GEOL 3050 INTRODUCTION TO PYROMETALLURGY (3 credit hours)

Elmira College

SPRING 2024

Required Text:
Y.K. Rao, ***Stoichiometry and Thermodynamics of Metallurgical Processes,*** Cambridge University Press, 1985.

Pre-requisites: .

Course Description

Pyrometallurgy is the branch of metallurgy that involves the use of high temperatures to extract and refine metals from their ores. This course provides a comprehensive overview of pyrometallurgical processes, emphasizing metallurgical material and heat balances, thermodynamics, and kinetics. Students will gain a deep understanding of the fundamental principles and practical applications of pyrometallurgy, enabling them to analyze, design, and optimize metallurgical processes.

Course Objectives and Goals

- Analyze and interpret the thermodynamics of pyrometallurgical processes using predominance area and Ellingham diagrams.
- Understand the physical chemistry and transport phenomena involved in pyrometallurgical unit operations, such as agglomeration, roasting, smelting, and refining.
- Apply knowledge gained to specific processes in zinc roasting, copper smelting and refining, iron and steel making, lead smelting and refining, nickel smelting, aluminum production, synthetic rutile, and titanium production.
- Conduct pyrometallurgical calculations to assess and optimize extraction processes.

Evaluation of Performance

Your grade will be based upon your performance on exams, assignments, and participation.

2 Assignments	20%
2 Quizzes	20%
Midterm Exam	25%
Final Exam	35%
Total	100%

Grades will be assigned as follows:

A	93% and above	B-	80 - 82%	D+	67 - 69%
A-	90 - 92%	C+	77 - 79%	D	63 - 66%

B+	87 - 89%	C	73 - 76%	D-	60 - 62%
B	83 - 86%	C-	70 - 72%	F	59% or below

Withdrawal Policy: Please see Elmira College Bulletin for information on this policy.

Academic Honesty: Please read the section on Academic Honesty in the **Code of Conduct**. Briefly, academic dishonesty includes: cheating, fabrication, facilitating academic dishonesty, and plagiarism. Ask if you have any questions on whether something constitutes as academic dishonesty. All work must be original and new. Past assignments from current or other courses will not be accepted. Academic dishonesty will not be tolerated. It will result in zero on the assignment, and a report will be filed with the school. Continued practice will result in failure of the class. Institutional penalties may also apply with repeated acts of academic honesty.

Student Responsibility:

- It is your responsibility to keep track of assignments and due dates.
- You should ask questions concerning assignments and lectures, if you need any clarifications.
- If you are struggling in class, have concerns, and/or unsure about expectations, please stop by during office hours or make an appointment for another time.

Tentative Schedule of Topics

Topic	Materials	Tasks & Evaluations
Overview of Metallurgical Processes	Chapter 1	
Historical Perspective of Pyrometallurgy	Chapter 2	
Stoichiometry and Charge Calculations	Chapter 3	Assignment 1
Heat, Heat Flow and Heat Balance Calculations	Chapter 4	
Combustion and Heat Utilization	Chapter 5	
Chemical Equilibria in Pyrometallurgy	Chapter 6	Quiz 1
Laws of Thermodynamics	Chapter 7	
Auxiliary Thermodynamics Functions	Chapter 8	Midterm Exam
Phases in Pyrometallurgical Systems	Chapter 9	
Gases and their Behaviors	Chapter 10	
Solutions and its Thermodynamics	Chapter 11	Assignment 2
High Temperature Kinetics	Chapter 12	
Influence of Temperature on Reaction Rates	Chapter 13	
Electrochemistry	Chapter 14	Quiz 2
Unit Pyrometallurgical Processes and Operations	Chapter 15	
Environmental Considerations in Pyrometallurgical Operations	Chapter 16	Final Exam