

# AFS Institute

## Metalcasting Training Catalog





A skilled workforce allows your company to optimize production, minimize errors, and differentiate from the competition.

The **AFS Institute** is the premier provider of education for the metalcasting industry. Hundreds of foundries, casting purchasers, and suppliers to the metalcasting industry rely on the Institute each year to train and develop their employees. In fact, the Institute has trained nearly 91, 600 students since 1957.

The Institute offers training in these convenient formats:

- **Instructor-Led Training** at the AFS headquarters in Schaumburg, Illinois
- Live online **Instructor-Led Training** via the Zoom platform.
- **In-Plant Training** customized for your company at your location.
- **Foundry E-Learning** allowing your workforce to learn anywhere, anytime.



## WELCOME!

You are in the right place for the latest in cutting-edge metalcasting training from your number one training provider, the AFS Institute. We offer 40+ instructor-led courses that are conducted live, online, and in the classroom by highly knowledgeable and experienced metalcasting professionals. We can also send these subject matter experts to your facility or provide customized training online via Zoom. You and your employees can learn at your own pace through our Foundry e-Learning, which hosts over 100 modules with 20+ in Spanish. AFS has invested over \$1 million in developing and updating our state-of-the-industry curriculum.

We have many areas of opportunity to help metalcasters run profitable and productive workplaces through the education and training of employees. Investing in your workforce is a critical element of our industry's future. We are pleased to share these statistics from FY 2024:

- Nearly 91,600 students trained since 1957
- 90+% student survey satisfaction rate for classroom, online, and in-plant training courses
- 623 students trained in the classroom and online from 165 unique companies
- 86 Foundry eLearning Company Subscribers
- 5,033 Foundry e-Learning modules completed

Our courses offer great opportunities for your education and training needs. Whether you are a business owner, a manager, a new employee, new to the industry, a student, or a professor, this resource will help you find the courses you need in one easy-to-access format. An index of courses and Foundry E-Learning

modules is in the back for easy reference. If you have questions or need additional information, our Institute staff is available to assist.

We are here for your workforce development needs!

**Jennifer Wheeler Christian**  
Director of Training Solutions  
jchristian@afsinc.org

**Shelby Goldman**  
Assistant Director  
of Training Solutions  
sgoldman@afsinc.org

Visit our website at [afsinc.org](http://afsinc.org) or contact AFS Customer Service at 847-824-0181 (800-537-4237 for U.S. and Canada).

\*Course discounts available for members. The AFS Institute offers 5 students for the price of 3 from the same organization for Institute courses.

## TABLE OF CONTENTS

### Educational Offerings

- 03 Instructor-Led Training
- 03 In-Plant Training
- 04 Foundry E-Learning Modules
- 04 Introduction to Supervisor Training
- 04 Are you hiring?
- 05 E-Learning Application

### Courses & Modules

- 07 Instructor-Led Training Courses

- 23 Foundry E-Learning Modules
- 41 Spanish Foundry E-Learning Modules

### AFS Information and Index

- 47 Corporate Membership Information
- 49 Individual Membership Information
- 51 AFS Institute Instructors
- 54 Topic Index

## INSTRUCTOR-LED TRAINING

The curriculum for all courses is developed to teach new job skills in an interactive, hands-on, student-centered format. We teach our courses in the classroom and live via Zoom with over 40+ courses in the following categories:

- Basic Metalcasting
- Casting Sourcing & Costing
- Design of Castings & Gating Systems
- Metallurgy & Melting Methods
- Molding Methods
- Quality Control & Improvement

To learn more about our **Instructor-Led Training**, visit [www.afsinc.org/instructor-led-training](http://www.afsinc.org/instructor-led-training).

To see a full list of scheduled upcoming courses or to register for a course, please visit [www.afsinc.org/courses](http://www.afsinc.org/courses).

## INSTITUTE COURSE REGISTRATION REFUND AND SUBSTITUTION POLICY

Institute course registration cancellations (both in-person and virtual events) must be received by AFS via email or by calling at least 14 days before the course start date for a full refund. Student substitutions from the same company may be made prior to the first day of the course. Cancellation and substitution requests must be made to Customer Service by emailing [customerservice@afsinc.org](mailto:customerservice@afsinc.org) or by calling 1-800-537-4237 | 1-847-824-0181 (International).

## IN-PLANT TRAINING

**AFS Institute In-Plant Training** provides you with high-value, immediate-impact, best-in-class, unbiased, and professional training at your facility for an affordable price. It is the best way to deliver new skills training to a large group of employees. In-Plant Training provides you with the ultimate in convenience: no travel expenses and a familiar environment while maximizing training efficiency and value.

**In-Plant Training** offers:

- Efficient, cost-effective skills training for a large group
- Hands-on, engaging activities to reinforce skills development
- Team-building opportunities across roles and departments

*Special pricing available for AFS Corporate Members.*

For more information on **In-Plant Training**, visit [www.afsinc.org/in-plant-training](http://www.afsinc.org/in-plant-training).

To schedule your **In-Plant Training**, contact Jen Christian at [jchristian@afsinc.org](mailto:jchristian@afsinc.org) or 847-824-0181.

## FOUNDRY E-LEARNING

**Foundry E-Learning** focuses on practical job skills you can use immediately. Each module is based on adult education best practices and with engagement throughout. You can purchase **Foundry E-Learning modules** in two ways:

### FOUNDRY E-LEARNING SUBSCRIPTION PROGRAM

Access the full suite of **Foundry E-Learning Modules** for all employees at one location. The annual subscription fee is based on the number of employees in your facility:

- \$1,300 up to 100 employees
- \$2,600 up to 250 employees
- \$5,200 over 250 employees

### FOUNDRY E-LEARNING MODULE INDIVIDUAL ACCESS

Foundry E-Learning Modules also are available for individual access for 30 days.

- \$55 per module for members
- \$110 per module for non-members

To subscribe or to purchase individual modules, visit [www.afsinc.org/e-learning](http://www.afsinc.org/e-learning). For more information and a **FREE** live demonstration via Zoom, contact Jen Christian at [jchristian@afsinc.org](mailto:jchristian@afsinc.org) or Shelby Goldman at [sgoldman@afsinc.org](mailto:sgoldman@afsinc.org).

## INTRODUCTION TO

## SUPERVISOR DEVELOPMENT

**Introduction to Supervisor Development** is designed to assist new supervisors acquire the knowledge and skills required to be an effective leader. The course covers a wide range of topics including team leadership, communication, employment issues, and building on your success as a leader. It is especially designed to help those in the metalcasting industry (union and non-union) who are supervising hourly, or salaried workers. Introduction to Supervisor Development is beneficial to those who have been recently promoted from hourly or salaried ranks who have little previous experience in supervision and for supervisors that have not had any formal training.

Available live online, in the classroom, or onsite in your facility. For more information, contact Jen Christian at [jchristian@afsinc.org](mailto:jchristian@afsinc.org) or 847-803-4302.

## ARE YOU HIRING?

## FOUNDRY E-LEARNING

## PROVIDES ONBOARD TRAINING

Do you want to upgrade your on-board training program and improve retention of new hires? Foundry E-Learning offers easy to use modules that seamlessly integrate into your current on-boarding program. Below are the suggested on-board training schedules for **Aluminum**, **Copper/Bronze**, **Iron**, and **Steel** using **Foundry E-Learning modules**. This is a sample of what your program could include.

### Aluminum:

- Big Picture of the Casting Process
- Aluminum Casting Alloys
- Aluminum Casting Applications
- Aluminum Casting Production
- Chemical Binder Handling Safety Requirements
- Coldbox Coremaking Process
- Green Sand Molding Equipment
- Green Sand Molding Process
- Green Sand Raw Materials
- Introduction to Casting Defect Analysis
- Melting and Pouring
- Metalcasting Safety
- Nobake Materials and Equipment
- Permanent Mold Casting Process
- Types of Casting Processes
- Types of Casting Tooling

### Copper/Bronze:

- Big Picture of the Casting Process
- Chemical Binder Handling Safety Requirements
- Copper Casting Alloys
- Copper Casting Applications
- Copper Casting Production
- Green Sand Molding Equipment
- Green Sand Molding Process
- Green Sand Raw Materials
- Introduction to Casting Defect Analysis
- Melting and Pouring
- Metalcasting Safety
- Nobake Materials and Equipment
- Permanent Mold Casting Process
- Types of Casting Processes
- Types of Casting Tooling

### Iron:

- Big Picture of the Casting Process
- Basic Melt Practices

### for Cast Iron

- Coldbox Coremaking Process
- Green Sand Molding Equipment
- Green Sand Molding Process
- Green Sand Raw Materials
- Introduction to Cast Iron
- Introduction to Casting Defect Analysis
- Melting and Pouring
- Metalcasting Safety
- Riser Iron Castings
- Six Families of Cast Iron
- Types of Casting Processes
- Types of Casting Tooling

### Steel:

- Big Picture of the Casting Process
- Chemical Binder Handling Safety Requirements
- Coldbox Coremaking Process
- Green Sand Molding Equipment
- Green Sand Molding Process
- Green Sand Raw Materials
- Introduction to Steel Heat Treatments
- Introduction to Casting Defect Analysis
- Melting and Pouring
- Metalcasting Safety
- Nobake Materials and Equipment
- Steel Casting Alloys
- Steel Casting Production
- Steel Casting Quality Requirements and Inspection Methods
- Types of Casting Processes
- Types of Casting Tooling

Improve your on-boarding program and get employees trained on technical topics faster with Foundry E-Learning. To sign up, visit [www.afsinc.org/e-learning](http://www.afsinc.org/e-learning). For more information and a **FREE** live demonstration via Zoom, contact Jen Christian at [jchristian@afsinc.org](mailto:jchristian@afsinc.org) or Shelby Goldman at [sgoldman@afsinc.org](mailto:sgoldman@afsinc.org).



# AFS Institute

## Foundry E-Learning

### Upgrade your on-board training program and improve retention of new hires

Take it from some great metalcasters like BCI Solutions, Inc., Batesville Products Inc., and Metal Technologies Inc.



**Jordan Brown**  
Executive Vice President  
BCI Solutions, Inc.

*"Whether someone is moving departments, and they want to learn something new, or they've been promoted into a higher position, AFS Foundry eLearning allows us to help give them that extra educational experience. That way they can continue to grow and succeed."*



**Tim Williams**  
Vice President of Sales  
Batesville Products Inc.

*"AFS Foundry eLearning is a helpful tool for those new to the industry, as well as seasoned staff. It fits nicely as an adjunct to our in-house training. We highly recommend this training tool!"*



**Sara Yarian**  
VP of Culture, Learning & Development  
Metal Technologies Inc.

*"The AFS Foundry eLearning curriculum is designed to educate different levels of learners. We use it as part of our onboarding training, as well as our employee development. This self-paced, self-directed curriculum is a great addition to our company's overall learning and development program."*

Foundry E-Learning is ideal for training new hires...not to mention for cross-training and developing promising employees. Customize your own training program with 110 modules covering all aspects of the foundry.

For more information and a **FREE** live demonstration via Zoom, contact Jen Christian at [jchristian@afsinc.org](mailto:jchristian@afsinc.org) or Shelby Goldman at [sgoldman@afsinc.org](mailto:sgoldman@afsinc.org).

## Strengthen Metalcasting Skills with Foundry E-Learning from the AFS Institute

The **AFS Institute** offers **more than 100 on-demand Foundry E-Learning modules** ranging in length from 15 minutes to over an hour, viewable on any device or browser. **Foundry E-Learning modules** focus on practical job skills you can use immediately. Each module is based on adult education best practices and strives to engage you throughout. You can purchase Foundry E-Learning modules in two ways:

### Foundry E-Learning Subscription Program

Access the full suite of Foundry E-Learning modules for all your employees at one location. The annual subscription fee is based on the number of employees in your facility:

**\$1,300 up to 100 employees | \$2,600 up to 250 employees  
\$5,200 over 250 employees**

### Foundry E-Learning Module Individual Access

Foundry E-Learning modules also are available for individual access for 30 days.

**Members - \$55 per module  
Non-members - \$110 per module**

Contact **Jen Christian**, Director of Training Solutions, at [jchristian@afsinc.org](mailto:jchristian@afsinc.org), to discuss your foundry's training needs or to schedule a free, no-obligation demonstration. To register, visit [www.afsinc.org/e-learning](http://www.afsinc.org/e-learning) or fill out the form below.

### Foundry E-Learning Categories Include:

- 3D Sand Printing
- Aluminum
- Basics of Metalcasting \*
- Casting Defect Analysis \*
- Cast Iron
- Coldbox
- Copper
- Gating and Riser Design
- Green Sand Molding \*
- Lean Manufacturing
- Lost Foam
- Mechanics for Heat Treatment
- Metalcasting Safety
- Permanent Mold
- Nobake Molding & Coremaking
- Sand Testing
- Steel

\* Available in Spanish

### Foundry E-Learning Subscription Application

#### Program Fees

- \$1,300 Corporate Members with up to 100 employees (per plant)
- \$2,600 Corporate Members with up to 250 employees (per plant)
- \$5,200 Corporate Members with more than 250 employees (per plant)

#### Program Requirements

- Corporate membership must be kept current during 12 month subscription period.
- Training administrator must be designated.
- No refunds or proration of funds once access is established for training administrator.
- A separate subscription and application form is required for each plant.

#### Optional and tax deductible:

Donate to the AFS Institute and its mission to educate the metalcasting industry.  \$20  \$40  Other Amount \$\_\_\_\_\_

Form below is only for the **Foundry E-Learning Subscription Program**.  
For **Foundry E-Learning Module Individual Access** please visit [www.afsinc.org/e-learning](http://www.afsinc.org/e-learning).

#### Company Information:

Company \_\_\_\_\_ AFS Corporate Member Number \_\_\_\_\_

Address \_\_\_\_\_ City/State/Zip \_\_\_\_\_

Designated Training Administrator/Contact Person \_\_\_\_\_

Phone \_\_\_\_\_ Email \_\_\_\_\_

Number of Employees \_\_\_\_\_

#### Payment:

- American Express  MasterCard  VISA  Check enclosed

Card Number \_\_\_\_\_ CV# \_\_\_\_\_ Expiration Date \_\_\_\_\_

Cardholder's Name \_\_\_\_\_ Authorized Signature \_\_\_\_\_ Date \_\_\_\_\_

**Return completed application with payment to:**  
American Foundry Society | 35169 Eagle Way Chicago, IL 60678-1351  
Tel: 847-824-0181/800-537-4237 | Fax: 847-824-7848 | [www.afsinc.org](http://www.afsinc.org)

# INSTRUCTOR-LED TRAINING



The following is the full catalog of all courses offered by the AFS Institute. These courses can be taken as Instructor-Led Training in the classroom, online via Zoom or onsite with In-Plant Training.

To see a full list of scheduled upcoming courses and to register for a course, please visit [www.afsinc.org/courses](http://www.afsinc.org/courses).

Prices listed are for in-person, Instructor-Led courses. Pricing for Live Online courses is available at [www.afsinc.org/courses](http://www.afsinc.org/courses).

To schedule an In-Plant Training course, and for pricing, contact Jen Christian at [jchristian@afsinc.org](mailto:jchristian@afsinc.org) or 847-824-0181.

## ALUMINUM METALCASTING 101

#### Categories:

*Basic Metalcasting, Buyers, Design of Casting & Gating Systems, Designers, Metalcasters*

Participants in this introductory course will develop their knowledge of aluminum's characteristics and properties, the use of appropriate alloying elements, latest industry applications, and important considerations when working with cast aluminum parts. Course materials include the latest information in melting and casting technology and the decision-making process for choosing specific technologies.

#### Course participants will learn to identify:

- Principal properties of aluminum
- AAUS alloy classification system
- Role of alloying elements in aluminum castings
- Aluminum alloys for specific applications
- Common aluminum melting methods
- Common molding/casting methods for aluminum

#### Course Length - 1 day

List Price: \$1,000 | Member Price: \$800

## ALUMINUM CRUCIBLE

## FURNACE PRACTICES

#### Categories:

*Metalcasters, Metallurgy & Melting Methods*

This Institute course covers aluminum furnace and crucible operations, including construction, operations, and maintenance practices for both electric and fuel-fired aluminum crucible furnaces.

#### Course participants will learn to describe and identify:

- Aluminum crucibles and furnaces
- Maintenance best practices for aluminum crucibles, including storage, handling, cleaning, and safety
- Aluminum furnace refractory materials (linings and crucibles), installation, and how to avoid deterioration
- Proper aluminum crucible furnace operations
- Crucible furnace heating system components and how to optimize performance
- Temperature measurement tools and controls
- The use of energy efficient aluminum crucible furnace optimization methods

#### Course Length — 1 day

List Price: \$1,100 | Member Price: \$900

## ALUMINUM MELTING 201

### Categories:

*Metalcasters, Metallurgy & Melting Methods*

This course introduces the principles and best practices of aluminum melting for metalcasting. The course will examine furnace charging, furnace temperature and its effect on the melt, and in-furnace treatments to reduce impurities. Melt sampling, transfer and pouring methods, and the corresponding equipment will be analyzed, with demonstrations of various techniques throughout the course. Casting defects related to melting, treatment and transfer also will be presented and discussed.

### Course participants will learn to describe and identify:

- The principles of transforming solid aluminum to liquid
- Furnace charging procedures
- Accurate temperature measurement and control techniques
- Purposes and methods of alloying
- Impurities and their causes and handling
- Melt loss causes and control methods
- The purpose of fluxing and common methods of melt treatment
- Various sampling and Pouring techniques

### Course Length — 2 days

*List Price: \$1,350 | Member Price: \$1,150*

## ALUMINUM METALLURGY 201

NEWLY  
REVISED

### Categories:

*Designers, Metallurgy & Melting Methods*

This course provides participants with the scientific principles needed to understand the metallurgy of aluminum-based casting alloys. The primary purpose of this course is to facilitate an understanding of the chemical and thermal fundamentals which control structures formed during aluminum solidification.

### Course participants will learn to identify:

- Unary and binary phase diagrams to predict the phases (structures) that form during solidification
- Phase diagrams and cooling curves can be used to determine the sources of castability issues
- How solidification impacts casting properties
- The effects of grain refiners and modifiers on microstructures
- How various melt treatments (e.g., degassing, fluxes, and filtration) can impact casting properties
- The types and applications of common melt quality and casting analysis techniques

- How the heat treatment tempers affect microstructure and mechanical properties of cast aluminum alloys

### Course Length - 2 days

*List Price: \$1,350 | Member Price: \$1,150*

## CASTING COST ESTIMATING

### Categories:

*Buyers, Casting Costing & Sourcing, Metalcasters*

Cost estimating is a critical factor in ensuring a manufacturing company continues to acquire customers and be profitable. Cost estimates are predictions of what the company thinks it will cost to produce a product. This course examines the various cost components and methods used to arrive at an accurate estimate of the production costs. It also provides information on common traps in casting estimates and ways to avoid these traps.

### Class participants will learn to:

- Identify key traps in casting cost estimates and how to avoid them
- Assess where an organization may need to reconsider methods for assigning costs
- Classify various costs by work center/department in a metalcasting facility
- Determine product markup and profit
- Identify and use various standards in cost estimates
- Calculate yield, melt loss, volume, mass, and total weight for a casting
- Enter and use data in a cost estimate spreadsheet to complete a quote
- Calculate the break-even point for a casting
- Discuss the benefits of activity-based costing methods
- Offer justification for the analysis and implementation of an activity-based costing strategy
- Apply concepts and methods of a cost estimating model to your specific projects
- Identify reasons to evaluate and follow up on an estimate

### Course Length - 2 days

*List Price: \$1,350 | Member Price: \$1,150*

## CASTING DEFECT ANALYSIS

### Categories:

*Casting Costing & Sourcing, Design of Casting & Gating Systems, Designers, Metalcasters, Quality Control & Improvement*

The intention of this course is for participants to become proficient in applying a 10-step procedure to analyze and reduce metalcasting defects by correctly identifying them and their root causes and determining the appropriate corrective actions. This course is applicable to sand molding processes (green, nobake, coldbox, shell).

