

MME 4303 Metals Processing

Instructor: Guikuan Yue, Ph.D., gyue@utep.edu, 747-6934

Office Hours: M201-D Tuesday (3:00-4:30 PM) and Thursday (9:30–10:30 AM) or by appointment

Class Days: Tuesday and Thursday, 13:30-14:50, LART 206

References:

1. Peter C. Hayes. *Process Principles in Minerals and Materials Production*, Third Edition. Hayes Publishing Co., Australia, 2003. ISBN-10: 0958919739
2. Mark E. Schlesinger, Matthew J. King, Kathryn C. Sole and William G. Davenport. *Extractive Metallurgy of Copper*, Fifth Edition. Amsterdam: Elsevier Ltd., 2011. ISBN: 978-0-08-096789-9
3. Terkel Rosenqvist. *Principles of Extractive Metallurgy*, 2nd Revised edition. Tapir Academic Press, 2004. ISBN-10: 8251919223

Prerequisites: MME 3306, MME3308, each with a grade of "C" or better.

Course description: Analysis of the unit operations involved in metal and mineral production using the principles of material and energy balance, fluid flow, heat transfer, reaction kinetics, and thermodynamics. A chemistry review of the fundamentals specifically involved in pyrometallurgy and hydrometallurgy will be included. Survey of processing operations for specific metals such as copper, iron, aluminum, etc.

Course objective: At the end of this course, students will have a solid grasp of fundamentals in the principles of pyrometallurgy and hydrometallurgy, as well as of the flow sheet of industrial metals production (copper, iron and aluminium), and can apply them to analyze and address the practical problems of most of the metals' production.

Topics: Units and unit analysis; stoichiometry; conservation of mass; mass balances; First law of thermodynamics; energy balances for closed systems; specific heat, sensible heat and enthalpy increments; heats of formation and reaction; adiabatic flame temperature; fuels and combustion; liquid, solid and gaseous fuels; combustion stoichiometry, excess air; heating values; gas reforming and substoichiometric combustion; reactors for pyrometallurgical unit processes; fixed and fluidized beds; shaft furnaces; rotary kilns; reverberatory furnaces; electric furnaces; pneumatic reactors; balance reactions; stoichiometric calculation; solution chemistry; equilibrium constant; introduction to leaching; mineral processing; copper production by pyrometallurgy and hydrometallurgy; iron production by blast furnace; aluminium production by Bayer process and Hall-Heroult process.

Grading	Percent
Assignments	20%
Midterm Exam	25%
Group Project	15%
Final Exam	40%

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LECTURE OUTLINE

Introduction

Extractive metallurgy; Pyrometallurgy; Hydrometallurgy; Electrometallurgy;
Unit operations and Unit processes; Process flow sheets.

1. Chemistry Review

1.1 Pyrometallurgy: Mass Balance, Heat Balance, etc.

1.2 Hydrometallurgy: Balance Reactions, Equilibrium, Kinetics, etc.

2. Introduction to Mineral Processing

2.1 Mineralogy

2.2 Size Reduction

2.3 Particle (mineral) Selection

2.4 Screening.

3. Introduction to Extractive Metallurgy

3.1 Pyrometallurgy

3.2 Hydrometallurgy

3.3 Electrometallurgy

4. Case Studies

4.1 Copper Production by Pyrometallurgy

4.2 Copper Production by Hydrometallurgy

4.3 Iron Production by Blast Furnace and Direct-Reduction

4.4 Aluminium Production by Bayer Process and Hall-Heroult Process

Course Withdrawal Policy: If a student withdraws from a course prior to the official census date of any semester, the course will be deleted from the student's record. Withdrawal from a course initiated by a student after the census date but prior to the course drop deadline, will result in a grade of "W." After the course drop deadline, withdrawal from a course initiated by a student will result in a grade of "F."

Attendance: University policy dictates that all students attend all scheduled classes, meaning that attendance to both the class and laboratory sessions is mandatory. However, I understand if you have conferences or other school-related activities to attend. Please notify me of any commitments you may have prior to you being absent from class. "Emergency" absences will be handled on a case by case basis

Homework: Homework assignments will normally be due two weeks after they are assigned. No late homework will be accepted.

E-Mail Policy: Please do not send e-mails regarding the course to me with an account other than your UTEP account. Do not turn in homework assignments via e-mail unless directly instructed to do so.

Use of Electronic Devices: As a courtesy to me and the other students in class, the use of cell phones, and pagers is not allowed while class is in session.

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Cheating, Plagiarism, Scholastic Dishonesty, and Student Discipline:

Students who engage in scholastic dishonesty will be subject to disciplinary action as stated in the UTEP-HoOP:

“Scholastic dishonesty (which includes the attempt of any student to present the work of another as his or her own, or any work which s(he) has not honestly performed, or attempting to pass any examination by improper means) is a serious offense and will subject the student to disciplinary action. The aiding and abetting of a student in any dishonesty is held to be an equally serious offense. All alleged acts of scholastic dishonesty should be reported to the Dean of Students for disposition. It is the Dean of Students’ responsibility to investigate each allegation, dismiss the allegation, or proceed with disciplinary action in a manner which provides the accused student his or her rights of due process.”

See the Dean of Students office for further information at website

<http://sa.utep.edu/studentlife/>; judicial affairs process at

<http://sa.utep.edu/studentlife/files/2010/10/Appendix-A-Discipline-process-NEW-OSL-2009.pdf>

Cite, reference, or quote information obtained from other sources and give credit where credit is due. In addition, when it is specified that a task needs to be performed individually, soliciting your classmates’ help is considered scholastic dishonesty. Do NOT copy any material regardless of where you obtained it into your own work. Do NOT submit work under your name if you did not complete it entirely yourself; you may **not submit work you completed for another class**, unless specifically stated otherwise. In accordance with university policy, any instances of plagiarism and dishonesty will be reported to the Dean of Students Office. If you are caught cheating you will be subject to the disciplinary action defined by UTEP’s Standards of Conduct and Dishonesty including the receiving of an incomplete “I” for the class and adjudication by the Dean of Students.

Disabilities: UTEP seeks to provide reasonable accommodations for all qualified individuals with disabilities, including learning disabilities. This university will adhere to all applicable federal, state, and local laws, regulations and guidelines with respect to providing reasonable accommodations as required affording equal educational opportunity.

If you have a disability and need classroom accommodations, please contact The Center for Accommodations and Support Services (CASS) at (915) 747-5148, or by email to cass@utep.edu, or visit their office located in UTEP Union East, Room 106. For additional information, please visit the CASS website at www.sa.utep.edu/cass.

It is the student's responsibility to register with The Center for Accommodations and Support Services and arrange the appropriate accommodations.