MSE-319 Non-ferrous Metallurgy

Credit Hours: 2-0

Pre-requisites: Nil

Course Description

The course focusses on extraction and production of non-ferrous metals from different ores and scrap. The environmental impacts of non-ferrous metals production will be presented. The course also discusses the general classification, properties, physical metallurgy, and applications of important non-ferrous metals and alloys.

Course Contents

- Introduction to Non Ferrous metals. Nonferrous ore deposits in Pakistan, General extraction processes for nonferrous metallic ores.
- Principles of metals extraction, Extraction of metals from oxide sources, Extraction of metals from sulfide ores, Extraction of metals from halides. Environmental impacts of non-ferrous metals extraction.
- Recycling of non-ferrous metals.
- General classification, physical, chemical, and mechanical properties, phase relationships, and applications of various non-ferrous alloys such as Aluminum alloys, Copper alloys, Titanium alloys, Magnesium alloys, Ni alloys, etc.

Weekly Plan

Week	Topics
1	Introduction to Non-Ferrous metals.
2	Nonferrous ore deposits in Pakistan.
3	General extraction processes for nonferrous metallic ores.
4	Principles of metals extraction, Extraction of metals from oxide sources.
5	Extraction of metals from sulphide ores, Extraction of metals from halides.
6	Environmental impacts of non-ferrous metals extraction.
7	Impacts of non-ferrous metals extraction.
8	Recycling of non-ferrous metals.
9	**Mid-Semester Exams**
10	General classification, physical, chemical, and mechanical properties,
11	Phase relationships, and applications nonferrous metals.

12	Phase relationships, and applications as Aluminium alloys.
13	Phase relationships, and applications as copper alloys.
14	Phase relationships, and applications as Magnesium alloys
15	Phase relationships, and applications as Ni alloys.
16	Environmental impacts of nonferrous materials.
17-18	**End Semester Exams**

Course Outcomes

At the end of the course, students will be able to:

- Explain different methods for extracting nonferrous metals from oxide, sulfide, and halide sources.
- Analyze phase diagrams of different nonferrous alloys to comprehend their microstructural features and mechanical behavior.
- Examine the suitability of different nonferrous alloys for a specific engineering application.
- Analyze the environmental impacts of nonferrous metals production and develop strategies for their sustainable production.

Suggested Books

- Extraction of nuclear and non-ferrous metals, S.K. Dutta, D.R. Lodhari, ebook, Springer, (2018)
- Light Alloys: Metallurgy of the Light Metals by I. Polmear, D. StJohn, J.-F. Nie, M. Qian, 5th ed. Butterworth-Heinemann (2017)
- Physical Metallurgy Principles by R. Abbaschian, L. Abbaschian, R. E. Reed-Hill. 4th ed. Cengage Learning (2010)
- Extraction of Nonferrous Metals by H.S. Ray, R. Sridhar and K.P. Abraham. Affiliated East West Press Pvt Ltd., New Delhi, (2007).
- Principles of Extractive Metallurgy by T. Rosenqvist. 2nd ed. (reprinted), McGraw Hill, New York, (2004)