### Class participants will learn to:

- Name the four most common casting defects, and identify the causes and potential solutions for each
- Apply a 10-step procedure to correctly identify actual casting defects (in samples) and their root causes, and determine appropriate corrective actions and solutions using the AFS-CIATF "International Atlas of Casting Defects" and the three AFS Casting Defects handbooks

### Course Length - 2 days

*List Price: \$1,350 | Member Price: \$1,150*



## CASTING DESIGN

### Categories:

*Design of Casting & Gating Systems, Designers*

This course delves into the major factors that affect final part design. Participants will explore alloy selection, metalcasting process capabilities and limitations, and their effects on casting design, and the impact of secondary operations. Other major topics will include design for manufacturability, fabrication to casting design conversions, dimensional control, and the importance of casting simulation. Discussion and case studies will be used throughout this two-day course to illustrate effective and practical casting design principles. Participants should have knowledge and experience in designing engineered components prior to attending this course.

### Class participants will learn to identify:

- The effect of different alloy characteristics on a finished casting product
- Material property factors to be considered when choosing a casting alloy
- How production and service requirements affect the casting method chosen
- How to choose an appropriate casting process based on the complexity and manufacturability of a part
- The secondary operations that affect casting design
- Factors that control casting tolerance
- The benefits of simulation in casting design

### Course Length - 2 days

*List Price: \$1,350 | Member Price: \$1,150*

## CASTING MATERIAL PROPERTIES

### Categories:

*Design of Casting & Gating Systems, Designers*

This course provides an in-depth discussion on expected performance of a casting. The production process influences the resulting mechanical properties and expected level of quality. The impacts of irregularities and post casting treatments are discussed along with testing methods for determining properties and existing sources of property information that can be used in the casting's design.

### Class participants will learn to:

- Describe a variety of production characteristics that can influence the mechanical properties of a casting
- Identify various tests to determine a casting's material characteristics and the impact the distribution of mechanical properties has on the function of the casting in service

### Course Length - 0.5 day

List Price: \$575 | Member Price: \$500

## CASTING SUPPLIER AUDITING

### Categories:

*Buyers, Casting Costing & Sourcing*

Held at a metalcasting facility, this course will review methods supply chain personnel utilize to effectively perform audits of metalcasting facilities. Participants will spend the better part of the second day auditing several different areas of the foundry as part of this interactive and hands-on course. This course is only open to employees from companies who design and/or purchase metal castings. Class size is limited to 20 participants.

### Class participants will learn to:

- Identify major factors affecting casting supplier auditing, including: management, sales, training, production, maintenance, quality checks and shipping
- Perform audits within the metalcasting industry, showing aptitude of processes in both the office and shop floor areas of a casting supplier

### Course Length - 2 days

List Price: \$1,450 | Member Price: \$1,250

## CHEMICALLY BONDED

## SAND TESTING

### Categories:

*Basic Metalcasting, Molding Methods, Quality Control & Improvement*

This course provides detailed instruction on the need for widely used chemically bonded tests and how to correctly perform them, including proper sand sampling methods from the "AFS Mold & Core Test Handbook."

### Class participants will be able to:

- Explain the purpose of chemically-bonded sand tests
- Describe sampling procedures
- Describe commonly used chemically-bonded sand tests
- Identify test purpose and frequency
- Determine the equipment to be used for each test
- Describe safety considerations for sand binders
- Run chemically-bonded sand tests, independently
- Explain acceptable ranges for chemically-bonded sand test results
- Formulate ways to communicate findings and alternatives

### Course Length — 1 day

List Price: \$1,000 | Member Price: \$800

## COLDBOX PROCESS 101

### Categories:

*Basic Metalcasting, Metalcasters, Molding Methods*

This course is an introduction to the coldbox coremaking process used in a metalcasting facility. Discussion will include terminology, common sands and binder systems used to make coldbox cores, the coremaking process, using and maintaining equipment, and considerations for identifying core defects.

### Class participants will be able to:

- Explain the benefits of using the coldbox process for coremaking
- Explain the coldbox coremaking process and the components of the three most common coldbox systems
- Identify how sand, binder and equipment selection can impact the quality of cores
- Describe the important safety measures and operating practices to use while making coldbox cores
- Identify the key aspects of well-designed tooling
- Identify common coldbox-related casting defects

### Course Length — 1 day

List Price: \$1,000 | Member Price: \$800

## COLDBOX PROCESS 201

### Categories:

*Metalcasters, Molding Methods, Quality Control & Improvement*

This course is the second course in the coldbox coremaking series and provides the next level of knowledge in relation to the molding process using within a foundry to make coldbox cores. Discussion will cover coldbox terminology; common sands; additives and coatings used; coldbox binders, in particular, phenolic urethane cold box (PUCB) resin; corebox equipment; corebox tooling and best usage parameters; and considerations when troubleshooting and optimizing the process for proper quality assurance.

### Class participants will be able to:

- Summarize the coldbox coremaking process
- Compare differences in properties of coldbox binder systems
- Evaluate raw material and equipment options for coldbox coremaking
- Identify the best corebox tooling variation for the catalyst type in use
- Explain common corebox tooling challenges and how to adjust a process to improve outcomes
- Describe ways to optimize the core production processes
- Describe the important safety measures and operating practices to use with coldbox binders and equipment

### Course Length - 2 days

List Price: \$1,350 | Member Price: \$1,150

## COPPER METALCASTING 101

### Categories:

*Basic Metalcasting, Buyers, Design of Casting & Gating Systems, Designers, Metalcasters*

This course introduces the characteristics and properties of copper, alloying elements and their general applications, as well as considerations for working with cast copper parts. This course also covers melting and casting technology and looks at the decision-making process behind specific technologies used.

### Class participants will learn to:

- Describe the principal properties of copper and its uses
- Explain the Unified Number System for copper
- Discuss the role of alloying elements in copper castings
- Identify copper alloys suited to specific applications
- Identify common melting methods for copper
- Identify common molding/casting methods for copper
- Describe common copper defects
- Discuss foundry safety
- Describe some environmental concerns when handling lead-containing copper alloys

### Course Length - 1 day

List Price: \$1,000 | Member Price: \$800

## COPPER MELTING 201

### Categories:

*Designers, Metalcasters, Metallurgy & Melting Methods*

This laboratory course introduces the principles and best practices of copper melting and pouring for producing premium quality castings. The various processes involved in melt protection, oxidation, deoxidation and degassing will be examined. Topics include: furnace types and uses, charge materials, melting practices and tests for melt quality.

### Class participants will learn to:

- Describe the advantages/disadvantages of the various furnaces used for copper melting
- Explain the effects of various charge materials on copper melting
- Discuss oxidation-deoxidation and degassing practices for copper melting
- Identify proper Personal Protective Equipment (PPE) used in copper melting and pouring practices
- Describe the tests used for melt quality
- Explain considerations for making quality, high-conductivity copper castings

### Course Length - 2 days

List Price: \$1,350 | Member Price: \$1,150





## COPPER METALLURGY 201

**Categories:**  
*Designers, Metalcasters, Metallurgy & Melting Methods*

Knowledge of the physical metallurgy of copper alloys is necessary for foundry metallurgists to effectively operate. This knowledge includes melt treatment, effects of alloy additions on physical and mechanical properties, solidification, heat treatment and final properties. The correlations among the processing technology, defects and properties is important to know for metallurgical as well as environmental issues. This course will address these topics to improve the metallurgical skills of casting personnel.

**Class participants will learn to:**

- Review influences of alloying elements on mechanical and physical copper properties
- Determine transformation temperatures between liquidus and solidus
- Identify cooling curves and phase diagrams
- Determine phases present in an alloy via an application of binary, ternary and complex phase diagrams
- Identify and explain various solidification characteristics
- Identify and explain several heat treatments of copper castings
- Explain sample preparation procedures as well as cast copper alloy microstructures
- Describe various metallurgical and visual inspection processes
- Identify key casting defects related to copper metallurgy

**Course Length - 2 days**

*List Price: \$1,350 | Member Price: \$1,150*

## DESIGN & OPTIMIZATION

## FOR 3D SAND PRINTING

**Categories:**  
*Buyers, Design of Casting & Gating Systems, Designers, Molding Methods*

There are many advantages to the use of 3D sand printing of molds and cores, especially when it comes to casting design, and the technology is being rapidly adopted in all sectors. This course focuses on designing castings for the 3D sand printing process, as well as optimizing existing designs to take advantage of the unique capabilities afforded by the process. Course topics include: the advantages/limitations of the 3D printing process, the storage and handling of cores and molds, gating design, and simulation, file formats, and key features allowable will be described. Case studies will be used throughout the course.



**Class participants will learn to:**

- Describe the various additive manufacturing techniques used in metalcasting
- Describe the 3D sand printing process
- List the process considerations for casting quality
- Describe cost implications of the process and their advantages/disadvantages
- Identify the optimal type of parts for the process
- List the design considerations for casting quality
- Identify methods to improve designs
- Describe the role of casting process simulation

**Course Length - 2 days**

*List Price: \$1,350 | Member Price: \$1,150*

## FOUNDRY PROCESS

## IMPROVEMENT

**Categories:**  
*Metalcasters, Quality Control & Improvement*

Participants will receive basic root cause analysis training, which can serve as a refresher, a preparatory course for the American Society for Quality (ASQ) Six Sigma Green Belt Certification program, or as a follow-up to any quality certification training. Metalcasting facilities often struggle with problem solving and

have a need for training with a focus on metalcasting issues. At its core, this course provides personnel with disciplined problem-solving techniques, and emphasizes tools to better understand process data and performance using unique examples and case studies drawn from metalcasting facility settings.

Participants will also have an opportunity to bring specific problems and/or process improvement challenges to class for discussion and analysis.

**Class participants will learn to:**

- Describe structured problem-solving approaches
- Develop effective problem statements
- Characterize problems to develop possible root causes
- Recognize various methods for collecting and analyzing data
- Explain why process stability is required for improvement
- Identify process sampling strategies for determining root cause
- Determine process improvement solutions and countermeasures
- Implement corrective action to sustain improvement

**Course Length - 2 days**

*List Price: \$1,350 | Member Price: \$1,150*

## FUNDAMENTALS OF SPC

## & PROCESS CAPABILITY

### Categories:

*Buyers, Designers, Metalcasters, Quality Control & Improvement*

SPC is considered one of the seven basic quality tools – yet many do not understand the meaning of the numbers or take advantage of the tool because they are fearful of the arithmetic. Unfortunately, there are also some that use statistics like standard deviation or Ppk without feeling comfortable with their meaning or the assumptions underlying their use.

By using a step-by-step approach to building understanding of the basic meaning of the terms, your instructor will assist you in grasping what the numbers mean and what can (and should) be done with them to support improvement. Combining years of experience as a math teacher with decades of foundry quality management practice, this course will give you the opportunity to develop confidence with these statistics with patient hands-on instruction and help.

Students will be taught how to prepare SPC charts and capability data using Excel software, accessible to all without specialized equipment.

### Course Length - 1.5 days

*List Price: \$945 | Member Price: \$795*

## GATING & RISER DESIGN 101

### Categories:

*Design of Casting & Gating Systems, Designers, Metalcasters*

Gating design directly impacts casting quality and yield. This course guides participants through the basic functions of gating and risers to provide clean, sound, and functional castings. An introduction to fluid flow and solidification will serve to guide participants through key design concepts of the various functional elements of good gating and riser design. Emphasis will be placed on hands-on activities, animations, and simulations to enhance understanding of the filling and solidification processes in a foundry. The focus will be on practical examples in iron, steel, aluminum, and copper castings. The goal will be to introduce to the participants the basics of gating and riser design, common industry norms and troubleshooting.

### Class participants will learn to:

- Identify how casting quality requirements impact gating and risers
- Describe the function of risers
- Identify the effects of different alloys on riser size and location
- Identify the effects of production process parameters on riser size and location
- Determine riser locations

- Calculate the size of riser and connections
- Demonstrate the basic applications of chills
- List unique riser considerations for iron castings
- Describe the function and features of a gating system
- Identify the effects of different alloys on a gating system
- Identify the effects of process parameters on gating system design
- Determine gate sizes and locations
- Describe the basics of fluid dynamic principles

### Course Length — 2 days

*List Price: \$1,250 | Member Price: \$1,050*

## GATING & RISER DESIGN 201

### Categories:

*Design of Casting & Gating Systems, Designers, Metalcasters, Quality Control & Improvement*

This course is a continuation of the concepts introduced in Gating & Riser Design 101. Participants will work on case studies to develop gating and risers to provide clean, sound, and functional castings. A continuation of the fluid flow and solidification principles will serve to guide participants to decision making regarding the quality of castings. Course emphasis will be placed on hands-on activities, animations, and simulations to enhance understanding of the filling and solidification processes in a foundry. Focus will be on practical examples in iron, steel, aluminum, and copper castings. The goal will be to introduce the participants to the basics of gating and riser design, common industry norms and troubleshooting.

### Class participants will learn to:

- Describe the use of sleeves, hot topping, specialty sands and the cost vs. benefit of each
- Describe sand and chill properties
- Measure the influence of sand and chill properties on cooling conditions to positively impact casting quality
- Describe fluid flow principles governing the flow of liquid metal
- Measure how flow principles governing the flow of liquid metal positively affect casting quality
- Identify the use of filters and other hydraulic controls
- Describe the influence of process parameter ranges with a fixed tool design on the casting cost and quality
- Identify how to accommodate for variations in process parameters while maintaining casting quality
- Translate quality requirements to cost implications for castings
- Develop a closed-loop tooling performance feedback system.

### Course Length - 2 days

*List Price: \$1,350 | Member Price: \$1,150*

## GREEN SAND MOLDING 101

### Categories:

*Basic Metalcasting, Metalcasters, Molding Methods*

Students are introduced to the green sand molding process used with a metalcasting facility. Discussion includes: basic terminology, types of sands used to make green sand molds, the mold making process, using and maintaining process equipment, and considerations for identifying casting defects.

### Class participants will learn to:

- Use the various types of green sand molding raw materials and equipment appropriately and safely
- Identify raw material and equipment problems and their effect on process variables
- Prepare simple green sand molds and discuss how to meet quality specifications
- Examine molds and castings for defects and determine the corrective action needed
- Describe the important safety measures and operating practices during the production of green sand molds

### Course Length - 1 day

*List Price: \$1,000 | Member Price: \$800*

## GREEN SAND MOLDING 201

### Categories:

*Metalcasters, Molding Methods, Quality Control & Improvement*

The first day of this course includes a review of important raw material requirements for green sand systems, an introduction to applications requiring specialty sands, the types of sand additives and their effects on green sand and green sand process variables and method adjustments to produce quality molds. The second day will focus on green sand quality control tests for ferrous and nonferrous alloys, typical problem areas seen in green sand metalcasting facilities, and how test results can help to identify areas for correction. The course will conclude with an introduction to statistical process control for sand systems.



### Class participants will learn to:

- Summarize the typical green sand systems used for various alloys
- Identify applications requiring specialty sands
- Describe common sand additives used by green sand metalcasters
- Identify sand handling and reclamation equipment and processes
- Examine green sand process variables and learn to make process adjustments
- Explain the various quality control tests used in green sand foundries
- Use quality test data to evaluate green sand for corrective action
- Recognize common quality control problems
- Describe important safety measures and operating practices to use in green sand foundries

### Course Length - 2 days

*List Price: \$1,350 | Member Price: \$1,150*

## GREEN SAND TESTING

### Categories:

*Metalcasters, Molding Methods, Quality Control & Improvement*

This course provides detailed instruction on how to perform the commonly used green sand tests, including proper sand sampling methods, from the AFS Mold & Core Test Handbook.

### Class participants will learn to:

- Describe green sand tests and sampling procedures
- Identify green sand test frequency and purpose
- Determine proper test equipment
- Adhere to safety requirements
- Run green sand tests independently
- Determine and discuss acceptable green sand testing ranges

### Course Length - 1 day

*List Price: \$1,000 | Member Price: \$800*



## IMPROVING THE

## EFFECTIVENESS OF

## VISUAL INSPECTION

### Categories:

*Buyers, Designers, Metalcasters, Quality Control & Improvement*

Human visual inspection is the most common method to confirm the quality of work, whether in manufacturing or service industries. Yet it is very common to assume not much can be done about the generally low reliability of visual inspection – to err is human!

For people interested in improving visual inspection practice, few resources have been available – until now. The course “Improving the Effectiveness of Visual Inspection” provides you with the information needed to understand the factors of influence on the human task of visual inspection, permitting true quality engineering of this critical operation. The course is based on Ted Schorn’s 2018 book of the same name (provided with the course) that summarizes the research into visual inspection through hands-on learning and interaction with the author.

**Course Length - 2 days**

*List Price: \$1,250 | Member Price: \$1,050*

## INTRODUCTION TO

## CASTING ALLOYS

### Categories:

*Basic Metalcasting, Design of Casting & Gating Systems, Designers, Metalcasters*

A comparison of the commonly cast ferrous and nonferrous alloys will be presented. There will be discussions on casting applications, properties, and criteria for selection of the following alloys: iron, steel, copper aluminum, magnesium, zinc, and super alloys.

### Class participants will learn to:

- Explain reasons for using the different alloy types
- Describe the difference between ferrous and nonferrous alloys
- List at least three criteria that must be considered during alloy selection
- Explain the alloy classification system and list some common alloys, their mechanical and physical properties; and applications/industries

**Course Length – 0.5 days**

*List Price: \$500 | Member Price: \$425*

## INTRODUCTION TO

## CORELESS INDUCTION

## FURNACE OPERATION

### Categories:

*Metalcasters, Metallurgy & Melting Methods*

This course provides participants with best practices for safe operating techniques for induction melting. Topics include furnace components, the sequence of operations for daily start-up, “normal” furnace operation and types of induction furnaces, the differences in induction furnaces sizes; emergency situations and action plans.

### Class participants will learn to:

- Identify furnace components
- List the sequence of operations for daily start-up
- Describe a normal furnace operation
- Describe safe operating techniques of induction melting
- List the types of induction furnaces
- Identify an emergency and determine an action plan
- List the daily maintenance tasks for induction furnace operations

**Course Length - 1 day**

*List Price: \$1,000 | Member Price: \$800*

## INTRODUCTION TO

## METALCASTING

### Categories:

*Basic Metalcasting, Buyers, Designers, Metalcasters*

This course introduces the process of metalcasting. It provides a broad picture of what happens in a casting facility, while illustrating the technology, variables and complexity involved in producing a casting. It covers casting design, alloy selection, process selection, design of the gating system, pouring and shakeout methods, cleaning and finishing methods, quality assurance, and safety and environmental regulations.

### Class participants will learn to:

- Describe the metalcasting industry by defining the process and terms used in metalcasting, listing at least five end-use metalcasting markets and at least two challenges facing the industry
- Summarize the overall process of how a casting is made from part design through casting deliver

- Describe the quality assurance methods and measures use to ensure castings meet customer specifications
- Explain the importance of safety in the metalcasting industry
- Make different expendable mold castings from start to finish

**Course Length - 2 days**

*List Price: \$1,250 | Member Price: \$1,050*

## INTRODUCTION TO

## SUPERVISOR DEVELOPMENT

### Categories:

*Management*

Introduction to Supervisor Development is designed to assist new supervisors acquire the knowledge and skills required to be an effective leader. The course covers a wide range of topics including team leadership, communication, employment issues, and building on your success as a leader. It is especially designed to help those in the metalcasting industry (union and non-union) who are supervising hourly, or salaried workers. Introduction to Supervisor Development is beneficial to those who have been recently promoted from hourly or salaried ranks who have little previous experience in supervision and for supervisors that have not had any formal training.

