

Met/MSE 442 Syllabus: Pyroprocessing of Materials Fall Semester

Course Information:

Course title: Pyroprocessing of Materials

Course number: Met 442/ MSE 442, 2003 Fall semester

Credit hours: 4 credits

Prerequisites by topic: Met/MSE 308 Thermodynamics of Materials

Classroom: McClure 411 (Tuesday, Thursday; 11:00am – 12:15am)

Instructor Information:

Instructor: Batric Pesic, Professor of Metallurgy

Office: McClure 407b

Office tel: 885-6569

Office hours: 8:00am-9:00am, Tu, Th: Room 407A McClure 407B

Textbooks:

- 1) A.K. Biswas and W.G. Davenport Extractive Metallurgy of Copper, Pergamon Press
- 2) Peter Hayes Process Principles in Minerals and Materials Production Hayes Publishing Co.

*NOTE: Purchase from the bookstore

Reference books:

- 1) L. Coudurier, D.W. Hopkins, I. Wilkomirsky, Fundamentals of Metallurgical Processes, Pergamon
- 2) A.K. Biswas, Blast Furnace Ironmaking, Cootha Publishing House.
- 3) J.S. Reed, Principles of Ceramic Processing

*NOTE: Selected class handouts will be provided.

Course Objectives:

This course is designed to give junior and senior students in metallurgical engineering the ability to select and develop flowsheets for processing of metals, minerals and materials by pyrometallurgical methods.

Course Learning Objectives:

1. To introduce the principles of pyrometallurgy.
2. To know how to use thermodynamics to study and evaluate pyrometallurgical reaction systems.

3. To know chemical reaction affinity principles.
4. To know how to construct phase diagrams.
5. To know basic unit operations of importance to pyrometallurgy: comminution, roasting, smelting, refining.
6. To know metal refining methods based on electrorefining and fire refining.
7. To know how to design a pyrometallurgical processing flowsheet.
9. To know the metallurgy of nonferrous metals (Cu, Pb, Zn, Ni).
10. To know the metallurgy of ferrous metals (iron and steel).
11. To know the metallurgy of refractory (W, Ta, Ti, Zr, etc.) and light metals (Al, Mg)
12. To know how to plan, design and conduct metallurgical laboratory experiments.

Grading System:

Exams: 60% of overall grade

Homework: No credit (homework is mandatory)

Lab Reports: 20% of overall grade. Lab reports are due one week after the lab was performed. For the lab reports turned in late, 5 points will be taken off per week for each individual lab report turned late.

Term Paper: 20%

Course calendar:

Lesson	Topic
1.	Introduction: history of pyrometallurgy. Hydrometallurgy versus pyrometallurgy
2.	Thermodynamic principles related to pyrometallurgy.
3.	Roasting: Thermodynamics
4.	Roasting: Kinetics
5.	Roasting: Furnaces
6.	Design: Mass balance calculations. Design of a fluidized bed reactor.
7.	Sintering of minerals and ceramic materials
8.	Exam
9.	Smelting of Non-ferrous metals
10.	Chemical reactions during smelting
11.	Furnaces
12.	Revaboratory furnaces. Blast furnace.
13.	Noranda furnace
14.	Outokumpu furnace
15.	Inco flash furnace
16.	Electric furnace
17.	Converting furnace: chemistry and design
18.	Exam

19.	Flowsheet design and analysis
20.	Charge calculation for reverb furnace, Noranda, Outocumpu and Inco flash furnace. Energy consumption for each above furnace
21.	Refining of Metals:
22.	Electrorefining of copper
23.	Electrorefining of lead
24.	Recovery of metals from molten salts
25.	Metallurgy in molten salts
26.	Design of electrometallurgical cells
27.	Fall Recess
28.	Metallurgy of ferrous-metals, Blast furnace in iron making, slag chemistry
29.	Steel making. New processes for steel making
30.	Flowsheet design and analysis: Charge calculation for blast furnace
31.	Other pyro-processing techniques. Heat treatment
32.	Final Examination

Laboratory Projects:

There will be 5 lab exercises. The labs will require generation of lab data and writing of the lab reports (printed).

Laboratory Safety

Discipline in the lab is mandatory. Come prepared for the lab by at least reading the lab handout. Leave all your bags in a corner for safety reasons (no tripping). Goggles must be used. No horsing around, neither applying bad or good jokes while handling the chemicals. *In the lab, the safety is number one priority.*

Homework:

There will be homework assignments (one per week). Solution manual will be also provided.

Problem set #1, Homework 1-6
 Problem set #2, Homework 7-15
 Problem set #3, Homework 16-23

Due: October 1
 Due: November 5
 Due: December 10

Term Projects:

Every student will have to prepare a term project. It can be done individually or as a group (depends on the number of students). Projects are selected according to pyro processing of individual metals not covered in the class.

Elements of Proper Behavior:

Come to class on time.
 No snacks, drinks and chewing gums.

For the students, please address me as Dr. Pesic or Professor Pesic, you choose. This is an institution of higher learning, therefore it calls for proper communications too.

Disability Support Services Reasonable Accommodations Statement:

Reasonable accommodations are available for students who have a documented disability. Please notify the instructor during the first week of class of any accommodation(s) needed for the course. Late notification may mean that requested accommodations might not be available. All accommodations must be approved through Disability Support Services located in the Idaho Commons Building, Room 333.

- **885-7200**
- **email at <dss@uidaho.edu>**
- **website at <www.access.uidaho.edu> or <www.webs.uidaho.edu/aap>**