

Course Syllabus

Iron Melting 201



Course Code 3-210	CEUs 1.2 CEUs
Course Length (Instructional Time only) 12 hours	

Course Introduction

This course provides a detailed coverage of iron melting and related processes. Topics include charge materials selection; the understanding of cost, value, and risk; information covering 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.

Benefits to Taking the Course: Benefits to taking this course include a comprehensive overview of electric or cupola melting of gray and ductile type irons; an understanding of metallurgical and operational factors affecting the outcome of melting in production; discussions on the influence of variables in cast iron production; and an understanding of why certain cast iron complexities interfere with the intended result; student chooses to attend either Electric Furnace Charge Materials and Melting Process or Cupola Charge and Melting Process.

Learning Outcomes

At the end of this course, participants should be able to:

1. Identify the differences between alternate scrap types and key furnace additions.
2. Calculate a charge mix.
3. Identify which elements need to be controlled and explain the need to adjust these elements in gray and ductile cast iron
4. Measure the efficiency of element recovery in iron melting processes.
5. Describe the melting practices and related refining technologies for cast iron.
6. Describe the key steps in converting solid charge materials to castable molten iron.
7. Identify and explain the role of slag and slag removal.
8. Describe sampling/test methods for determining molten iron quality.
9. Apply safety procedures to the daily work environment on a metalcasting facility melt deck.
10. Identify how channel holding furnaces can be utilized in both electric and cupola melting.

Lesson Outline

Module 1: Introduction

- Introduction Lesson

Module 2: Course Overview

- Melting as it Affects the Final Cast Product
- Iron Melt Overview

Module 3: Converting Solid Iron and Steel Scraps to Molten Iron

- Safety Considerations
- Handling and Preparation of Charge Materials
- Furnace Charging of Metallics

Module 4: Sampling Procedures and Melt Treatments

- Molten Base Iron Quality Tests
- Melt Treatments
- Casting Quality Tests

Module 5A: Electric Furnace Charge Materials and Melting Process

- Electric Melting Methods
- Metallic Charge Materials
- Induction Furnace Operations
- Refractories and Relining
- Process Concerns

Module 5B: Cupola Charge and Melting Process

- Cupola Description
- Metallic Charge Materials
- Cupola Furnace Operations
- Refractories and Relining
- Process Concerns

Module 6: Molten Metal Handling Practices

- Iron Transfer and Temperature Loss
- Alloy Additions and Carbon Raiser
- Pouring into Molds

Module 7: Channel Furnace Holding and Automatic Pouring Operations

- Channel Holding and Autopour/Pressure Pour Operations
- Practical Process Concerns

Module 8: Conclusion

- Conclusion Lesson

Instructional Methods:

- Facilitator-led lectures
- Q&A sessions
- Discussions with feedback
- Labeling key equipment essential for melt control
- Case study of charge calculations (cupola and electric furnaces)
- Group activities
- Individual problem solving
- Puzzles

Assessment Methods:

- Informal knowledge checks
- Q&A sessions
- Group activity review

Course Prerequisites, if any:

Recommended: *Iron 101*

Pre-course Activities, if any:

None

Texts, Books or other Resources:

None

Attendee Requirements to Earn CEUs:

1. Present at least 11 hours of the total 12 hours of instructional time (90%), which does not include meals or breaks.
2. Active participation (can include asking questions, communicating with other attendees during and taking part in group activities, providing responses during whole class or group discussions).
3. Successful achievement of learning outcomes.

Who Should Attend?

- Melting operators/supervisors
- Metalcasting facility production and management
- Process control
- Quality assurance
- Production and/or sales of supplies and services to the industry
- Environmental engineers
- Equipment designers
- New employees or anyone new to iron casting