### Class participants will learn to:

- Increase productivity
- Improve their communication skills
- Manage change, including dealing with resistance
- Interview prospective employees
- Understand basic legal requirements
- Handle substance abuse issues
- Understand the components of sexual harassment
- Successfully manage multicultural teams

**Course Length - 2 day**

*List Price: \$1,350 | Member Price: \$1,150*

## IRON METALCASTING 101

NEWLY  
REVISED

### Categories:

*Basic Metalcasting, Buyers, Design of Casting & Gating Systems, Designers, Metalcasters*

This is an introductory course covering the major cast iron families. Course topics include: characteristics and properties as well as general applications for each iron type; common alloying elements and their uses; iron melting technology and considerations; compatible casting processes and heat treatment options; and applications.

### Class participants will learn to:

- Describe the critical factors and features of cast iron that make it the casting alloy of choice
- Understand how elements in cast iron are adjusted to produce different grades
- Explain the classification systems for each of the five cast iron families
- Discuss the mechanical and physical properties of each of the five families of cast irons
- State four important inspection/testing methods for determining cast iron quality
- Analyze how different elements impact the properties of cast iron
- Describe the basic melting practices and related technologies for cast iron
- Compare iron casting processes
- Explain the use of heat treatment of cast iron and how it affects mechanical properties and cost
- Apply safety procedures to the daily work environment in a metalcasting facility

### Course Length - 1 day

List Price: \$1,000 | Member Price: \$800

## IRON MELTING 201

### Categories:

*Metalcasters, Metallurgy & Melting Methods, Quality Control & Improvement*

This course provides detailed coverage of iron melting and related processes. Course topics include: charge materials selection; cost, value, and risk; electric and cupola melting procedures; the relationship between molten metal and refractory lining; sampling and checks to determine iron quality; common effects of key major element adjustments; iron refining technology/treatment practices and safety procedures.

### Class participants will learn to:

- Identify the differences between alternate scrap types and key furnace additions
- Calculate a charge mix
- Identify which elements need to be controlled and explain the need to adjust these elements in gray and ductile cast iron

- Measure the efficiency of element recovery in iron melting processes
- Describe the melting practices and related refining technologies for cast iron
- Describe the key steps in converting solid charge materials to castable molten iron
- Identify and explain the role of slag and slag removal
- Describe sampling/test methods for determining molten iron quality
- Apply safety procedures to the daily work environment for a metalcasting facility melt deck
- Identify how channel holding furnaces can be utilized in both electric and cupola melting

### Course Length - 2 days

List Price: \$1,350 | Member Price: \$1,150

## IRON METALLURGY 201

### Categories:

*Designers, Metalcasters, Metallurgy & Melting Methods*

This course will provide participants with the knowledge and skills regarding the terminology, principles, and techniques for the metallurgy of gray and ductile iron casting alloys. Topics include equilibrium phase diagrams, kinetics (rates of change), eutectic solidification, undercooling, graphite shapes in gray and ductile iron, effects of alloying elements, eutectoid reaction in cast irons, mechanical testing, and defects related to metallurgy.

### Class participants will learn to:

- Recognize and describe the fundamentals of the Fe-C/Fe<sub>3</sub>C equilibrium (phase) diagram and the effect of adding silicon
- Describe the concepts of equilibrium and kinetics (speed of reactions)
- Identify and explain the solidification (eutectic) reactions that produce graphite and Fe<sub>3</sub>
- Describe the solidification behavior of ductile iron vs. gray iron vs. white iron
- Describe the process for pearlite formation in graphitic cast irons
- Relate solidification behavior to key points on cooling curves for various irons
- Describe the analysis of metallographic samples for cast irons, including phase identification
- Describe the major types and applicability of mechanical testing methods for irons
- Recognize metallurgical defects in gray and ductile iron
- Tools and procedures for identifying

### Course Length - 2 day

List Price: \$1,350 | Member Price: \$1,150



## METALCASTING PROCESS BASICS

### Categories:

*Basic Metalcasting, Buyers, Casting Costing & Sourcing, Designers, Metalcasters*

This course provides participants with a basic overview of the metalcasting process. It will track the path of a casting from quoting through shipping. This course covers common metalcasting terms and highlights the activities inside the major departments of a metalcasting production facility.

### Class participants will learn to:

- Define key industry terms
- Describe the major departments in a metalcasting facility
- Chronologically track a casting through the metalcasting facility from quoting to shipping

### Course Length - 0.5 day

List Price: \$500 | Member Price: \$425

## NOBAKE MOLDING &

## COREMAKING 101

### Categories:

*Basic Metalcasting, Buyers, Metalcasters, Molding Methods*

This course provides participants with a foundation of the no-bake molding and coremaking process used within a foundry and is designed for those with little or no prior experience in making no-bake molds. Course discussion includes: basic terminology; common chemical binders used; the mold and coremaking process; equipment; and mold defect analysis.

### Class participants will learn to:

- Identify the important safety measures and operating practices to use while making no-bake molds and cores
- Recognize the various types of raw materials and equipment used during the mold and coremaking process
- Prepare no-bake molds and cores that meet quality specifications
- Examine molds and cores for defects and determine the appropriate corrective action

### Course Length — 1 day

List Price: \$1,000 | Member Price: \$800

## NOBAKE MOLDING &

## COREMAKING 201

### Categories:

*Metalcasters, Molding Methods, Quality Control & Improvement*

This course includes advanced foundry terminology, introduction to specialty sands, sand variables and sand additives, as well as an in-depth discussion of the types of chemical binders used to make nobake molds and cores. There will be added focus on the mold and coremaking processes, how to use more complex tools and components, the use of refractory coatings, adhesives, how to evaluate problem areas with raw materials, binders, and equipment, how to adjust the process to ensure a quality mold, discussions on quality control tools and checks.

### Class participants will learn to:

- Summarize the advantage/disadvantages of various types of sand used in the nobake process
- Identify the equipment and processes used to handle and reclaim sand
- Describe common equipment challenges present in the nobake molding process
- Describe the basic sand additives, refractory coatings, adhesives, and release agents used in the nobake process
- Compare the variables of common sand binder systems
- Recognize ways to determine the best sand and binder for the mold application
- Follow the process for using mold-making tools and components
- Recognize raw material and equipment issues and their effect on process variables
- Use quality control check data to evaluate molds for defects and determine corrective action

### Course Length — 2 days

*List Price: \$1,350 | Member Price: \$1,150*

## PERMANENT MOLD

## THERMAL MANAGEMENT

### Categories:

*Design of Casting & Gating Systems, Metalcasters, Molding Methods, Quality Control & Improvement*

Permanent mold casting is a significant and major process used in the metalcasting industry. This course provides essential information on key factors that affect the thermal profile in a permanent mold casting process cycle. The most common permanent mold manufacturing practices for mold thermal management that focus on ensuring product quality will be covered.

### Class participants will learn to:

- Identify the types and properties of mold materials along with factors used in the selection and design of permanent molds for thermal control
- Explain the permanent mold process and machine safety measures
- Identify various cooling, heating, and other methods of controlling permanent mold temperatures
- Explain the importance of documenting the permanent mold process
- Recognize and troubleshoot various defects of permanent mold castings

### Course Length - 1 day

*List Price: \$1,100 | Member Price: \$900*

## PROCESS CONTROL

## FOR ENGINEERS

### Categories:

*Buyers, Designers, Metalcasters, Quality Control & Improvement*

The first goal of every process is stability: a consistent and predictable outcome. When we can make every casting the same, every dimension and every characteristic the same we can truly say we can control the process. If we can control it, we can improve it. But how are processes controlled? What are the factors of influence on processes that must be managed? This introductory course is designed to help process and quality engineers to answer these questions and to develop a methodology of process control. Attendees will leave with a set of tools and perspectives on process control that will provide a framework for attacking production and quality problems.

### Course Length - 2 days

*List Price: \$1,250 | Member Price: \$1,050*

## PROBLEM SOLVING &

## PROCESS IMPROVEMENT

### Categories:

*Buyers, Designers, Metalcasters, Quality Control & Improvement*

This course provides participants with an overview of basic problem solving with an emphasis on the effective use of quality tools and root cause analysis. A five-step approach to problem solving is presented, encouraging the necessary “closed loop” thinking that drives better problem solutions and facilitates improvement. Data collection and data analysis tools are briefly described leading to improved communication about problems and fostering efficient problem solving. Examples are drawn from a metalcasting environment. Participants will be able to assess their own problem solving methods for gaps as they survey the sequence and systems approach presented to resolve quality problems.

### Class participants will learn to:

- Describe structured problem solving approaches.
- Develop effective problem definitions.
- Describe process behaviors and identify process inputs and outputs.
- Distinguish between expected and unexpected process performance.
- Explain why process stability is required for improvement.
- Characterize problems to develop possible root causes.
- Recognize various methods for collecting and analyzing data.
- Determine process improvement solutions and countermeasures (short-term vs. permanent).
- Implement corrective action to sustain improvement.

### Course Length - 0.5 day

*List Price: \$595 | Member Price: \$395*

## STEEL METALCASTING 101

### Categories:

*Basic Metalcasting, Buyers, Design of Casting & Gating Systems, Designers, Metalcasters*

This introductory course provides participants with a basic understanding of steel classifications, metallurgical aspects, and the steelmaking process. This course covers the following topics: steelmaking and casting in a metalcasting facility, metallurgy and classification, heat treatment, quality control and understanding customer steel specifications.

### Class participants will learn to:

- Describe the main principles and features of the steelmaking, molding and metalcasting processes
- Explain the chief properties and types of steel, as well as what distinguishes it from iron;

- Describe the various heat treatment processes and procedures
- Describe inspection methods along with types and causes of steel defects
- Identify industry requirements and standards for inspections and welding repairs
- Describe features of chemical and mechanical testing of steel
- Explain the importance of fully understanding customer specifications and the role of communications in the specification process

### Course Length - 1 day

*List Price: \$1,000 | Member Price: \$800*

## STEEL MELTING 201

### Categories:

*Metalcasters, Metallurgy & Melting Methods, Quality Control & Improvement*

This course will study the operations of steel melting furnaces including electric arc and induction, the process steps during charging and startup, melt down, chemistry slag control, alloying, tapping, and process documentation, post melt processing methods, Argon Oxygen Decarburization (AOD) and Vacuum Oxygen Decarburization (VOD), melt quality control of undesirable elements with sampling and chemistry measurements, ladle selection and considerations, including maintenance and safety procedures.

### Class participants will learn to:

- Explain the difference among steel melting processes
- List melt-stock components
- Explain alloying techniques
- Explain chemistry measurement techniques
- Explain post-furnace processing variables
- Describe the quality implications from melting variables
- Explain proper refractory selection
- Describe the selection of ladle options (pros and cons)
- Describe the safety procedures and equipment related to the melting process

### Course Length - 2 days

*List Price: \$1,350 | Member Price: \$1,150*

## THE 10-STEP METHOD

## FOR CORRECTIVE ACTION

### Categories:

Buyers, Casting Costing & Sourcing, Design of Casting & Gating Systems, Designers, Metalcasters

Participants will be introduced to a basic overview of a casting defect analysis procedure. Course topics will include an introduction to the 10-step method for casting defect identification, how to compose a problem statement, a discussion on the importance of recording process parameters, an introduction to navigating the “International Atlas of Casting Defects”, a path to identifying the correct defect and its root cause for corrective action. Learning a systematic procedure for root cause identification supports the business goal of designing, producing, and selling quality castings in a timely manner in a safe environment at a profit.

### Class participants will learn to:

- List the steps used in casting defect analysis
- State the benefits of using a consistent approach
- Identify a good problem statement
- Collect process data using the process sheet
- State the importance of evaluating data
- Use the international atlas of casting defects classification system

### Course Length - 0.5 days

List Price: \$500 | Member Price: \$425

## 3D CASTING

## DESIGN REIMAGINED

### Categories:

Basic Metalcasting, Buyers, Design of Casting & Gating Systems, Designers, Metalcasters

This 2-day course will cover basic casting design rules comparing the traditional sand casting with toolingless 3D sand printing and emphasize the design freedom that comes with it. Overall design and optimization process and computer aided engineering tools including the effective use of casting process simulation for any new product development, casting conversion and redesign for thin-wall lower weight cast components will be covered with case studies. Key aspects of surface finish and dimensional tolerances with this new sand casting process will be discussed along with the typical casting and mold defects with examples. Overall inspection and quality control aspects for the 3D sand printing will be highlighted.

### Class participants will learn to:

- Identify basic casting design rules
- Describe the differences between the 3D sand printing and traditional casting processes
- Identify casting design optimization methods and computer aided design tools
- Identify dimensional tolerances, compare traditional and 3D sand printing tolerances and surface finish
- Identify common potential casting and mold defects in the 3D sand printing process
- Identify root causes for casting and mold defects
- Describe inspection methods and quality control tests for mold and casting production

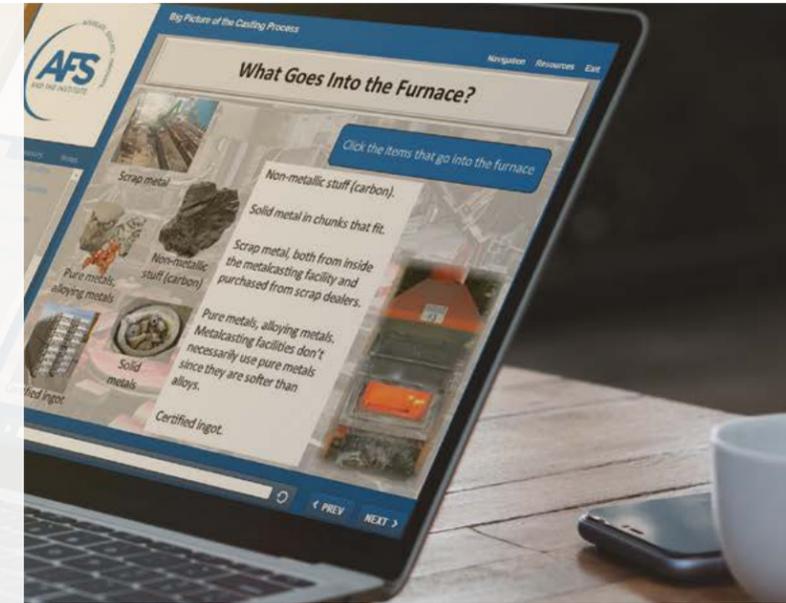
### Course Length - 2 days

List Price: \$1,350 | Member Price: \$1,150

# FOUNDRY E-LEARNING MODULES

The following is the full catalog of all Foundry E-Learning Modules offered by the AFS Institute. Foundry E-Learning Modules can be purchased via the Subscription Program or on an individual access basis. See page 5 or visit [www.afsinc.org/e-learning](http://www.afsinc.org/e-learning) for more details or to register for Foundry E-Learning Modules.

For more information and a FREE live demonstration via Zoom, contact Jen Christian at [jchristian@afsinc.org](mailto:jchristian@afsinc.org) or Shelby Goldman at [sgoldman@afsinc.org](mailto:sgoldman@afsinc.org).



## ACID DEMAND

## VALUE (ADV) OF SAND

### Categories:

Metalcasters, Molding Methods, Quality Control & Improvement

In this module, the AFS 1114-00-S: Acid Demand Value (ADV) sand test will be demonstrated. Module topics will include: purpose of the ADV test, basic variables that factor into the test, and performing the test in a virtual environment. By the end of this module, you will be capable of measuring the Acid Demand Value of sand.

## AFS 2 IN. DIA. X 2 IN. SPECIMEN

## PREPARATION, RAMMER METHOD

### Categories:

Metalcasters, Molding Methods, Quality Control & Improvement

The AFS 5222-13-S: AFS 2 in. Dia. x 2 in. Specimen Preparation, Rammer Method test will be taught in this module. In addition, the AFS 2251-00-S: Riddling, Molding Sand is part of this test and is included. Module topics will include: purpose of the tests, basic variables that factor into the tests, and performing the tests in a virtual environment. By the end of this module, you will be able to prepare a (2 in. diameter x 2 in.) test specimen for the testing of green sand and the dried physical properties of mold and core sands.

## AFS CLAY

### Categories:

Metalcasters, Molding Methods, Quality Control & Improvement

The AFS 2110-04-S: Clay, AFS Method test will be the focus of this module. Topics that will be covered: test objectives, basic test variables, and performing the test in a virtual environment. By the end of this module, you will be able to determine the percentage of clay (and other particles that settle at a rate of less than one inch per minute in water, typically material <20 microns).

## AFS PERMEABILITY

## FOR GREEN SAND

### Categories:

Metalcasters, Quality Control & Improvement

The AFS 5224-13-S: Permeability, Standard AFS 2 in. Dia. x 2 in. Test Specimen test will be the focus of this E-learning module. Prior to performing this test, you must complete the following sand tests: AFS 5222-13-S: 2 in. Diameter x 2 in. Specimen Preparation, Rammer Method and AFS 2251-00-S: Riddling, Molding Sand. These tests are incorporated in this module. Module topics that will be covered: purpose of the test, basic test variables, and performing the test in a virtual environment. By the end of this module, you will be able to determine the permeability of a Standard AFS (2 in. Dia. x 2 in.) test specimen.



## ALUMINUM CASTING ALLOYS

### Categories:

Basic Metalcasting, Buyers, Designers, Metalcasters, Quality Control & Improvement

In this module, the various mechanical and physical properties of aluminum that make it the casting alloy of choice will be defined. The Aluminum Association alloy designation system will be explained to identify the various alloying elements of aluminum. In addition, an introduction to aluminum heat treatment operations will be presented. By the end of this module, you will be able to describe the principal properties of aluminum; classify an aluminum alloy using the Aluminum Association designation system, identify the different alloying elements of aluminum; and define the various aluminum heat treatment operations.

## ALUMINUM CASTING

## APPLICATIONS

### Categories:

Buyers, Casting Costing & Sourcing, Designers, Metalcasters

This module will identify the properties that should be considered in the selection of an aluminum alloy and briefly review the aluminum alloy family characteristics that make them suitable for general casting applications. This module will conclude by choosing an aluminum alloy suitable for a case study. By the end of this module, you will be able to identify aluminum alloys suited to specific applications.

## ALUMINUM CASTING

## DEFECTS: GAS POROSITY

## & SHRINKAGE POROSITY

### Categories:

Buyers, Designers, Metalcasters, Quality Control & Improvement

In this module, the difference between gas porosity and shrinkage porosity will be examined along with causes and the methods to control them. Upon completion of this module, you will be able to define macro and micro porosity shrinkage aluminum defects and identify two control methods to reduce the defects.

## ALUMINUM CASTING DEFECTS:

## OXIDES & INCLUSIONS

### Categories:

Buyers, Designers, Metalcasters

In this module, learn about the problems associated with aluminum oxide and inclusion defects and their classification. Explore oxide and inclusion measurement and removal methods, and also learn about methods to avoid inclusions. By the end of this module, you will be able to describe problems associated with aluminum oxide and inclusion defects, determine whether an inclusion is oxide related or otherwise, identify measures to be taken to remove oxides and inclusions, and identify methods to avoid oxides and inclusions.

## ALUMINUM CASTING

## PRODUCTION

### Categories:

Basic Metalcasting, Buyers, Designers, Metalcasters, Molding Methods

This module will explore the aluminum casting production process. Four furnace types and five major types of casting processes for aluminum will be examined. Some safety considerations will also be included. By the end of this module, you will be able to identify the common melting techniques and molding methods for aluminum.

