Molten Metal Processing

MATSCEN 5451

Credit Hours:
3.00

Course Levels:
Undergraduate (1000-5000 level)
Graduate (5000-8000 level)

Course Components:
Lecture

Course Description:
An advanced class in application of thermodynamics, kinetics, and macro-transport phenomena to primary metals production, refining, and solidification processing.

Prerequisites and Co-requisites:
Prereq: 2251 or 3151; or Grad standing; or permission of instructor.

Course Goals / Objectives:
- Learn extraction, refining, and processing of metals
- Learn metal casting science and technology
- Learn solidification science and technology
- Learn recycling of metals
- Learn numerical simulation of casting processes
Course Topics:

- Reduction of metal oxides (the iron blast furnace, electric iron smelting, reduction of other iron oxides ores)
- Matte smelting (iron-copper mattes, copper smelting, nickel smelting, other matte smelting processes)
- Electrometallurgy (refining cells, production cells, aqueous winning and refining processes, fused salt processes)
- Refining processes (steel-making reactions, basic oxygen process - BOS, OBM, Q-OBM, electric arc melting process, AOD stainless steel process)
- Ladle metallurgy for steel and cast iron (injection metallurgy, electromagnetic stirring, desulfurization, deoxidation, vacuum degassing)
- Macro-solidification (macroshrinkage, macrosegregation)
- Continuous casting of steel and non-ferrous alloys (tundish metallurgy, molds for horizontal and vertical casting)
- Shaped casting (sand casting, die casting, investment casting)
- Other solidification processes (semi-solid casting, rapid solidification, spray casting)
- Chemical vapor deposition
- Recycling of metals

Designation:
Elective