



<b>Course Code</b> 4-210	<b>CEUs</b> 1.2 CEUs
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### Course Introduction

This course introduces the principles and best practices of aluminum melting for use in castings. The course will examine furnace charging, furnace temperature and its effect on the melt, and examine 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 will also be presented and discussed.

### Benefits to Taking the Course

Participants of this course will leave with the knowledge and skills to reduce the overall cost of melting operations by reducing metal spills, waste, dross, and scrap; realize profitability gains by improving energy efficiency through better molten metal handling; improve productivity by applying proper molten metal handling techniques; and demonstrate to all other company employees as well as potential customers that quality begins with proper molten metal operations.

### Learning Outcomes

1. Describe the principles of transforming solid aluminum to liquid.
2. Describe furnace charging procedures.
3. Identify accurate temperature measurement and control techniques.
4. Describe purposes and methods of alloying.
5. Identify impurities and their causes and handling.
6. Identify melt loss causes and control methods.
7. Describe the purpose of fluxing and common methods of melt treatment.
8. Describe various sampling techniques.
9. Describe pouring techniques.

### Lesson Outline

#### Introduction

#### Melt Process Overview

- Relationship between quality and the melt process
- Melt process overview – flowchart/process steps

#### Transforming Solid Aluminum to Liquid

- Safety overview
- Heat Transfer & Efficient Heat Supply
- Furnace charging
  - Charge preheating
  - Charge materials - proper conditions for charging, alloying (master alloys, silicon)
- Temperature measurement and control
  - Importance of maintaining temperature control
  - Thermocouple placement, handling, monitoring

#### Impurities and Melt loss

- Oxidation
  - Charged oxides
  - Sand/core debris
  - Melt oxidation (from atmosphere, high temperature)
- Hydrogen—(atmosphere, fossil fuel, lubricants)

- Dross formation and melt loss
  - Impact on energy efficiency, productivity, profitability
  - Reducing melt loss: benefits and methods

**Laboratory Session**

**Fluxes, Degassing & Filtration**

- Fluxes
- Degassing
  - Static lances or dispersers
  - Rotary degassers
    - Balancing rpm, gas flows, time, results
    - Flux injection
  - Ladle degassing practices
- Filtration
  - In Furnace filtration: benefits/requirements
  - Methods to install, monitor and replace filters

**Sampling procedures**

- Sampling procedures
  - Sampling for off-line inclusion analysis (PoDFA, Prefil, LAIS)
  - RPT test
  - K-Mold
  - Thermal analysis

**Pouring Techniques and Practices**

- From furnace to transfer ladles
- Skimming and pouring into molds (sand, vertical PM, tilt pour PM, low pressure)
- Manual and Automated pouring devices/techniques (pumps, auto-ladlers, dosers)

**Laboratory Session**

**Instructional Methods:**

- Class discussion
- Equipment and procedure demonstrations
- Group activities
- Individual problem solving
- Case studies
- Video

**Assessment Methods:**

No formal assessment will take place in this course; however, attendees will participate in informal activities such as knowledge check and Q&A sessions with the facilitator to verify that learning outcomes are being met. Assessment of successful achievement of learning outcomes must be included throughout the course in order to meet the ANSI/IACET 1-2013 standard for continuing education programs and for CEUs to be awarded.

**Course Prerequisites:**

- Aluminum 101 (recommended)

**Attendee Requirements to Earn CEUs:**

1. Present at least 10 hours of the 11.5 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?**

The target audience for this course consists of individuals responsible for:

- Furnace tending
- Mold pouring
- New personnel
- Process engineers
- Managers
- Quality control personnel responsible for developing best practice procedures