ph.D., Saginaw Valley State University, University Center, MI

Interaction of Rare Earth Oxide with Alumina Refractories (15-062)

Aravinda Bommareddy, Saginaw Valley State University, University Center, MI
Robert Tuttle, Ph.D., Saginaw Valley State University, University Center, MI

Aluminum

Alternatives to the Al-Si Eutectic System in Aluminum Casting Alloys (15-089)

Theodoros Koutsoukis, Worcester Polytechnic Institute, Advanced Casting Research Center, Worcester, MA
Makhlouf M Makhlouf, Worcester Polytechnic Institute, Advanced Casting Research Center, Worcester, MA

Effect of Additions of SiC and Al₂O₃ Particulates on the Microstructure and Tensile Properties of Al-Si-Cu-Mg Cast Alloys (15-028)

Jacobo Hernandez-Sandoval, Université du Québec à Chicoutimi, Chicoutimi, QC, Canada
Agnes Samuel, Université du Québec à Chicoutimi, Chicoutimi, QC, Canada
Salvador Valtierra Gallardo, Nemak S.A., Garcia, Mexico
Fawzy Samuel, Université du Québec à Chicoutimi, Chicoutimi, QC, Canada

Mechanical Properties and Processing Technology for an Elevated Temperature Metal Matrix Composite Alloy (15-057)

David Weiss, Eck Industries, Inc., Manitowoc, WI
Gerald Gegel, Material & Process Consultancy, Morton, IL

Casting Design & Purchasing

Intro to Casting Processes (Panel 15-153)

Randy Brull, Arrowcast Inc., Shawano, WI
Adam Curtis, Signicast Investment Castings, Hartford, WI
Scott Frens, Fort Recovery Industries Inc, Fort Recovery, OH
Michael Johnston, Lost Foam Group International, Alexander City, AL

9:45 AM-10:45 AM

Molding Methods & Materials

An Investigation into Processing Parameters for 3D-Light Cured Sand Used in Rapid Casting (15-093)

Sean Derrick, Western Michigan University, Kalamazoo, MI

Sam Ramrattan, Professor, Western Michigan University, Kalamazoo, MI

Michael Konkel, Western Michigan University, Kalamazoo, MI

Performance of Long Thin Printed Cores in Aluminum Castings (15-074)

Thomas Mueller, Voxeljet of America, Canton, MI

Larry Andre, Solidiform, Fort Worth, TX

Environmental Health & Safety

What's Going on with OSHA's Silica Proposal - What Foundries Can Expect (15-108)

Thomas Slavin, Slavin OSH Group, LLC, Chicago, IL

How PM2.5 Permitting Can Derail Your Expansions Plans (15-109)

Thomas Rarick, ERM, Carmel, IN

Brad Muller, Charlotte Pipe & Foundry Co., Charlotte, NC

Steel

The Effect of Heat Treatment on the Machinability and Toughness of a High Manganese and Aluminum Steel (15-035)

Michael Grams, Texas State University, San Marcos, TX

Laura Bartlett, Texas State University, San Marcos, TX

Nitriding of Lightweight High Manganese and Aluminum Steels (15-036)

Laura Bartlett, Texas State University, San Marcos, TX

Sabra Serino, Texas State University, San Marcos, TX

Aluminum

Optimizing the Heat Treatment of High Strength 7075-Type Wrought Alloys: A Metallographic Study (15-029)

Mohamed F. Ibrahim, Université du Québec à Chicoutimi, Chicoutimi, QC, Canada

Guillermo H. Garza-Elizondo, Université du Québec à Chicoutimi, Chicoutimi, QC, Canada

Agnes Samuel, Université du Québec à Chicoutimi, Chicoutimi, QC, Canada

Fawzy Samuel, Université du Québec à Chicoutimi, Chicoutimi, QC, Canada

On the Impact Toughness of Al-B4C MMC: The Role of Minor Additives and Heat Treatment (15-030)

Mohamed F. Ibrahim, Université du Québec à Chicoutimi, Chicoutimi, QC, Canada

Agnes Samuel, Université du Québec à Chicoutimi, Chicoutimi, QC, Canada

Fawzy Samuel, Université du Québec à Chicoutimi, Chicoutimi, QC, Canada

Hany R. Ammar, PhD, Suez University, Suez, Egypt

Mahmoud Soliman, King Saud University, Riyadh, Saudi Arabia

Casting Design & Purchasing

How Casting Design Affects Casting Prices (15-157)

Tom Kayser, Osco Industries Inc, Portsmouth, OH



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[Intro to the Cast Aluminum Family - What the Buyer Should Know \(15-161\)](#)

Nicole Tedrow, Fairfield Aluminum Castings Co., Fairfield, IA

11:00 AM-1:00 PM

President's Brunch & Annual Business Meeting

1:15 PM-2:15 PM

Hoyt Memorial Lecture

[Outstanding Quality Using Team Management \(15-088\)](#)

Sara Joyce, Badger Mining Corp., Berlin, WI