## BASICS OF FLUID DYNAMICS

## FOR METALCASTING

## GATING SYSTEMS

### Categories:

Design of Casting & Gating Systems, Designers, Metalcasters

In this module, the various mechanical and physical This module examines the basics of fluid dynamics for metalcasting and defines fluid flow in gating systems. This module will also define the laws of fluid dynamics and the effects of momentum and turbulence on gating systems. By the end of this module, you will be able to describe the basics of fluid dynamic principles related to gravity fed metalcasting gating design.

## BASICS OF HEAT TRANSFER

## PRINCIPLES FOR RISER DESIGN

### Categories:

Design of Casting & Gating Systems, Designers, Metalcasters

This module will explore the influence of heat flow, identify the two types of solidification and how shrinkage occurs. This module also looks at how shrinkage occurs differently in various metalcasting alloys. By the end of this module, you will be able to explain the influence of heat flow and identify the effects of different alloys on risers.

## BASIC MELT PRACTICES

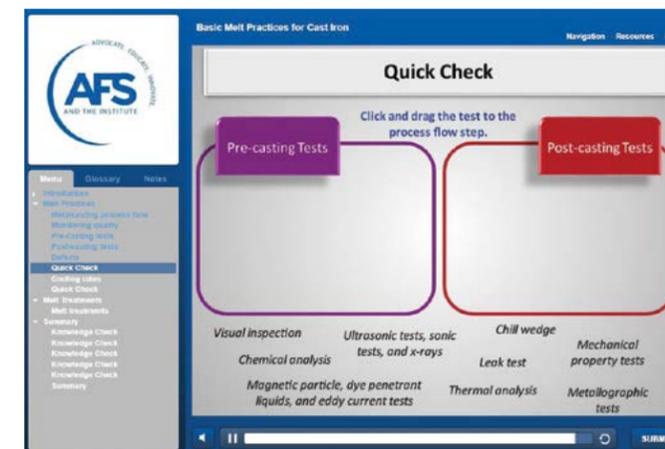
## FOR CAST IRON

### Categories:

Metalcasters, Metallurgy & Melting Methods

Different cast iron melting and pouring procedures will be explained along with quality tests (pre- and post-casting); cooling rates; and the three types of melt treatments used in metalcasting facilities. By the end of this module, you will be able to identify four important inspection/testing methods for determining cast iron quality and describe the basic melting practices and related technologies for cast iron.

*\*Also available in Spanish.*



## BIG PICTURE OF THE

## CASTING PROCESS

### Categories:

Basic Metalcasting, Buyers, Casting Costing & Sourcing, Designers, Metalcasters

This module identifies the primary casting processes and post-casting production processes that occur in a metalcasting facility. By the end of this module, you will be able to define key industry terms; describe the major departments in a metalcasting facility; and chronologically, track a casting from the quotation process, through casting production to casting shipment.

*\*Also available in Spanish.*

## CAST IRON DEFECTS:

## SOLIDIFICATION SHRINKAGE

## IN DUCTILE CAST IRON

### Categories:

Buyers, Designers, Metalcasters, Quality Control & Improvement

In this module, the focus will be on the factors that affect solidification shrinkage in ductile iron. Topics that will be discussed: the differences between pure iron and graphitic cast irons; the unique characteristics of ductile irons; metal and mold factors that affect shrinkage defect formation; effects of solidification shrinkage on casting quality and defect appearance; and some steps and considerations to reduce the risk of solidification shrinkage defects. By the end of this module, you will be able to identify two control measures to reducing solidification shrinkage in ductile irons.



## CAST IRON DEFECTS:

### SOLIDIFICATION SHRINKAGE

#### IN GRAY CAST IRON

**Categories:**  
*Buyers, Designers, Metalcasters, Quality Control & Improvement*

In this module, the focus will be on the factors that affect solidification shrinkage in gray iron. Topics that will be discussed: the differences between pure iron and graphitic cast irons; the unique characteristics of gray irons; the range of behavior for gray irons over the normal range of carbon equivalent (C.E.); the effects of solidification shrinkage on casting quality and defect appearances; and some steps and considerations to reduce the risk of solidification shrinkage defects. By the end of this module, you will be able to identify two control measures to reducing solidification shrinkage in gray cast irons.

*\*Also available in Spanish.*

### CASTING DEFECT ANALYSIS

#### PRACTICE AND CONCLUSION

**Categories:**  
*Buyers, Designers, Metalcasters, Quality Control & Improvement*

This module will focus on the practice of using the 10-Step Procedure to analyze a casting defect. This module is the culmination of the previous five modules. AFS recommends the completion of the following modules before taking this module:

- Introduction to Casting Defect Analysis
- Gas-related Defects
- Oxide-related Defects
- Sand-related Defects
- Shrink-related Defects

By the end of this module, you'll be able to identify the 10-Step Procedure and use these steps to analyze a casting defect.

*\*Also available in Spanish.*

## CASTING DESIGN

### FOR CASTABILITY

**Categories:**  
*Basic Metalcasting, Buyers, Design of Casting & Gating Systems, Designers, Metalcasters*

This module will focus on how to choose an appropriate casting process based on the complexity and manufacturability of a part. Topics will include defining the various casting processes available, tolerances, and the opportunity to complete a challenge. This module is designed for those who are involved in selecting, designing, and creating various types of molds and castings. By the end of this module, you will be able to choose a suitable casting process based on the complexity and manufacturability of a part.

### CASTING MATERIAL

#### PROPERTIES

**Categories:**  
*Basic Metalcasting, Buyers, Design of Casting & Gating Systems, Designers, Metalcasters*

This module will cover the following topics: heat flow and cooling rates, mold materials and methods, voids, irregularities, and post casting treatments. These topics affect the final mechanical properties of a casting. By the end of this module, you will be able to identify and describe a variety of production characteristics that can influence the mechanical properties of a casting.

### CHEMICAL BINDER HANDLING

#### SAFETY REQUIREMENTS

**Categories:**  
*Metalcasters, Molding Methods*

This module will identify the various types of personal protective equipment (PPE), safe handling practices, and equipment maintenance regarding chemically bonded sand testing. Chemically bonded sand testing, in this module, consists of nobake and coldbox mold and coremaking processes. By the end of this module, you will be able to identify the important safety guidelines to use during the production of chemically bonded molds and cores.

## COLDBOX CORE QUALITY

### AND CASTING DEFECTS

**Categories:**  
*Metalcasters, Molding Methods*

This module will identify how sand can impact core and mold making production costs and casting quality. There will be emphasis on controlling the temperature and moisture of your system. The various properties for binder selection and the consequences of poor performance for each property will be identified. This module will conclude with identifying core and casting defects and their causes. By the end of this module, you will be able to identify how sand and binder selection can impact the quality of cores and determine causes for core and casting defects.

### COLDBOX COREMAKING

#### COMPONENTS

**Categories:**  
*Metalcasters, Molding Methods*

The top three coldbox systems will be identified in this module. The different types of foundry sands and how they impact coldbox molds and cores will be explored. By the end of this module, you will be able to explain the components of the top three coldbox systems.

### COLDBOX COREMAKING

#### PROCESS

**Categories:**  
*Basic Metalcasting, Metalcasters, Molding Methods*

In this module, the coldbox coremaking process, related terminology, and the benefits/factors to using the coldbox process will be identified. By the end of this module, you will be able to explain the coldbox coremaking process.

## COLDBOX TOOLING

### DESIGN BASICS

**Categories:**  
*Metalcasters, Molding Methods*

In this module, the key aspects of well-designed tooling will be identified and applied to a case study. The types of core boxes, blow tubes, ejector pins, parting seals, and vents will be identified. By the end of this module, you will be able to identify the key aspects of well-designed tooling.

### COMPACTABILITY

**Categories:**  
*Metalcasters, Molding Methods, Quality Control & Improvement*

In this module, the AFS 2220-00-S: Compactability of Molding Sand Mixtures, Rammer Method sand test will be performed. By the end of this module, you will be able to determine the percentage decrease in the height of a loose mass of sand under the influence of compaction.

### COPPER CASTING ALLOYS

**Categories:**  
*Metalcasters, Molding Methods, Quality Control & Improvement*

In this module, the Unified Numbering System (UNS) of copper will be explored; the different types of copper alloys and the different alloying elements in copper castings will be identified. By the end of this module, you will be able to explain the UNS for copper and discuss the role of alloying elements in copper castings.

### COPPER CASTING APPLICATIONS

**Categories:**  
*Buyers, Casting Costing & Sourcing, Designers, Metalcasters, Metallurgy & Melting Methods*

This module will explore the numerous mechanical and physical properties of copper alloys; the details of the different copper families; and use that information to choose the specific copper alloy for three real-world examples. By the end of this module, you will be able to describe the principal properties of copper and its uses and describe and identify copper alloys suited to specific applications.

## COPPER CASTING

### DEFECTS: GATING

**Categories:**  
*Buyers, Designers, Metalcasters, Quality Control & Improvement*

This module focuses on gating-specific defects that occur in copper castings. This module will also define what is a gating system and common terms related to gating. Basic principles of solidification and shrinkage are also discussed. By the end of this module, you will be able to review the 10-Step Procedure used to analyze casting defects, identify copper casting gating defects, and identify gating changes that can reduce these defects.

## COPPER CASTING

### DEFECTS: SHRINKAGE

**Categories:**  
*Buyers, Designers, Metalcasters, Quality Control & Improvement*

In this module, shrinkage porosity will be defined and various shrinkage porosity characteristics and classifications will be identified (e.g., size, distribution, location, and performance). By the end of this module, you will be able to define macro and micro porosity shrinkage copper casting defects and identify two control methods to reduce those defects.

## COPPER CASTING

### PRODUCTION

**Categories:**  
*Buyers, Designers, Metalcasters, Metallurgy & Melting Methods, Molding Methods*

This module will explore the different melting and molding methods used in copper metalcasting facilities. Copper safety practices will also be presented. By the end of this module, you will be able to identify common melting methods and identify common molding methods for copper alloys.

## ELEMENTS IN CAST IRON

**Categories:**  
*Basic Metalcasting, Buyers, Designers, Metalcasters, Metallurgy & Melting Methods*

In this module, the role of carbon, silicon, and alloying elements in cast iron will be explored. This module will conclude with two real world case studies that compare different cast iron grades. By the end of this module, you will be able to analyze how different elements affect the properties of cast iron.

*\*Also available in Spanish.*

## FRIABILITY

**Categories:**  
*Metalcasters, Molding Methods, Quality Control & Improvement*

The AFS 2248-11-S: Friability sand test will be taught in this module. In addition, the AFS 2251-00-S: Riddling, Molding Sand and AFS 5222-13-S: AFS 2 in. Dia. x 2 in. Specimen Preparation, Rammer Method tests are part of the Friability test and included in this module. Module topics will include: purpose of the tests, basic variables that factor into the tests, and performing the tests in a virtual environment. By the end of this module, you will be able to measure the resistance to surface abrasion of green molding sands.

## FUNCTIONS AND FEATURES

### OF A RIGGING SYSTEM

**Categories:**  
*Design of Casting & Gating Systems, Designers, Metalcasters*

Riser function, riser types and their features, gating system functions and features, and riser sleeves and chills will be explored. This module also covers basic riser and gating system terminology. By the end of this module, you will be able to describe the functions of risers; list the types of risers and their features; describe the function and features of a gating system; and describe the use of sleeves and chills.

## GATING DESIGN FOR

### 3D PRINTED SAND

**Categories:**  
*Design of Casting & Gating Systems, Designers, Metalcasters, Molding Methods*

This E-Learning module will explore the topic of gating design for 3D sand printing. The following topics will be addressed in this module: the 3D sand printing process, cooling, gating and feed-riser design, mold economics, and simulation. Upon completion of this module, you will be able to list design advantages special to 3D sand printing, describe the 3D sand printing process from design to production, and differentiate between conventional casting and 3D sand casting regarding gating and feed-risers.

## GAS RELATED DEFECTS

**Categories:**  
*Buyers, Designers, Metalcasters, Quality Control & Improvement*

In this module, the many sources of gas-related defects and the three types of gas-related defects will be identified. This module will also identify the causes of these three types of defects and control measures that can be made at your facility. By the end of this module, you will be able to list the three types of gas-related defects and two control measures for each gas-related defect.

## GREEN SAND COMPACTION

**Categories:**  
*Metalcasters, Molding Methods, Quality Control & Improvement*

In this module, the different types of sand compaction will be explored. This module will also explain methods to prevent and resolve sand compaction problems. By the end of the module, you will be able to list the four methods to compact sand to ensure optimum quality castings.

*\*Also available in Spanish.*

## GREEN SAND

### MOLDING EQUIPMENT

**Categories:**  
*Metalcasters, Molding Methods*

The five key pieces of molding equipment needed to make a quality green sand mold will be identified along with proper equipment maintenance techniques. This module also consists of an optional safety section concerning personal protective equipment (PPE) and molding equipment. By the end of the module, you will be able to describe the measures required to choose, use, and maintain green sand molding equipment.

*\*Also available in Spanish.*

## GREEN SAND

### MOLDING PROCESS

**Categories:**  
*Metalcasters, Molding Methods*

This module will identify the components needed to make a green sand mold and explain how to make a quality green sand mold. Several molding processes will be discussed along with the topic of venting. By the end of the module, you will be able to list the steps needed for preparing high-quality green sand molds.

*\*Also available in Spanish.*

## GREEN SAND PREPARATION &

### QUALITY CONTROL

**Categories:**  
*Metalcasters, Molding Methods, Quality Control & Improvement*

In this module, the mulling sequence of horizontal wheel mullers will be explored and the primary tests involved in basic process control will be discussed. This module will also explore green sand strengths and the different alloy requirements. By the end of the module, you will be able to analyze raw material issues that may affect the quality of green sand molding outcomes.

*\*Also available in Spanish.*

## GREEN SAND RAW MATERIALS

**Categories:**  
*Metalcasters, Molding Methods*

This module will identify the different types of sand, clay, and additives that are used in making green sand molds. The features and properties that affect compactability and the role of water in green sand molding will be discussed. By the end of the module, you will be able to identify and assess the raw materials used in creating high-quality green sand molds.

*\*Also available in Spanish.*

## INTRODUCTION TO CAST IRON

**Categories:**  
*Basic Metalcasting, Buyers, Designers, Metalcasters, Metallurgy & Melting Methods*

This module will identify the industries that use cast iron, the alloying elements used in the production of cast iron, and the mechanical and physical properties of cast iron. By the end of the module, you will be able to describe the critical factors and features of cast iron that make it the casting alloy of choice.

*\*Also available in Spanish.*

## INTRODUCTION TO CAST IRON

## HEAT TREATMENTS

**Categories:**  
*Basic Metalcasting, Buyers, Designers, Metalcasters, Metallurgy & Melting Methods*

In this module, the reasons why cast iron metalcasting facilities heat treat their castings will be examined. We will also define the various heating and cooling cycles available. By the end of this module, you will be able to explain the use of heat treatment in cast iron and how it affects mechanical properties and cost.

*\*Also available in Spanish.*

## INTRODUCTION TO

## CAST IRON MELTING

**Categories:**  
*Basic Metalcasting, Metalcasters, Metallurgy & Melting Methods*

This module will provide a brief overview of the cast iron melting process and the multiple furnace types used in cast iron melting. In addition, general safety practices to perform while working on the shop floor and when visiting a metalcasting facility will be defined. By the end of this module, you will be able to briefly explain the cast iron metalcasting process and apply safety procedures in your daily work environment.

*\*Also available in Spanish.*

## INTRODUCTION TO CAST

## IRON MICROSTRUCTURES

**Categories:**  
*Basic Metalcasting, Buyers, Designers, Metalcasters, Metallurgy & Melting Methods*

This module will identify the differences between unary, binary, and ternary phase diagrams; define the microstructural components in the cast iron phase diagram and explain how and why microstructures form. By the end of this module, you will be able to identify unary, binary, and ternary phase diagrams.

*\*Also available in Spanish*

## INTRODUCTION TO CASTING

## DEFECT ANALYSIS

**Categories:**  
*Basic Metalcasting, Buyers, Designers, Metalcasters, Quality Control & Improvement*

This module is divided into three parts:

- Part 1: Meet Metro Metalcasting, Inc.
- Part 2: Categorize Casting Defects
- Part 3: Analyze Casting Defects

Part 1 of this module will be an introduction to Metro Metalcasting, Inc. (a fictional company) that is experiencing a high percentage of casting defects. Through the solutions team, participants will be introduced to a systematic approach to analyzing and reducing casting defects, the 10-Step Procedure.

In Part 2, the seven categories of casting defects will be described and participants will become familiar with the “International Atlas of Casting Defects.” In Part 3, participants will learn how to use the 10-Step Procedure to resolve a casting defect. You will be introduced to the tools used in each of the 10 steps and how to implement them. By the end of this module, you will be able to identify the 10-Step Procedure and use these steps to analyze a casting defect.

*\*Also available in Spanish.*

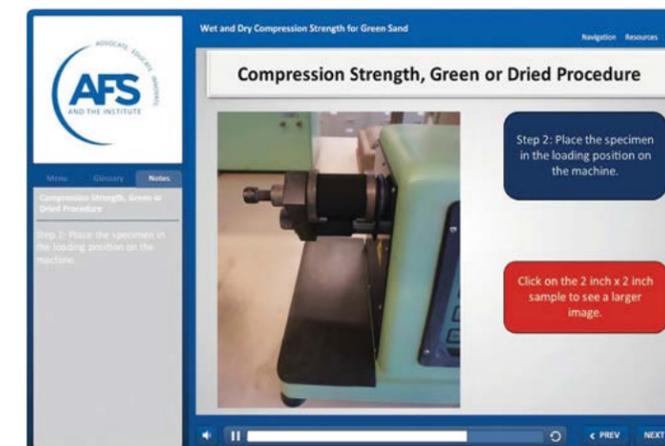
## INTRODUCTION TO

## GREEN SAND DEFECTS

**Categories:**  
*Metalcasters, Molding Methods, Quality Control & Improvement*

In this module, the visual inspection and physical properties needed to look at green sand defects will be identified. This module will also describe the causes of common green sand defects. By the end of the module, you will be able to identify one shrinkage defect, one gas porosity defect, one sand adherence defect, one sand strength defect, and one sand expansion defect.

*\*Also available in Spanish.*



## INTRODUCTION TO

## LEAN MANUFACTURING

**Categories:**  
*Buyers, Designers, Metalcasters*

This module provides participants with an overview of lean manufacturing and how to avoid the seven primary sources of waste. By the end of this module, you will be able to describe lean manufacturing concepts and process measurements that drive improvements in productivity and reduce costs and identify the seven primary sources of waste and how to avoid them.

## INTRODUCTION TO STEEL

## HEAT TREATMENTS

**Categories:**  
*Basic Metalcasting, Buyers, Designers, Metalcasters, Metallurgy & Melting Methods*

In this module, steel heat treatments will be defined and the basic steps to heat treating steel will be identified. The following heat treatment techniques will be introduced: annealing, normalizing, quenching, tempering, austempering, precipitation hardening, solution treating, and stress relieving. By the end of this module, you will be able to describe the various heat treatment processes and procedures for steel.

## LEAN MANUFACTURING

## APPLICATION

**Categories:**  
*Buyers, Designers, Management, Metalcasters*

This module reviews the basics of lean manufacturing, sensors, and the Industrial Internet of Things. From these concepts, you will apply what you have learned to your own lean manufacturing opportunity and complete the Lean Manufacturing Opportunity form. By the end of this module, you will be able to identify opportunities to improve your facility using lean manufacturing principles and document opportunities for improvement.

## LEAN MANUFACTURING

### CASE STUDIES

**Categories:**

*Buyers, Designers, Management, Metalcasters*

This module provides participants with the opportunity to work through some real case studies to enable thinking about how to apply lean manufacturing concepts. By the end of this module, you will be able to understand how to apply lean manufacturing concepts to real-life foundry problems and begin to think about how you can apply these concepts to the foundry where you work.

## LEAN MANUFACTURING

### PRINCIPLES

**Categories:**

*Metalcasters, Management, Molding Methods*

This module discusses the following topics: Industrial Internet of Things (IIoT), sensors, measurements, and metrics. By the end of this module, you will be able to describe the Industrial Internet of Things and how it fits in with lean manufacturing concepts and identify sensors and methods of utilizing the Industrial Internet of Things.

## LOST FOAM BASICS

**Categories:**

*Metalcasters, Molding Methods*

The basics of the lost foam process will be discussed in this module. Terminology, the casting process, and properties of the lost foam casting process will be addressed. By the end of this module, you will be able to define key lost foam terminology; list the steps in the lost foam casting process; state the advantages and disadvantages of using the lost foam casting process; and identifying the alloys that can be poured using this process.

## LOST FOAM DESIGN

### FOR ALUMINUM CASTINGS

**Categories:**

*Metalcasters, Molding Methods*

This module will review the benefits and identify the design challenges regarding foam, coating, and glue considerations. By the end of this module, you will be able to describe the benefits of the lost foam casting process for aluminum castings; identify design considerations when creating a lost foam mold; and explain what considerations need to be made when creating a foam mold.

## LOSS ON IGNITION (LOI)

**Categories:**

*Metalcasters, Molding Methods, Quality Control & Improvement*

In this module, the AFS 5100-12-S: Loss on Ignition (LOI) test will be performed. This module also incorporates the AFS 5101-12-S: Magnetic Material, Removal, and Determination sand test as part of the LOI test. Topics that will be covered: purpose of the tests, basic variables that factor into the tests, and performing the tests in a virtual environment. By the end of this module, you will be able to measure the weight change of a sample, consisting of weight losses and weight gains when a sample is fired at 1,800°F [982°C]. This includes weight loss due to volatilization of organics, weight loss due to removal of chemically bound water, weight loss due to dissociation or inorganic compounds with one or more components given off as a gas, and weight gain due to oxidation reactions (specifically chromite, olivine, and magnetite). You will also be able to remove magnetic materials in a sand sample and determine magnetic content.

## MECHANICS FOR

### HEAT TREATMENT:

## ALUMINUM PRACTICES

**Categories:**

*Metalcasters*

This module will identify why aluminum metalcasting facilities heat treat castings. This module will look at the various operational costs, furnace maintenance, how to select a heat treatment furnace, and how to select various quenching media at a facility. By the end of this module, you will be able to identify direct costs in aluminum heat treating, explain the impact of maintenance on operating cost, describe the characteristics of various furnac-

es and ovens, explain the purpose of rigidity in heat treatment basket design, state the different quenching media, and describe the different types of quenching.

## MECHANICS FOR

### HEAT TREATMENT:

## ALUMINUM PROCESSES

**Categories:**

*Metalcasters*

This module will address the effects of temperature on aluminum parts in the treatment process, the variables and problems that arise in the daily operations of heat treating aluminum parts, and the operational issues related to installing and using heat treating equipment. By the end of this module, you will be able to explain good rack loading procedures, explain the solution heat treating process, describe residual stresses and ways to mitigate them, describe straightening methods, and explain furnace installation issues.

## MELTING AND POURING

**Categories:**

*Basic Metalcasting, Buyers, Design of Casting & Gating Systems, Designers, Metalcasters*

This module addresses activities in the melt department of a metalcasting facility. It provides an overview of the process from the raw materials added to a furnace, to the adjustments made to the metal chemistry before consistently pouring molds. Safety issues regarding people, materials, and equipment are also highlighted. By the end of this module, you will be able to describe the melting process; identify the furnace types; state the advantages and disadvantages of each furnace type; explain how materials coming out of the furnace are adjusted; identify pouring methods; and state safety considerations.

## METALCASTING FACILITY SAFETY

**Categories:**

*Basic Metalcasting, Metalcasters*

This module will describe the safety precautions one should take when working in or walking through a foundry or metalcasting facility. The cleaning room of a metalcasting facility was used as an example because it includes many of the hazards encountered in a metalcasting facility. This module will discuss general safety statistics, personal protection equipment (PPE), metalcasting facility hazards, and equipment safety. By the end of this module, you will be able to recognize potential safety hazards in the

cleaning room of a metalcasting facility; describe the personal protective equipment (PPE) used in a metalcasting facility; and identify steps to take to reduce safety risks.

## METHYLENE BLUE CLAY TEST

**Categories:**

*Metalcasters, Molding Methods, Quality Control & Improvement*

In this module, the AFS 2210-00-S: Methylene Blue Clay Test, Ultrasonic Method, Molding Sand test will be performed. Topics that will be covered: purpose of the test, basic variables that factor into the test, and performing the test in a virtual environment. By the end of this module, you will be able to measure the amount of live (active) clay present in a sample of molding sand.

## MOISTURE DETERMINATION

### FOR SAND TESTING

**Categories:**

*Metalcasters, Molding Methods, Quality Control & Improvement*

In this module, the AFS 2216-00-S: Moisture, Infrared, Determination in Molding Sand test and the AFS 2219-00-S: Moisture Determination, Oven Method test will be performed. Topics that will be covered: purpose of the tests, basic variables that factor into the tests, and performing the tests in a virtual environment. By the end of this module, you will be able to determine the moisture content in foundry sand mixes and additives and determine the percentage of moisture in sand.

## NOBAKE MATERIALS

### AND EQUIPMENT

**Categories:**

*Basic Metalcasting, Metalcasters, Molding Methods*

In this module, the materials used in making nobake molds and cores will be identified. The equipment used throughout the nobake mold and core process will be explained. By the end of this module, you will be able to recognize the various types of raw materials and equipment used in the nobake mold and core making process.

## NOBAKE MOLD AND

## CORE DEFECTS

**Categories:**  
*Metalcasters, Molding Methods, Quality Control & Improvement*

This module will explore the various defects that occur in nobake molds and cores, such as slow cure defects, low strength or poor scratch defects, and lamination defects. The nine areas of quality control that must be addressed will be identified. By the end of this module, you will be able to evaluate nobake molds and cores for defects and determine the corrective action needed.

## NOBAKE MOLDS AND

## CORE PROCESS

**Categories:**  
*Basic Metalcasting, Metalcasters, Molding Methods*

In this module, the reasons for using nobake molds will be explained along with the basic terminology regarding the nobake process; the importance of work time and strip time will be described; and the need for production consistency in temperature and time will be discussed. By the end of this module, you will be able to explain the nobake mold and core making process.

## OXIDE RELATED DEFECTS

**Categories:**  
*Buyers, Designers, Metalcasters, Quality Control & Improvement*

In this module, the different types of oxide-related defects will be defined and identified. This module will also identify the oxide-related defect causes and control measures to combat these defects. There will be a brief examination of certain gating system topics to understand how oxides can be affected by the gating system. By the end of this module, you will be able to identify the types of oxide-related defects and list two control measures for preventing oxides.

*\*Also available in Spanish.*

## PERMANENT MOLD

## CASTING PROCESS

**Categories:**  
*Metalcasters, Molding Methods*

This module defines the permanent mold casting process and identify the four steps of the casting process: preparation, filling, solidification, and ejection. This module will also identify key benefits of this process over other casting processes. By the end of this module, you will be able to identify the steps and key features/benefits of the permanent mold process, distinguish factors that may affect a mold during the preparation, filling, solidification, and ejection phases, and identify methods that aid in the solidification and cooling process.

## pH OF SAND

**Categories:**  
*Metalcasters, Molding Methods, Quality Control & Improvement*

In this module, the AFS 5113-00-S: pH of Sand test will be performed. Topics that will be covered: purpose of the test, basic variables that factor into the test, and performing the test in a virtual environment. By the end of this module, you will be able to determine the alkalinity or acidity of sand, expressed in terms of pH.

## PURCHASING CASTINGS:

## CREATE THE RELATIONSHIP

**Categories:**  
*Buyers, Metalcasters*

This module will define the purchasing casting process from the perspective of a new buyer-supplier relationship. This process includes the following segments: pre-procurement, supplier information gathering, supplier analysis, and supplier relationship. By the end of this module, you will be able to identify the key buyer and supplier roles; define key purchasing casting terminology; define the steps in the purchasing casting process; and provide the responsibilities of each role throughout the purchasing casting process.

## PURCHASING CASTINGS:

## GROW THE RELATIONSHIP

**Categories:**  
*Buyers, Metalcasters*

This module will review the benefits of growing the relationship between a purchasing casting buyer and casting supplier. This module will also review the ways suppliers can impact a buying organization and discuss ways that both buyers and suppliers can grow their relationship. This module concludes with information strategies a buyer can take to help the supplier better understand their expectations. By the end of this module, you will be able to state the benefits of growing the relationship; list the ways that suppliers can impact the buying organization; list the ways that buyers can grow their relationship with the supplier; list the ways that suppliers can grow their relationship with the buyer; and state what the buyer can do to help the supplier understand their expectations.

## PURCHASING CASTINGS:

## MAINTAIN THE RELATIONSHIP

**Categories:**  
*Buyers, Metalcasters*

This module will discuss maintaining the purchasing casting buyer-supplier relationship and key terminology regarding maintaining the relationship. By attempting to understand the terms of the relationship between buyer and seller you will be gaining a greater insight into the basic workings of the economy. By the end of this module, you will be able to discuss the benefits of maintaining the relationship, discuss how to be a valued supplier, and identify supplier and buyer touchpoints.

## RISERIRING IRON CASTINGS

**Categories:**  
*Design of Casting & Gating Systems, Designers, Metalcasters*

This module identifies the uniqueness of feeding graphitic cast iron alloys. The three ways risers should be designed for cast iron will be explained along with the factors that affect volume change. By the end of this module, you will be able to list unique riser considerations for iron castings.

## SAND RELATED DEFECTS

**Categories:**  
*Buyers, Designers, Metalcasters, Quality Control & Improvement*

The sand molding process and the four types of sand casting methods will be identified in this module. The three different types of sand-related defects: sand expansion; sand adhesion; and sand strength will be reviewed. Along with in-depth explanations of these defects, possible sand system control measures will be discussed to help avoid these defects. By the end of this module, you will be able to identify the three different types of sand-related defects and one control measure to implement, per sand-related defect.

*\*Also available in Spanish.*

## SAND SAMPLING METHODS

**Categories:**  
*Metalcasters, Molding Methods, Quality Control & Improvement*

Two tests will be performed in this module: AFS 1101-13-S: Sampling of Sand and AFS 1104-13-S: Sampling of Bagged Sand. Topics that will be covered: purpose of the tests, basic variables that factor into the tests, and performing the tests in a virtual environment. By the end of this module, you will be able to obtain a representative sample of free falling sand entering or exiting a bulk storage container (rail car, bin, barge, palletainer, intermediate bulk storage container, etc.) and obtain a sample of bagged sand which represents the lot from which the sample was obtained.

## SHRINK RELATED DEFECTS

**Categories:**  
*Buyers, Designers, Metalcasters, Quality Control & Improvement*

In this module, shrinkage and the different types of shrink-related defects will be identified. This module will also identify the causes of these shrink-related defects. In addition, shrink defects will be distinguished from gas defects and shrink control measures will be described. The module will briefly examine some gating system topics and how shrinkage can be affected by the gating system. By the end of this module, you will be able to identify the types of shrink-related defects and list two control measures to preventing shrink defects.

*\*Also available in Spanish.*



## SIEVE ANALYSIS AND

## GRAIN FINENESS

## NUMBER (AFS GFN)

**Categories:**  
*Metalcasters, Metallurgy & Melting Methods, Quality Control & Improvement*

Two tests will be performed in this module: the AFS 1105-12-S: Sieve Analysis (Particle Determination of Sand) and the AFS 1106-12-S: Grain Fineness Number, AFS GFN, Calculation tests. Topics that will be covered: purpose of the tests, basic variables that factor into the tests, and performing the tests in a virtual environment. By the end of this module, you will be able to determine the particle size distribution of loose, dry sand using standard test sieves and calculate the AFS Grain Fineness Number (AFS GFN), an estimate of the average sieve size of a sand sample.

## SIX FAMILIES OF CAST IRON

**Categories:**  
*Basic Metalcasting, Buyers, Designers, Metalcasters, Metallurgy & Melting Methods*

This module will explore the designation systems and details of each of the six families of cast iron. The Introduction to Cast Iron module is a prerequisite for this module and incorporated in this module. By the end of the module, you will be able to identify how elements in cast iron are adjusted to produce different grades; explain the classification systems for each of the six cast iron families; and discuss the mechanical and physical properties of each of the six families of cast iron.

*\*Also available in Spanish.*

## STEEL CASTING ALLOYS

**Categories:**  
*Basic Metalcasting, Buyers, Designers, Metalcasters, Metallurgy & Melting Methods*

This module will explore how steel is made and identify the differences between cast iron and steel. The different steel alloy types and properties will be explained. By the end of this module, you will be able to explain the chief properties and types of steel, as well as what properties distinguish it from cast iron.

## STEEL CASTING DEFECTS:

## OXIDES AND INCLUSIONS

**Categories:**  
*Buyers, Designers, Metalcasters, Quality Control & Improvement*

This module will explore oxides and inclusions that affect steel castings. This module will review the source of each of these defects and measures to take to control these defects. By the end of this module, you will be able to identify oxides and inclusions, how to determine the source, and how to prevent them. This module will also give you the opportunity to document causes of inclusions by working through a case study.

## STEEL CASTING

## DEFECTS: SHRINKAGE

**Categories:**  
*Buyers, Designers, Metalcasters, Quality Control & Improvement*

In this module, the two types of steel shrinkage defects: macro and micro shrinkage porosity (voids) will be explored. This module will also identify control measures to reduce or eliminate shrinkage defects. By the end of this module, you will be able to: define macro and micro shrinkage porosity (voids) defects in steel and identify two control methods to reduce the defects.

## STEEL CASTING PRODUCTION

**Categories:**  
*Buyers, Casting Costing & Sourcing, Designers, Metalcasters, Molding Methods*

This module will explore the steel casting process, including: optimizing a design; patternmaking; mold and core making; melting and pouring; and cleaning and inspection. By the end of this module, you will be able to describe the main principles and features of the metalcasting and molding processes of steel.

## STEEL CASTING QUALITY

## REQUIREMENTS &

## INSPECTION METHODS

**Categories:**  
*Buyers, Design of Casting & Gating Systems, Designers, Metalcasters, Quality Control & Improvement*

In this module, the two types of steel inspection methods and the different types of chemical composition tests will be identified. By the end of this module, you will be able to identify industry requirements and standards for inspections and welding repairs and describe features of the chemical and mechanical testing of steel.

## TENSILE STRENGTH FOR

## CHEMICALLY BONDED SAND

**Categories:**  
*Metalcasters, Molding Methods, Quality Control & Improvement*

In this module, the AFS 3301-08-S: Tensile Strength, 1 in. Thick Tensile Specimen test will be performed. Prior to taking this module, you must complete the following sand test module: AFS 3315-00-S: Specimen Preparation, 1 in. Thick Specimen, Hot Box, Warm Box/Cold Box. This test is incorporated in this module. Topics that will be covered: purpose of the tests, basic variables that factor into the tests, and performing the tests in a virtual environment. By the end of this module, you will be able to determine tensile strength of 1 in. thick tensile specimens.

## TYPES OF ALLOYS

**Categories:**  
*Basic Metalcasting, Buyers, Design of Casting & Gating Systems, Designers, Metalcasters*

This module will define the term alloy and identify the seven common alloys seen in the metalcasting industry: aluminum, copper, iron, steel, zinc, magnesium, and superalloys. This module will also differentiate between the terms, ferrous and nonferrous. By the end of the module, you will be able to identify the seven alloys used in the metalcasting industry and describe why certain alloys are used.

## TYPES OF CASTING PROCESSES

**Categories:**  
*Basic Metalcasting, Buyers, Design of Casting & Gating Systems, Designers, Metalcasters*

Based on the latest metalcasting census data, this module will identify the top casting processes and briefly identify the various advantages and disadvantages for each process. By the end of this module, you will be able to identify the various casting processes available for producing a metalcasting and describe the advantages and disadvantages of each of the common casting processes.

## TYPES OF CASTING TOOLING

### Categories:

Basic Metalcasting, Buyers, Design of Casting & Gating Systems, Designers, Metalcasters

This module will explore the different types tooling used in the metalcasting industry: permanent mold tooling, sand mold tooling, and investment pattern tooling. Common Tooling Department constraints will be described. By the end of this module, you will be able to identify and describe the types of tooling that are used with the major casting production processes.

## WET AND DRY COMPRESSION

## STRENGTH FOR GREEN SAND

### Categories:

Metalcasters, Molding Methods, Quality Control & Improvement

In this module, the AFS 5202-09-S: Compression Strength, Green or Dried sand test will be performed. Prior to performing this test, you must complete the following sand tests: AFS 5222-13-S: 2 in. Diameter x 2 in. Specimen Preparation, Rammer Method and AFS 2251-00-S: Riddling, Molding Sand. These tests are incorporated in this module. Topics that will be covered: purpose of the tests, basic variables that factor into the tests, and performing the tests in a virtual environment. By the end of this module, you will be able to determine the compression strength of an AFS 2 in. Dia. x 2 in. specimen.

## WET TENSILE STRENGTH

## FOR GREEN SAND

### Categories:

Metalcasters, Molding Methods, Quality Control & Improvement

In this module, the AFS 2206-12-S: Tensile, Wet Molding Sand test will be performed. Topics that will be covered: purpose of the test, basic variables that factor into the test, and performing the test in a virtual environment. By the end of this module, you will be able to measure the wet tensile strength of bentonite-bonded molded sands.

## 3D SAND PRINTING BENEFITS

### Categories:

Buyers, Casting Costing & Sourcing, Design of Casting & Gating Systems, Designers, Metalcasters

This module will compare the 3D sand printing process with the traditional sand casting process and identify the advantages of additive manufacturing, including cost and time implications. The module incorporates optimized real-world applications of 3D sand printing. Upon completion of this module, you will be able to identify applications where 3D sand printing addresses complexity, speed to solution/prototype, and cost vs. castability.

## 3D SAND PRINTING

## CASTING DESIGN

### Categories:

Designers, Metalcasters, Molding Methods

This module will compare traditional casting methods and 3D sand printing. Topics will include part design, parting lines, casting filling and solidification, cores, undercuts, number of cores and undercuts, junctions, geometry orientation, and bosses and ribs. The module will also examine 3D sand printing mold design. The following topics will be discussed in this section: questions to ask the client, process to move from a CAD file to mold design, documenting the mold with text, assembly aids, lifting aids, building a virtual box, and designing for cleaning. Upon completion of this module, you will be able to demonstrate mold design techniques and describe material handling techniques for 3D sand printing.

## 3D SAND PRINTING

## MOLD QUALITY

### Categories:

Designers, Metalcasters, Quality Control & Improvement

This module will explore 3D sand printing mold and core quality. The following topics will be addressed: elements of quality 3D sand printed molds and cores, standard cleaning and test procedures, potential defects of 3D Sand printed molds and cores, and lifting aids used with 3D sand printed molds and cores. Upon completion of this module, you will be able to identify best practices for quality molds and cores and select the tools used to ensure mold and core quality.

## 3D SAND PRINTING

## PROCESS & TERMINOLOGY

### Categories:

Basic Metalcasting, Casting Costing & Sourcing, Design of Casting & Gating Systems, Designers, Metalcasters

This module will define and identify the different types of additive manufacturing (AM). The 3D sand printing process and the basic means of creating a 3D sand printed mold will also be explained. The module will assist you in identifying the different types of 3D sand printing materials. Upon completion of this module, you will be able to identify the process, terminology, and applications regarding 3D sand printing.



**AFS Institute In-Plant Training** provides you with high-value, immediate-impact, best-in-class, unbiased, and professional training at your facility for an affordable price. It is the best way to deliver new skills training to a large group of employees. In-Plant Training provides you with the ultimate in convenience: no employee travel expenses and a familiar environment while maximizing training efficiency and value.

**In-Plant Training** offers:

- Customized training to fit your company's workforce needs
- Efficient, cost-effective skills training for a large group
- Hands-on, engaging activities to reinforce skills development
- Team-building opportunities across roles and departments

Special pricing available for AFS Corporate Members.

For more information on **In-Plant Training**, visit [www.afsinc.org/in-plant-training](http://www.afsinc.org/in-plant-training).

To schedule your In-Plant Training, contact **Jen Christian** at [jchristian@afsinc.org](mailto:jchristian@afsinc.org).

# SPANISH FOUNDRY E-LEARNING MODULES



## COMPACTACIÓN DE

## ARENA VERDE

**Categories:**  
*Metalcasters, Molding Methods, Quality Control & Improvement*

En este módulo, se explorarán los diferentes tipos de compactación de arena. Este módulo también explicará los métodos para prevenir y resolver problemas de compactación de la arena. Al final del módulo, podrá enumerar los cuatro métodos para compactar la arena para garantizar una calidad óptima de las piezas vaciadas.

## DEFECTOS EN EL HIERRO

## FUNDIDO: CONTRACCIÓN

## POR SOLIDIFICACIÓN

## EN HIERRO GRIS

**Categories:**  
*Buyers, Designers, Metalcasters, Quality Control & Improvement*

En este módulo nos enfocaremos en los factores que afectan la contracción por solidificación en hierro gris. Discutiremos las diferencias entre el hierro puro y los hierros fundidos grafiticos, las características únicas de los hierros grises, el intervalo del

comportamiento para hierros grises sobre el intervalo normal de equivalente de carbono (CE), los efectos de la contracción por solidificación en la calidad de la pieza y la apariencia de los defectos, y demás etapas y consideraciones para reducir el riesgo de defectos de contracción por solidificación. Al final de este módulo, usted podrá identificar dos medidas de control para reducir la contracción por solidificación en los hierros grises.

## DEFECTOS RELACIONADOS

## CON LA ARENA

**Categories:**  
*Buyers, Designers, Metalcasters, Quality Control & Improvement*

El proceso de moldeo en arena y los cuatro tipos de métodos de fundición en arena se identificarán en este módulo. Tres tipos diferentes de defectos relacionados con la arena: expansión de arena; adhesión de arena; y la resistencia de la arena será revisados. Además, se proporcionará una explicación a profundidad de estos defectos, se discutirán las posibles medidas de control del sistema de arenas para ayudar a evitar estos defectos. Al final de este módulo, podrá identificar los tres tipos diferentes de defectos relacionados con la arena y una medida de control para implementar, por defecto relacionado con la arena.

## DEFECTOS RELACIONADOS

## CON LA CONTRACCIÓN

**Categories:**  
*Buyers, Designers, Metalcasters, Quality Control & Improvement*

En este módulo, se definirá e identificará la contracción y los diferentes tipos de defectos relacionados con esta. En este módulo además se identificarán las causas de los defectos relacionados con la contracción. Además, se distinguirán los defectos derivados de la contracción de los defectos del gas y se describirán las medidas de control de contracción. En este módulo se examinarán brevemente algunos temas del sistema de alimentación y de qué manera la contracción se puede ver afectada por el sistema de alimentación. Al final del módulo, podrá identificar los tipos de defectos relacionados con la contracción y dos medidas de control para evitar los defectos de contracción.

## DEFECTOS RELACIONADOS

## CON EL GAS

**Categories:**  
*Buyers, Designers, Metalcasters, Quality Control & Improvement*

En este módulo, se identificarán las diversas fuentes de defectos relacionados con el gas y los tres tipos de defectos relacionados con el gas. En este módulo también se identificarán las causas de estos tres tipos de defectos y las medidas de control que se pueden adoptar en las fundiciones. Al final del módulo, podrá enumerar los tres tipos de defectos relacionados con el gas y dos medidas de control para cada defecto relacionado con el gas.

## DEFECTOS RELACIONADOS

## CON EL ÓXIDO

**Categories:**  
*Buyers, Designers, Metalcasters, Quality Control & Improvement*

En este módulo, se definirán e identificarán los diferentes tipos de defectos relacionados con el óxido. En este módulo también se identificarán las causas de los defectos relacionados con el óxido y las medidas de control para combatir estos defectos. Habrá un breve examen sobre determinados temas del sistema de alimentación para comprender de qué manera este puede ser afectado por el óxido. Al final del módulo, podrá identificar los tipos de defectos relacionados con el óxido y dos medidas de control para evitar el óxido.

## ELEMENTOS EN EL

## HIERRO FUNDIDO

**Categories:**  
*Basic Metalcasting, Buyers, Designers, Metalcasters, Metallurgy & Melting Methods*

En este módulo, se analizará el rol del carbono, del silicio, y los elementos de aleación en el hierro fundido. Este módulo concluirá con dos casos de estudio del mundo real que comparan diferentes grados de hierro fundido. Al finalizar el módulo, podrá analizar de qué manera los diferentes elementos afectan las propiedades del hierro fundido.

## EQUIPO DE MOLDEO

## DE ARENA VERDE

**Categories:**  
*Metalcasters, Molding Methods*

Se identificarán las cinco piezas principales del equipo de moldeo necesarias para preparar un molde de arena verde de calidad, junto con técnicas adecuadas de mantenimiento de equipos. Este módulo además comprende una sección de seguridad opcional relacionada con los equipos de protección personal (EPP) y equipos de moldeo. Para el final del módulo, podrá describir las prácticas adecuadas para elegir, usar y mantener los equipos de moldeo de arena verde.

## INTRODUCCIÓN AL ANÁLISIS DE

## DEFECTOS DE FUNDICIÓN

**Categories:**  
*Basic Metalcasting, Buyers, Designers, Metalcasters, Quality Control & Improvement*

Este módulo se divide en tres partes:

Parte 1: Conozca a Metro Metalcasting, Inc.  
Parte 2: Categorización de los Defectos de Fundición  
Parte 3: Análisis de los Defectos de Fundición

La Parte 1 del módulo será una introducción a Metro Metalcasting, Inc. (una compañía ficticia) que tiene un alto porcentaje de defectos de fundición. Utilizando la técnica de formar un equipo para la solución a estos defectos, se presentará a los participantes un enfoque sistemático para el análisis y la reducción de los defectos de la fundición. El Procedimiento de 10-Etapas. En la Parte 2, se describirán las siete categorías de los defectos de fundición y los participantes se familiarizarán con el International Atlas of Casting Defects. En la Parte 3, los participantes aprenderán cómo usar el Procedimiento de 10-Etapas para resolver un defecto de fundición. Se le presentarán las herramientas utilizadas en cada una de las 10 etapas y cómo implementarlas. Para el final del módulo, podrá identificar el Procedimiento de 10-Etapas y utilizar dichas etapas para analizar un defecto de fundición.

## INTRODUCCIÓN A LA FUSIÓN

## DE HIERRO FUNDIDO

**Categories:**  
*Basic Metalcasting, Metalcasters, Metallurgy & Melting Methods*

En este módulo se proporcionará un breve resumen del proceso de fundición de hierro fundido y los diversos tipos de hornos utilizados para la fundición del hierro fundido. Además, se indicarán las prácticas generales de seguridad mientras trabaja en el taller y se definirá cuándo visitar una instalación de fundición de metales. Para el final de este módulo, podrá explicar brevemente el proceso de fundición de metales del hierro fundido y aplicar procedimientos de seguridad a su entorno de trabajo diario.

## INTRODUCCIÓN AL

## HIERRO FUNDIDO

**Categories:**  
*Basic Metalcasting, Buyers, Designers, Metalcasters, Metallurgy & Melting Methods*

En este módulo identificará las industrias que utilizan hierro fundido, los elementos de aleación utilizados en la producción de hierro fundido y las propiedades mecánicas y físicas del hierro fundido. Para el final del módulo, usted podrá describir los factores y las características críticas del hierro fundido que lo hacen la aleación de preferencia.

## INTRODUCCIÓN A LA

## MICROESTRUCTURA

## DEL HIERRO FUNDIDO

**Categories:**  
*Buyers, Designers, Metalcasters, Metallurgy & Melting Methods*

En este módulo se identificarán las diferencias entre diagramas de fases unario, binario, y ternario; se definirán los componentes de microestructuras en el diagrama de fases del hierro fundido y se explicará cómo y por qué se forman las microestructuras. Para el final de este módulo, usted podrá identificar los diagramas de fases unario, binario, y ternario.

## INTRODUCCIÓN A LOS

## TRATAMIENTOS TÉRMICOS

## DE FUNDICIÓN DE HIERRO

**Categories:**  
*Basic Metalcasting, Buyers, Designers, Metalcasters, Metallurgy & Melting Methods*

En este módulo, se examinarán por qué las instalaciones de fundición de metales tratan térmicamente sus piezas (con calor sus coladas). También definiremos los diversos ciclos de enfriamiento y calentamiento disponibles. Para el final del módulo, podrá explicar el uso del tratamiento térmico (con calor) en el hierro fundido y de qué manera afecta las propiedades mecánicas y el costo.

## INTRODUCCIÓN A LOS DEFECTOS

## DE LA ARENA VERDE

**Categories:**  
*Metalcasters, Molding Methods, Quality Control & Improvement*

En este módulo, se identificarán las propiedades físicas y la inspección visual necesaria para analizar los defectos de la arena verde. En este módulo además se describirán las causas de los defectos más comunes de la arena verde. Al final del módulo podrá identificar un defecto de contracción, un defecto de porosidad por gas, un defecto de adherencia de la arena, un defecto de resistencia de la arena y un defecto de expansión de la arena.

## MATERIAS PRIMAS

## DE ARENA VERDE

**Categories:**  
*Metalcasters, Molding Methods*

En este módulo identificaremos los diferentes tipos de arena, arcilla y aditivos que se utilizan para realizar moldes de arena verde. Se analizarán las características y propiedades que afectan la compactabilidad y el rol del agua en el moldeado con arena verde. Al finalizar el módulo, el alumno podrá identificar y evaluar las materias primas utilizada para elaborar moldes de arena verde de gran calidad.

## PANORAMA GENERAL DEL

## PROCESO DE FUNDICIÓN

**Categories:**  
*Basic Metalcasting, Buyers, Casting Costing & Sourcing, Designers, Metalcasters*

En este módulo se identifican los procesos primarios y los procesos de producción posteriores al vaciado que se utilizan en una fundición de metales. Para el final del módulo, usted podrá definir los términos clave de la industria, describir los principales departamentos en una fundición de metales y realizar un seguimiento, de manera cronológica, desde el proceso de cotización, hasta la producción y el envío de partes vaciadas.

## PRÁCTICAS BÁSICAS DE

## FUSIÓN PARA HIERRO

**Categories:**  
*Metalcasters, Metallurgy & Melting Methods*

Se epicurean los diferentes procedimientos de fusión y vertido de hierro fundido junto con los ensayos de calidad (pre-vaciado y post-vaciado); velocidades de enfriamiento; y los tres tipos de tratamientos de fusión utilizados en las fundiciones. Al final de este módulo, podrá identificar cuatro métodos importantes de inspección / pruebas para determinar la calidad del hierro fundido y describir las prácticas básicas de fusión y las tecnologías relacionadas para el hierro fundido.

## PRÁCTICA PARA EL ANALISIS DE

## DEFECTOS EN PIEZAS

## Y CONCLUSIÓN

**Categories:**  
*Buyers, Designers, Metalcasters, Quality Control & Improvement*

Este módulo se centrará en la práctica del uso del Procedimiento de 10-Etapas para analizar un defecto de pieza. Este módulo es la culminación de los cinco módulos anteriores. AFS recomienda completar los siguientes módulos antes de tomar este módulo:

Introducción al Análisis de Defectos de Fundición  
Defectos Relacionados con el Gas  
Defectos Relacionados con el Óxido  
Defectos Relacionados con la Arena  
Defectos Relacionados con la Contracción

Al final del módulo, podrá identificar el Procedimiento de 10-Etapas y utilizar dichas etapas para analizar un defecto de pieza.

## PREPARACIÓN DE ARENA VERDE

## Y CONTROL DE CALIDAD

**Categories:**  
*Metalcasters, Molding Methods, Quality Control & Improvement*

En este módulo, se estudiará la secuencia de funcionamiento de los mezcladores con rueda horizontal y las pruebas básicas relacionadas con el control del proceso. En este módulo además exploraremos la resistencia de la arena verde y los diferentes requerimientos sobre las arenas para diferentes tipos de aleaciones. Al finalizar el módulo, el participante podrá analizar los problemas relacionados con las materias primas que pudieran afectar la calidad de los resultados del moldeo en arena verde.

## PROCESO DE MOLDEO

## DE ARENA VERDE

**Categories:**  
*Metalcasters, Molding Methods*

En este módulo, identificará los componentes necesarios para preparar un molde de calidad de arena verde. Se analizarán diversos procesos junto con el tema del venteo. Al final del módulo usted podrá enumerar los pasos necesarios para elaborar moldes de arena verde de gran calidad.

## LAS SEIS FAMILIAS

## DE HIERRO FUNDIDO

**Categories:**  
*Basic Metalcasting, Buyers, Designers, Metalcasters, Metallurgy & Melting Methods*

En este módulo exploraremos los sistemas de designación y los detalles de cada una de las seis familias de hierro fundido.

El módulo Introducción al Hierro Fundido es un prerrequisito para este módulo y se ha incorporado aquí. Al finalizar el módulo, podrá identificar de qué manera se ajustan los elementos en el hierro fundido para producir diferentes grados, explicar los sistemas de clasificación para cada una de las seis familias de hierro fundido, y analizar las propiedades físicas y mecánicas de cada una de las seis familias de hierro fundido.



# AFS Corporate Member Advantage

For Metalcasters



### Industry Intelligence

- Bi-Annual Metalcasting Forecast**
  - This crucial marketplace outlook is free to Corporate Members (\$1,000 value)
- Wage and Benefit Survey**
  - Key compensation information, free to participating Corporate Members (\$1,000 value)
- World Foundry Organization Annual Census**
  - A look at the state of the worldwide metalcasting industry is delivered free to Corporate Members
- Employment Law Update**
  - A monthly summary prepared by our partner law firm to keep you apprised of key developments concerning OSHA regulations and inspections, NLRB decisions, wage-hour rules, pending workplace legislation and many more topics.
- EPA, OSHA and Public Policy Advocacy Webinars**
  - Quarterly webinars on Key Policy Issues Affecting Metalcasters.

### Workforce & Career Development

- Leadership Training & Sustainability**
  - AFS trains the current and future leaders of metalcasting
- Building the Next Generation of Metalcasters**
  - Student chapters, Institute training, foundry demonstrations, Melting Point magazine and more attract new talent to the industry
- Regional Chapters**
  - Individual members may join AFS regional chapters
- Casting Connection**
  - Members can network, ask questions and get answers from peers through this metalcasting social network
- Industry Job Descriptions**
  - AFS' complete, detailed list of metalcasting industry job descriptions is available for Corporate Members to use for recruiting, evaluations, or other workforce needs
- Metalcasting Job Board**
  - Corporate Members get a 50% discount when they post jobs on the AFS Job Board
- Event Discounts**
  - Save on registration for educational and networking events hosted by AFS (discounts vary)
- AFS Energy Program**
  - Corporate Members can reduce their electricity and natural gas supply costs

### Government Advocacy

- Legislative Influence**
  - On Capitol Hill, AFS shapes a better business climate for metalcasters

### Education

- In-Plant Training**
  - Corporate Members receive special rates on in-depth training at their facilities (10% off is the discounted rate)
- Instructor-Led Training**
  - Receive discounts on classes (in-person and online) for new and experienced metalcasters (\$200 discount per person)
- Free AFS Members-Only Webinars**
  - All individual members and employees of Corporate Members participate in technical and management webinars (\$250 value per session)
- Foundry E-Learning**
  - Only Corporate Member companies are eligible to a discounted subscription for unlimited access to AFS Institute e-Learning in English and Spanish (at an additional cost on an annual basis)

### Technical/Management/Research Support & Innovation

- Driving Research**
  - 8% of corporate dues support AFS research
- Committee Membership**
  - Individual members are eligible to sit on AFS committees, which conduct cutting-edge research and help establish industry standards
- Technical Assistance**
  - The AFS technical services team is ready for your calls on technical, metallurgical, and EHS questions, as well as casting design assistance, with top priority going to Corporate Members
- HR Consulting**
  - AFS provides foundry-specific insights and assistance for your human resources needs
- Energy Consulting**
  - AFS can help with questions about energy costs, consumption and efficiency

### Books & Publications

- Modern Casting**
  - A subscription to one of the industry's leading trade magazines, delivered monthly (\$115 value)
- International Journal of Metalcasting**
  - A subscription to AFS' metalcasting research journal (\$199 value)
- Book Discounts**
  - Get price breaks on AFS-published technical books (discounts vary)
- AFS Library**
  - Receive full online access to the AFS Library, the world's largest collection of metalcasting research papers and articles
- AFS Insider News**
  - Stay up-to-date on industry news and AFS events with this weekly e-newsletter
- AFS Nonferrous Bulletin**
  - Keep yourself informed about nonferrous news and events through this newsletter, available in both print and digital formats.

### Business Opportunities & Branding

- Trade Show/Exhibit Space Discounts**
  - Save money on exhibits and attendance at CastExpo and Metalcasting Congress (discounts vary)
- Referrals**
  - AFS refers all phone, e-mail and online inquiries to Corporate Members
- Logo**
  - Corporate Members can add credibility to their business by using the AFS logo on brochures and websites
- AFS Shipping Solutions**
  - Take advantage of shipping savings and more with AFS' shipping program (savings vary)
- Casting Source Directory**
  - Online and Print: Corporate Member metalcasters are featured in the Casting Source Directory.



# Metalcasters Corporate Membership Application

Dues Category Based on Annual Sales Volume in Million Dollars	Annual Dues	Free Corporate Affiliate Members Including Corporate Contact
\$0 - 1.99 Million	\$1,240	2
\$2 - 3.99 Million	\$1,850	3
\$4 - 6.99 Million	\$2,480	4
\$7 - 10.99 Million	\$3,090	5
\$11 - 16.99 Million	\$3,690	6
\$17 - 24.99 Million	\$4,330	7
\$25 - 34.99 Million	\$4,940	8

Dues Category Based on Annual Sales Volume in Million Dollars	Annual Dues	Free Corporate Affiliate Members Including Corporate Contact
\$35 - 46.99 Million	\$5,545	9
\$47 - 60.99 Million	\$6,180	10
\$61 - 75.99 Million	\$6,785	11
\$76 - 93.99 Million	\$7,390	12
\$94 - 113.99	\$10,500	13
\$114 - 199.99 Million	\$14,845	14
Above \$200 Million	\$18,480	15

\*Non-U.S. based company dues are 10% lower per federal regulations on association services.

Your firm's sales volume last year from **casting-related sales only (include all North American facilities)** \$ \_\_\_\_\_

Company Name \_\_\_\_\_ Number of Employees \_\_\_\_\_

Company Address \_\_\_\_\_ City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

Company Telephone \_\_\_\_\_ Company Website \_\_\_\_\_

Company Social Media \_\_\_\_\_

Key Contact for Membership\* \_\_\_\_\_ Title \_\_\_\_\_ E-mail \_\_\_\_\_

Key Contact for Human Resources\* \_\_\_\_\_ Title \_\_\_\_\_ E-mail \_\_\_\_\_

Key Contact for Marketing/Sales\* \_\_\_\_\_ Title \_\_\_\_\_ E-mail \_\_\_\_\_

Key Contact for Engineering/Manufacturing\* \_\_\_\_\_ Title \_\_\_\_\_ E-mail \_\_\_\_\_

\* AFS Staff will follow-up with key contacts for their seat names.

Sign key contacts up for **Modern Casting** magazine subscription.  Yes  No

### Primary metal focus

- Aluminum
- Copper-base (brass, bronze, ect.)
- Iron
- Magnesium
- Steel
- Zinc
- Other \_\_\_\_\_

### Primary process

- Green sand
- Investment
- Lost foam
- Permanent mold
- Other \_\_\_\_\_

### Reason for joining AFS

- Enhanced exposure to casting consumers
- Industry insight/technical information
- Training/workforce development
- Support industry initiatives
- Other \_\_\_\_\_

### Payment Information

Check enclosed (U.S. funds only)  Bill company **Charge to:**  American Express  Mastercard  Visa **Membership Length:**  One Year  Two Years

The following information is required to charge your membership:

Account Number \_\_\_\_\_ Exp. Date \_\_\_\_\_ Security Code \_\_\_\_\_

Signature \_\_\_\_\_ Date \_\_\_\_\_

### Return completed application to:

American Foundry Society | 35169 Eagle Way | Chicago, IL 60678-1351  
Tel: 1-847-824-0181/1-800-537-4237 | Fax: 1-847-824-7848 | www.afsinc.org | e-mail: AFSmembership@afsinc.org



# AFS Individual Member Benefits

## Workforce & Career Development

### Leadership Training & Sustainability

- AFS trains the current and future leaders of metalcasting

### Building the Next Generation of Metalcasters

- Student chapters, Institute training, foundry demonstrations, Melting Point magazine and more attract new talent to the industry

### Regional Chapters

- Only individual members may join AFS regional chapters

### Casting Connection

- Individual members can network, ask questions and get answers from peers through this metalcasting social network

### Event Discounts

- Deep discounts on registration for educational and networking events hosted by AFS (discounts vary)

## Education

### Instructor-Led Training

- Receive discounts on classes (in-person and online) for new and experienced metalcasters (\$200 discount per person)

### Foundry e-Learning Modules

- Receive discounted rate of \$55 per module (half off the general rate of \$110)

### Free AFS Members Only-Webinars

- All individual members participate in 30+ technical and management webinars per year (\$250 value per session)

## Technical/Management/Research Support & Innovation

### Committee Membership

- Only individual members are eligible to sit on AFS committees, which conduct cutting-edge research and help establish industry standards

## Books & Publications

### Modern Casting

- A subscription to one of the industry's leading trade magazines, delivered monthly (\$115 value)

### Book Discounts

- Get 25% discounts on all AFS-published technical books

### AFS Library

- Receive free online access to the AFS Library, the world's largest collection of metalcasting research with more than 17,000+ papers and articles

### AFS Insider News

- Stay up-to-date on industry news and AFS events with this weekly e-newsletter

For more information, contact **Kim Farrugia** at 800-537-4237 or [kfarrugia@afsinc.org](mailto:kfarrugia@afsinc.org).





# AFS Individual Member Application

## Individual Annual Dues

<input type="checkbox"/> Individual	\$140	<input type="checkbox"/> International Technical	\$255
<input type="checkbox"/> Corporate Individual	\$75	<input type="checkbox"/> Teaching Associate	\$70
<input type="checkbox"/> Retired	\$25	<input type="checkbox"/> Student (Full-Time)	\$20

Name \_\_\_\_\_ Job Title \_\_\_\_\_

Company \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Country \_\_\_\_\_ Zip/Postal Code \_\_\_\_\_

Telephone \_\_\_\_\_ E-mail \_\_\_\_\_

I desire affiliation with the following AFS Chapter \_\_\_\_\_

Do you wish to receive *Modern Casting* magazine? (For Metalcasters)  Yes  No

Do you wish to receive *Casting Source* magazine? (For Industry Suppliers)  Yes  No

### Which best describes your business?

- Producer of metal castings (foundry, diecaster, ect.)
- Pattern and tooling shop
- Supplier of metalcasting equipment, raw materials or services
- Consultant/consulting engineer
- Research institute/testing lab
- Casting user/designer/buyer
- Educational institute/facility/military
- Other \_\_\_\_\_

### What metals do you primarily work with?

- Iron
- Steel
- Aluminum
- Copper-base (brass, bronze, ect.)
- Magnesium
- Zinc
- Other \_\_\_\_\_

### What is your reason for joining AFS?

- Boost career success & professional development
- Maximize my technical knowledge
- Deep discounts on AFS events and books
- Strengthen my professional network
- Participate in an AFS committee
- Support the important work of AFS
- Other \_\_\_\_\_

### Payment Information

Check enclosed (U.S. funds only)  Bill company **Charge to:**  American Express  Mastercard  Visa **Membership Length:**  One Year  Two Years

The following information is required to charge your membership:

Account Number \_\_\_\_\_ Exp. Date \_\_\_\_\_ Security Code \_\_\_\_\_

Signature \_\_\_\_\_ Date \_\_\_\_\_

### Return completed application to:

American Foundry Society | 35169 Eagle Way | Chicago, IL 60678-1351  
 Tel: 1-847-824-0181/1-800-537-4237 | Fax: 1-847-824-7848 | www.afsinc.org | e-mail: AFSmembership@afsinc.org

NEW  
 ★★★★★  
 COURSE  
 ★★★★★



# Introduction to Supervisor Development

**Introduction to Supervisor Development** is designed to assist new supervisors acquire the knowledge and skills required to be an effective leader. The course covers a wide range of topics including team leadership, communication, employment issues, and building on your success as a leader. It is especially designed to help those in the metalcasting industry (union and non-union) who are supervising hourly, or salaried workers. Introduction to Supervisor Development is beneficial to those who have been recently promoted from hourly or salaried ranks who have little previous experience in supervision and for supervisors that have not had any formal training.

### Introduction to Supervisor Development course is Designed For:

- Supervisors
- Superintendents
- Engineers
- Quality professionals
- Safety professionals
- Sales leaders
- Maintenance leaders
- Crew leaders

Available live online, in the classroom, or onsite in your facility. For more information, contact **Jen Christian** at [jchristian@afsinc.org](mailto:jchristian@afsinc.org) or **847-803-4302**.

# AFS INSTITUTE INSTRUCTORS



**DOUG DESMIT**  
*ASK Chemicals*

Doug DeSmit is the Technical Service Manager for ASK Chemicals and has been working in the metalcasting industry since 1974. DeSmit oversees the training of all new Technical Representatives as well as maintaining training for ASK Chemicals.



**LUKE DIX**  
*Profound Alloys*

Luke Dix earned a B.S. in manufacturing technology with an emphasis in metalcasting from the University of Northern Iowa. He received his M.S. in metallurgical engineering from the University of Alabama. Currently the regional sales manager for Profound Alloys, Dix previously was a regional sales manager for Miller and Company and a melting engineer and assistant superintendent for American Cast Iron Pipe Company.



**WALTER EVANS**  
*Walter J. Evans Consulting*

Walter Evans is the owner of Walter J. Evans Consulting where he works with the AFS Institute in developing new courses and teaching current ones. Evans worked for the Ford Motor Company for 30 years as a supervisor and staff technical specialist. Prior to working at Ford, Evans completed his PhD in metallurgy at Case Western University.



**PATRICK FRAZIER**  
*ME Global Inc.*

Patrick Frazier has worked in Human Resources since 2007 and joined ME Global's Tempe Foundry as the HR Manager in 2017. In June 2023 he was promoted into his current role, Director of Organizational Development. This is a new role within the organization where his primary focus has been on developing a streamlined training process, supporting

training coordinators to assist onsite at both of their foundries. He has also created and maintained a succession planning exercise for the leadership team to use as an ongoing process

to ensure the continued development and retention of high potential employees. Frazier has additional HR experience in the manufacturing industry (Semiconductor & Aerospace). He has a passion for teaching and working with college students and post-graduates in the field of human resources. In 2024, Frazier attended the Institute's Introduction to Supervisor Development class where he was an active participant, and he also joined the Talent and Development Division within AFS.



**DR. SUDESH KANNAN**  
*Foundry Consultant*

Seasoned foundry veteran Dr. Sudesh Kannan delivers real-world solutions to transform your operations. Tap into his 20+ years of global foundry support to optimize your processes and reduce costly errors. His hands-on work with foundry suppliers like Selee, Praxair, and St. Gobain and their foundry customers ensures practical, actionable insights. Advance your understanding with his extensive technical publications and research background.



**PATRICK KLUESNER**  
*Grede Castings*

Patrick Kluesner graduated with a Bachelor of Science degree in Industrial Technology Management from the University of Wisconsin-Platteville, and currently works for Grede Castings. Previously, Patrick served as a Training Engineer at MAGMA where he taught basic and advanced

simulation techniques, with an emphasis on HPDC and sand casting. When he wasn't teaching, he was also responsible for creating content for seminars, webinars, and online tutorials for defect analysis and resolution.



**BRANDON LAMONCHA**  
*Humtown Products*

Brandon Lamoncha is sales manager/director of additive manufacturing for Humtown Products (Columbiana, Ohio), where he has worked for more than 20 years. Starting as a computer aided machinist (CAM), Lamoncha learned to produce tooling for aerospace, engine components, glass

molds, and other foundry products. Most recently, Brandon has focused on 3D sand printing and establishing Humtown's 3D

printer facility in partnership with Youngstown State University and America Makes.



**EDWARD MARCZYSAK**  
*Retired*

Since starting his metalcasting career in 1973, Edward Marczyzak has worked in all facets of foundry work, including coremaker, material handler, green sand molder, production manager, and president/general manager. He has implemented lean manufacturing and safety programs in several plants.



**RANDY OEHRLEIN**  
*Carley Foundry Inc.*

Randy Oehrlein has been involved with numerous foundry engineering tasks since 1974 and has been with Carley Foundry since 1999. He serves as VP of Engineering, overseeing a multi-disciplined team of engineers. He is active at the national level in the AFS Aluminum and Research Committees and has given presentations in specialty conferences.



**DAVE PALMER, P.E.**  
*BRP-US Inc.*

Dave Palmer has a B.S. in materials engineering from the Illinois Institute of Technology and an M.S. in materials engineering from UW-Milwaukee. He works for BRP-US Inc as supplier quality development engineer, with a focus on castings and coatings. Dave also worked for Modine Manufacturing Co for several years. He is an experienced teacher

and has worked for both producers and end-users of metal castings. Dave serves as Secretary-Elect for the AFS Aluminum and Light Metals Division.



**SAIRAM RAVI**  
*ATEK Metal Technologies, LLC*

Sairam Ravi is a Director of Process Development for Wisconsin Aluminum Foundry Division and is experienced with green sand, no-bake, cold-box and permanent mold processes. Sairam previously worked for UNI (University of Northern Iowa) where he worked on applied research projects related to the advancement and development of foundry technol-

ogies. Over the course of his career, he has worked with several suppliers and OEMs in developing processes for equipment and materials.



**DR. KUMAR SADAYAPPAN**  
*CANMET-MATERIALS*

Dr. Kumar Sadayappan is a senior research scientist since 1996 at CANMET Materials, Natural Resources Canada. He started his metal casting career in 1986 and obtained his doctoral degree at Indian Institute of Science in 1994. His research activities include alloy development,

solidification processing, and process-structure-property correlation studies of non-ferrous metals. Dr. Sadayappan is a member of the copper Division of AFS since 1997. He was involved in the development of lead-free copper alloys for plumbing applications for which Dr. Sadayappan received AFS Technology Transfer Award twice. He is also a recipient of AFS Penton gold Medal, AFS Scientific Merit Award, and ASM Fellowship for his contributions to Non-Ferrous alloy metallurgy.



**TED SCHORN**  
*Enkei America, Inc.*

Ted Schorn is currently responsible for quality and technology for Enkei America's North American operations as Vice President. He has worked in the field of quality over 35 years, spanning automotive, aerospace and medical markets. Ted also operates his own consulting firm, Schorn Consulting, LLC which provides training, management

consulting and expert witness services. Ted's areas of special expertise include quality management, wheel design and engineering, foundry safety and visual inspection. He has degrees in Physics and Mathematics and is the author of two books: Understanding the Wheel Fastening System on Trailers (RVIA/NATM) and Improving the Effectiveness of Visual Inspection (AFS). Ted is frequently called on to speak on both technical and management topics and has authored over 40 technical articles. Ted is a recent Thomas W. Pangborn Gold Medal award recipient. He was also awarded the Scientific Merit Award by AFS, was the 2005 Hoyt Memorial Lecturer and has been the recipient of the Ray Witt Management Paper Award three times. He served on the AFS board of directors 2011 - 2015, chaired the Division Council and the Engineering Division, serving on the Quality Systems committee over 25 years. Ted serves as President of the Lean Network, Inc. an association of Honda suppliers.



## JITEN SHAH

Product Development  
and Analysis LLC

Jiten Shah is founder and president of Product Development & Analysis (PDA) LLC. He has over 30 years of metalcasting design and manufacturing experience and is proficient in computer aided engineering tools, including process simulation and 3D scanning. Shah specializes in product

and process development, redesign for optimization, reverse engineering, additive digital manufacturing and value engineering of metal castings.



## KEN WAY

Miller and Company

Ken Way has a B.S. in materials science and engineering from Purdue University. He is the Vice President of Sales and Technical Services for Miller and Company. Way's other experience includes working as an engineering manager, senior plant metallurgist, laboratory manager and melting supervisor at Internet Corporation; and as a technical,

operations and quality manager for Citation Corp.



## JIM WHITE

Expert Consultant

With over 20 years' experience in the foundry industry working for Caterpillar Inc. Jim White was responsible for developing processes for iron castings, advanced product quality planning (APQP), design for manufacturability, and continuous improvement at Caterpillar's Cast Metals Organization. The second half of

Mr. White's career was spent at Caterpillar's Purchasing Division, providing leadership and technical expertise to both non-ferrous and ferrous casting suppliers. Eventually Mr. White would lead a team of purchasing professionals responsible for \$200 million in world-wide casting spend. His unique blend of experience as both a casting producer and purchaser gives him a unique perspective on the Casting Industry. Mr. White has addressed the AFS Executive Conference, and Casting Congress concerning the state of the foundry industry from the purchaser's perspective. White is the 2010 recipient of the Childress-Loebler Lifetime Achievement Award.

# TOPIC INDEX

## BASIC METALCASTING

### COURSES

Aluminum Metalcasting 101.....	7
Chemically Bonded Sand Testing.....	10
Coldbox Process 101.....	11
Copper Metalcasting 101.....	11
Green Sand Molding 101.....	15
Introduction to Casting Alloys.....	16
Introduction to Metalcasting.....	17
Iron Metalcasting 101.....	18
Metalcasting Process Basics.....	19
Nobake Molding & Coremaking 101.....	19
Steel Metalcasting 101.....	21
3D Casting Design Reimagined.....	22

### MODULES

Aluminum Casting Alloys.....	24
Aluminum Casting Production.....	24
Big Picture of the Casting Process.....	25
Casting Design for Castability.....	26
Casting Material Properties.....	26
Coldbox Coremaking Process.....	27
Elements in Cast Iron.....	28
Introduction to Cast Iron.....	30
Introduction to Cast Iron Heat Treatments.....	30
Introduction to Cast Iron Melting.....	30
Introduction to Cast Iron Microstructures.....	30
Introduction to Casting Defect Analysis.....	30
Introduction to Steel Heat Treatments.....	31
Melting and Pouring.....	33
Metalcasting Facility Safety.....	33
Nobake Materials and Equipment.....	33
Nobake Molds and Core Process.....	34
Six Families of Cast Iron.....	36
Steel Casting Alloys.....	36
Types of Alloys.....	37
Types of Casting Processes.....	37
Types of Casting Tooling.....	38
3D Sand Printing Process & Terminology.....	39

### SPANISH MODULES

Elementos en el Hierro Fundido.....	41
Introducción al Análisis de Defectos de Fundición.....	42
Introducción a la Fusión de Hierro Fundido.....	42
Introducción al Hierro Fundido.....	42
Introducción a los Tratamientos Térmicos de Fundición de Hierro.....	42
Panorama General del Proceso de Fundición.....	43
Las Seis Familias de Hierro Fundido.....	44

## BUYERS

### COURSES

Aluminum Metalcasting 101.....	7
Casting Cost Estimating.....	8
Casting Supplier Auditing.....	10
Copper Metalcasting 101.....	11
Design & Optimization for 3D Sand Printing.....	12
Fundamentals of SPC & Process Capability.....	14
Improving the Effectiveness of Visual Inspection.....	16
Introduction to Metalcasting.....	17
Iron Metalcasting 101.....	18
Metalcasting Process Basics.....	19
Nobake Molding & Coremaking 101.....	19
Process Control for Engineers.....	20
Problem Solving & Process Improvement.....	21
Steel Metalcasting 101.....	21
The 10-Step Method for Corrective Action.....	22
3D Casting Design Reimagined.....	22

### MODULES

Aluminum Casting Alloys.....	24
Aluminum Casting Applications.....	24
Aluminum Casting Defects: Gas Porosity & Shrinkage Porosity.....	24
Aluminum Casting Defects: Oxides & Inclusions.....	24
Aluminum Casting Production.....	24
Big Picture of the Casting Process.....	25
Cast Iron Defects: Solidification Shrinkage in Ductile Cast Iron.....	25
Cast Iron Defects: Solidification Shrinkage in Gray Cast Iron.....	26
Casting Defect Analysis Practice and Conclusion.....	26
Casting Design for Castability.....	26
Casting Material Properties.....	26
Copper Casting Applications.....	27
Copper Casting Defects: Gating.....	28
Copper Casting Defects: Shrinkage.....	28
Copper Casting Production.....	28
Elements in Cast Iron.....	28
Gas Related Defects.....	29
Introduction to Cast Iron.....	30
Introduction to Cast Iron Heat Treatments.....	30
Introduction to Cast Iron Microstructures.....	30
Introduction to Casting Defect Analysis.....	30
Introduction to Lean Manufacturing.....	31
Introduction to Steel Heat Treatments.....	31
Lean Manufacturing Application.....	31
Lean Manufacturing Case Studies.....	32
Melting and Pouring.....	33
Oxide Related Defects.....	34
Purchasing Castings: Create the Relationship.....	34
Purchasing Castings: Grow the Relationship.....	35
Purchasing Castings: Maintain the Relationship.....	35
Sand Related Defects.....	35
Shrink Related Defects.....	35
Six Families of Cast Iron.....	36
Steel Casting Alloys.....	36



Steel Casting Defects: Oxides and Inclusions.....	36
Steel Casting Defects: Shrinkage.....	37
Steel Casting Production.....	37
Steel Casting Quality Requirements & Inspection Methods.....	37
Types of Alloys.....	37
Types of Casting Processes.....	37
Types of Casting Tooling.....	38
3D Sand Printing Benefits.....	38

## SPANISH MODULES

Defectos en el Hierro Fundido:	
Contracción por Solidificación en Hierro Gris.....	40
Defectos Relacionados con la Arena.....	40
Defectos Relacionados con la Contracción.....	41
Defectos Relacionados con el Gas.....	41
Defectos Relacionados con el Óxido.....	41
Elementos en el Hierro Fundido.....	41
Introducción al Análisis de Defectos de Fundición.....	42
Introducción al Hierro Fundido.....	42
Introducción a la Microestructura del Hierro Fundido.....	42
Introducción a los Tratamientos	
Térmicos de Fundición de Hierro.....	42
Panorama General del Proceso de Fundición.....	43
Práctica para el Análisis de Defectos en Piezas y Conclusión.....	43
Las Seis Familias de Hierro Fundido.....	44

## CASTING COSTING & SOURCING

### COURSES

Casting Cost Estimating.....	8
Casting Defect Analysis.....	9
Casting Supplier Auditing.....	10
Metalcasting Process Basics.....	19
The 10-Step Method for Corrective Action.....	22

### MODULES

Aluminum Casting Applications.....	24
Big Picture of the Casting Process.....	25
Copper Casting Applications.....	27
Steel Casting Production.....	37
3D Sand Printing Benefits.....	38
3D Sand Printing Process & Terminology.....	39

## SPANISH MODULES

Panorama General del Proceso de Fundición.....	43
--	----

## DESIGN OF CASTING

## & GATING SYSTEMS

### COURSES

Aluminum Metalcasting 101.....	7
Casting Defect Analysis.....	9
Casting Design.....	9

Casting Material Properties.....	10
Copper Metalcasting 101.....	11
Design & Optimization for 3D Sand Printing.....	12
Gating & Riser Design 101.....	14
Gating & Riser Design 201.....	14
Introduction to Casting Alloys.....	16
Iron Metalcasting 101.....	18
Metalcasting Process Basics.....	19
Permanent Mold Thermal Management.....	20
Steel Metalcasting 101.....	21
The 10-Step Method for Corrective Action.....	22
3D Casting Design Reimagined.....	22

### MODULES

Basics of Fluid Dynamics for Metalcasting Gating Systems.....	24
Basics of Heat Transfer Principles for Riser Design.....	25
Casting Design for Castability.....	26
Casting Material Properties.....	26
Functions and Features of a Rigging System.....	28
Gating Design for 3D Printed Sand.....	29
Melting and Pouring.....	33
Rising Iron Castings.....	35
Steel Casting Quality Requirements & Inspection Methods.....	37
Types of Alloys.....	37
Types of Casting Processes.....	37
Types of Casting Tooling.....	38
3D Sand Printing Benefits.....	38
3D Sand Printing Process & Terminology.....	39

## DESIGNERS

### COURSES

Aluminum Metalcasting 101.....	7
Aluminum Metallurgy 201.....	8
Casting Defect Analysis.....	9
Casting Design.....	9
Casting Material Properties.....	10
Copper Metalcasting 101.....	11
Copper Melting 201.....	11
Copper Metallurgy 201.....	12
Design & Optimization for 3D Sand Printing.....	12
Fundamentals of SPC & Process Capability.....	14
Gating & Riser Design 101.....	14
Gating & Riser Design 201.....	14
Improving the Effectiveness of Visual Inspection.....	16
Introduction to Casting Alloys.....	16
Introduction to Metalcasting.....	17
Iron Metalcasting 101.....	18
Iron Metallurgy 201.....	18
Metalcasting Process Basics.....	19
Process Control for Engineers.....	20
Problem Solving & Process Improvement.....	21
Steel Metalcasting 101.....	21
The 10-Step Method for Corrective Action.....	22
3D Casting Design Reimagined.....	22

### MODULES

Aluminum Casting Alloys.....	24
Aluminum Casting Applications.....	24
Aluminum Casting Defects:	
Gas Porosity & Shrinkage Porosity.....	24
Aluminum Casting Defects: Oxides & Inclusions.....	24
Aluminum Casting Production.....	24
Basics of Fluid Dynamics for Metalcasting Gating Systems.....	24
Basics of Heat Transfer Principles for Riser Design.....	25
Big Picture of the Casting Process.....	25
Cast Iron Defects:	
Solidification Shrinkage in Ductile Cast Iron.....	25
Cast Iron Defects:	
Solidification Shrinkage in Gray Cast Iron.....	26
Casting Defect Analysis Practice and Conclusion.....	26
Casting Design for Castability.....	26
Casting Material Properties.....	26
Copper Casting Applications.....	27
Copper Casting Defects: Gating.....	28
Copper Casting Defects: Shrinkage.....	28
Copper Casting Production.....	28
Elements in Cast Iron.....	28
Functions and Features of a Rigging System.....	28
Gating Design for 3D Printed Sand.....	29
Gas Related Defects.....	29
Introduction to Cast Iron.....	30
Introduction to Cast Iron Heat Treatments.....	30
Introduction to Cast Iron Microstructures.....	30
Introduction to Casting Defect Analysis.....	30
Introduction to Lean Manufacturing.....	31
Introduction to Steel Heat Treatments.....	31
Lean Manufacturing Application.....	31
Lean Manufacturing Case Studies.....	32
Melting and Pouring.....	33
Oxide Related Defects.....	34
Rising Iron Castings.....	35
Sand Related Defects.....	35
Shrink Related Defects.....	35
Six Families of Cast Iron.....	36
Steel Casting Alloys.....	36
Steel Casting Defects: Oxides and Inclusions.....	36
Steel Casting Defects: Shrinkage.....	37
Steel Casting Production.....	37
Steel Casting Quality Requirements & Inspection Methods.....	37
Types of Alloys.....	37
Types of Casting Processes.....	37
Types of Casting Tooling.....	38
3D Sand Printing Benefits.....	38
3D Sand Printing Casting Design.....	38
3D Sand Printing Mold Quality.....	38
3D Sand Printing Process & Terminology.....	39

### SPANISH MODULES

Defectos en el Hierro Fundido:	
Contracción por Solidificación en Hierro Gris.....	40
Defectos Relacionados con la Arena.....	40
Defectos Relacionados con la Contracción.....	41
Defectos Relacionados con el Gas.....	41
Defectos Relacionados con el Óxido.....	41
Elementos en el Hierro Fundido.....	41
Introducción al Análisis de Defectos de Fundición.....	42
Introducción al Hierro Fundido.....	42
Introducción a la Microestructura del Hierro Fundido.....	42

Introducción a los Tratamientos	
Térmicos de Fundición de Hierro.....	42
Panorama General del Proceso de Fundición.....	43
Práctica para el Análisis de Defectos en Piezas y Conclusión.....	43
Las Seis Familias de Hierro Fundido.....	44

## MANAGEMENT

### COURSES

Introduction to Supervisor Development.....	17
---	----

### MODULES

Lean Manufacturing Application.....	31
Lean Manufacturing Case Studies.....	32
Lean Manufacturing Principles.....	32

## METALCASTERS

### COURSES

Aluminum Metalcasting 101.....	7
Aluminum Crucible Furnace Practices.....	7
Aluminum Melting 201.....	8
Casting Cost Estimating.....	8
Casting Defect Analysis.....	9
Coldbox Process 101.....	11
Coldbox Process 201.....	11
Copper Metalcasting 101.....	11
Copper Melting 201.....	11
Copper Metallurgy 201.....	12
Foundry Process Improvement.....	13
Fundamentals of SPC & Process Capability.....	14
Gating & Riser Design 101.....	14
Gating & Riser Design 201.....	14
Green Sand Molding 101.....	15
Green Sand Molding 201.....	15
Green Sand Testing.....	15
Improving the Effectiveness of Visual Inspection.....	16
Introduction to Casting Alloys.....	16
Introduction to Coreless Induction Furnace Operation.....	17
Introduction to Metalcasting.....	17
Iron Metalcasting 101.....	18
Iron Melting 201.....	18
Iron Metallurgy 201.....	18
Metalcasting Process Basics.....	19
Nobake Molding & Coremaking 101.....	19
Nobake Molding & Coremaking 201.....	20
Permanent Mold Thermal Management.....	20
Process Control for Engineers.....	20
Problem Solving & Process Improvement.....	21
Steel Metalcasting 101.....	21
Steel Melting 201.....	21
The 10-Step Method for Corrective Action.....	22
3D Casting Design Reimagined.....	22

## MODULES

Acid Demand Value (ADV) of Sand.....	23
AFS 2 in. Dia. x 2 in. Specimen Preparation, Rammer Method.....	23
AFS Clay.....	23
AFS Permeability for Green Sand.....	23
Aluminum Casting Alloys.....	24
Aluminum Casting Applications.....	24
Aluminum Casting Defects: Gas Porosity & Shrinkage Porosity.....	24
Aluminum Casting Defects: Oxides & Inclusions.....	24
Aluminum Casting Production.....	24
Basics of Fluid Dynamics for Metalcasting Gating Systems.....	24
Basics of Heat Transfer Principles for Riser Design.....	25
Basic Melt Practices for Cast Iron.....	25
Big Picture of the Casting Process.....	25
Cast Iron Defects: Solidification Shrinkage in Ductile Cast Iron.....	25
Cast Iron Defects: Solidification Shrinkage in Gray Cast Iron.....	26
Casting Defect Analysis Practice and Conclusion.....	26
Casting Design for Castability.....	26
Casting Material Properties.....	26
Chemical Binder Handling Safety Requirements.....	26
Coldbox Core Quality and Casting Defects.....	27
Coldbox Coremaking Components.....	27
Coldbox Coremaking Process.....	27
Coldbox Tooling Design Basics.....	27
Compactability.....	27
Copper Casting Alloys.....	27
Copper Casting Applications.....	27
Copper Casting Defects: Gating.....	28
Copper Casting Defects: Shrinkage.....	28
Copper Casting Production.....	28
Elements in Cast Iron.....	28
Friability.....	28
Functions and Features of a Rigging System.....	28
Gating Design for 3D Printed Sand.....	29
Gas Related Defects.....	29
Green Sand Compaction.....	29
Green Sand Molding Equipment.....	29
Green Sand Molding Process.....	29
Green Sand Preparation & Quality Control.....	29
Green Sand Raw Materials.....	30
Introduction to Cast Iron.....	30
Introduction to Cast Iron Heat Treatments.....	30
Introduction to Cast Iron Melting.....	30
Introduction to Cast Iron Microstructures.....	30
Introduction to Casting Defect Analysis.....	30
Introduction to Green Sand Defects.....	31
Introduction to Lean Manufacturing.....	31
Introduction to Steel Heat Treatments.....	31
Lean Manufacturing Application.....	31
Lean Manufacturing Case Studies.....	32
Lean Manufacturing Principles.....	32
Lost Foam Basics.....	32
Lost Foam Design for Aluminum Castings.....	32
Loss on Ignition (LOI).....	32
Mechanics for Heat Treatment: Aluminum Practices.....	32
Mechanics for Heat Treatment: Aluminum Processes.....	33
Melting and Pouring.....	33
Metalcasting Facility Safety.....	33
Methylene Blue Clay Test.....	33
Moisture Determination for Sand Testing.....	33
Nobake Materials and Equipment.....	33

Nobake Mold and Core Defects.....	34
Nobake Molds and Core Process.....	34
Oxide Related Defects.....	34
Permanent Mold Casting Process.....	34
pH of Sand.....	34
Purchasing Castings: Create the Relationship.....	34
Purchasing Castings: Grow the Relationship.....	35
Purchasing Castings: Maintain the Relationship.....	35
Rising Iron Castings.....	35
Sand Related Defects.....	35
Sand Sampling Methods.....	35
Shrink Related Defects.....	35
Sieve Analysis and Grain Fineness Number (AFS GFN).....	36
Six Families of Cast Iron.....	36
Steel Casting Alloys.....	36
Steel Casting Defects: Oxides and Inclusions.....	36
Steel Casting Defects: Shrinkage.....	37
Steel Casting Production.....	37
Steel Casting Quality Requirements & Inspection Methods.....	37
Tensile Strength for Chemically Bonded Sand.....	37
Types of Alloys.....	37
Types of Casting Processes.....	37
Types of Casting Tooling.....	38
Wet and Dry Compression Strength for Green Sand.....	38
Wet Tensile Strength for Green Sand.....	38
3D Sand Printing Benefits.....	38
3D Sand Printing Casting Design.....	38
3D Sand Printing Mold Quality.....	38
3D Sand Printing Process & Terminology.....	39

## SPANISH MODULES

Compactación de Arena Verde.....	40
Defectos en el Hierro Fundido: Contracción por Solidificación en Hierro Gris.....	40
Defectos Relacionados con la Arena.....	40
Defectos Relacionados con el Óxido.....	41
Elementos en el Hierro Fundido.....	41
Equipo de Moldeo de Arena Verde.....	41
Introducción al Análisis de Defectos de Fundición.....	42
Introducción a la Fusión de Hierro Fundido.....	42
Introducción al Hierro Fundido.....	42
Introducción a los Tratamientos Térmicos de Fundición de Hierro.....	42
Introducción a los Defectos de la Arena Verde.....	43
Materias Primas de Arena Verde.....	43
Panorama General del Proceso de Fundición.....	43
Prácticas Básicas de Fusión para Hierro.....	43
Práctica para el Análisis de Defectos en Piezas y Conclusión.....	43
Preparación de Arena Verde y Control de Calidad.....	44
Proceso de Moldeo de Arena Verde.....	44
Las Seis Familias de Hierro Fundido.....	44

## METALLURGY &

## MELTING METHODS

### COURSES

Aluminum Crucible Furnace Practices.....	7
Aluminum Melting 201.....	8
Aluminum Metallurgy 201.....	8
Copper Melting 201.....	11
Copper Metallurgy 201.....	12
Introduction to Coreless Induction Furnace Operation.....	17
Iron Melting 201.....	18
Iron Metallurgy 201.....	18
Steel Melting 201.....	21

### MODULES

Basic Melt Practices for Cast Iron.....	25
Copper Casting Applications.....	27
Copper Casting Production.....	28
Elements in Cast Iron.....	28
Introduction to Cast Iron.....	30
Introduction to Cast Iron Heat Treatments.....	30
Introduction to Cast Iron Melting.....	30
Introduction to Cast Iron Microstructures.....	30
Introduction to Steel Heat Treatments.....	31
Sieve Analysis and Grain Fineness Number (AFS GFN).....	36
Six Families of Cast Iron.....	36
Steel Casting Alloys.....	36

## SPANISH MODULES

Elementos en el Hierro Fundido.....	41
Introducción a la Fusión de Hierro Fundido.....	42
Introducción al Hierro Fundido.....	42
Introducción a la Microestructura del Hierro Fundido.....	42
Introducción a los Tratamientos Térmicos de Fundición de Hierro.....	42
Prácticas Básicas de Fusión para Hierro.....	43
Las Seis Familias de Hierro Fundido.....	44

## MOLDING METHODS

### COURSES

Chemically Bonded Sand Testing.....	10
Coldbox Process 101.....	11
Coldbox Process 201.....	11
Design & Optimization for 3D Sand Printing.....	12
Green Sand Molding 101.....	15
Green Sand Molding 201.....	15
Green Sand Testing.....	15
Nobake Molding & Coremaking 101.....	19
Nobake Molding & Coremaking 201.....	20
Permanent Mold Thermal Management.....	20

## MODULES

Acid Demand Value (ADV) of Sand.....	23
AFS 2 in. Dia. x 2 in. Specimen Preparation, Rammer Method.....	23
AFS Clay.....	23
Aluminum Casting Production.....	24
Chemical Binder Handling Safety Requirements.....	26
Coldbox Core Quality and Casting Defects.....	27
Coldbox Coremaking Components.....	27
Coldbox Coremaking Process.....	27
Coldbox Tooling Design Basics.....	27
Compactability.....	27
Copper Casting Alloys.....	27
Copper Casting Production.....	28
Friability.....	28
Gating Design for 3D Printed Sand.....	29
Green Sand Compaction.....	29
Green Sand Molding Equipment.....	29
Green Sand Molding Process.....	29
Green Sand Preparation & Quality Control.....	29
Green Sand Raw Materials.....	30
Introduction to Green Sand Defects.....	31
Lean Manufacturing Principles.....	32
Lost Foam Basics.....	32
Lost Foam Design for Aluminum Castings.....	32
Loss on Ignition (LOI).....	32
Methylene Blue Clay Test.....	33
Moisture Determination for Sand Testing.....	33
Nobake Materials and Equipment.....	33
Nobake Mold and Core Defects.....	34
Nobake Molds and Core Process.....	34
Permanent Mold Casting Process.....	34
pH of Sand.....	34
Sand Sampling Methods.....	35
Steel Casting Production.....	37
Tensile Strength for Chemically Bonded Sand.....	37
Wet and Dry Compression Strength for Green Sand.....	38
Wet Tensile Strength for Green Sand.....	38
3D Sand Printing Casting Design.....	38

## SPANISH MODULES

Compactación de Arena Verde.....	40
Equipo de Moldeo de Arena Verde.....	41
Introducción a los Defectos de la Arena Verde.....	43
Materias Primas de Arena Verde.....	43
Preparación de Arena Verde y Control de Calidad.....	44
Proceso de Moldeo de Arena Verde.....	44

# QUALITY CONTROL

# & IMPROVEMENT

## COURSES

Casting Defect Analysis.....	9
Chemically Bonded Sand Testing.....	10
Coldbox Process 201.....	11
Foundry Process Improvement.....	13
Fundamentals of SPC & Process Capability.....	14
Gating & Riser Design 201.....	14
Green Sand Molding 201.....	15
Green Sand Testing.....	15
Improving the Effectiveness of Visual Inspection.....	16
Iron Melting 201.....	18
Nobake Molding & Coremaking 201.....	20
Permanent Mold Thermal Management.....	20
Process Control for Engineers.....	20
Problem Solving & Process Improvement.....	21
Steel Melting 201.....	21

## MODULES

Acid Demand Value (ADV) of Sand.....	23
AFS 2 in. Dia. x 2 in. Specimen Preparation, Rammer Method.....	23
AFS Clay.....	23
AFS Permeability for Green Sand.....	23
Aluminum Casting Alloys.....	24
Aluminum Casting Defects:	
Gas Porosity & Shrinkage Porosity.....	24
Cast Iron Defects:	
Solidification Shrinkage in Ductile Cast Iron.....	25
Cast Iron Defects:	
Solidification Shrinkage in Gray Cast Iron.....	26
Casting Defect Analysis Practice and Conclusion.....	26
Compactability.....	27
Copper Casting Alloys.....	27

Copper Casting Defects: Gating.....	28
Copper Casting Defects: Shrinkage.....	28
Friability.....	28
Gas Related Defects.....	29
Green Sand Compaction.....	29
Green Sand Preparation & Quality Control.....	29
Introduction to Casting Defect Analysis.....	30
Introduction to Green Sand Defects.....	31
Loss on Ignition (LOI).....	32
Methylene Blue Clay Test.....	33
Moisture Determination for Sand Testing.....	33
Nobake Mold and Core Defects.....	34
Oxide Related Defects.....	34
pH of Sand.....	34
Sand Related Defects.....	35
Sand Sampling Methods.....	35
Shrink Related Defects.....	35
Sieve Analysis and Grain Fineness Number (AFS GFN).....	36
Steel Casting Defects: Oxides and Inclusions.....	36
Steel Casting Defects: Shrinkage.....	37
Steel Casting Quality Requirements & Inspection Methods.....	37
Tensile Strength for Chemically Bonded Sand.....	37
Wet and Dry Compression Strength for Green Sand.....	38
Wet Tensile Strength for Green Sand.....	38
3D Sand Printing Mold Quality.....	38

## SPANISH MODULES

Compactación de Arena Verde.....	40
Defectos en el Hierro Fundido: Contracción por Solidificación en Hierro Gris.....	40
Defectos Relacionados con la Arena.....	40
Defectos Relacionados con la Contracción.....	41
Defectos Relacionados con el Gas.....	41
Defectos Relacionados con el Óxido.....	41
Introducción al Análisis de Defectos de Fundición.....	42
Introducción a los Defectos de la Arena Verde.....	43
Práctica para el Análisis de Defectos en Piezas y Conclusión.....	43
Preparación de Arena Verde y Control de Calidad.....	44



1695 N. Penny Lane  
Schaumburg, IL 60173

Tel: 847-824-0181 | Fax: 847-824-7848

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

