



HACETTEPE UNIVERSITY

KMU 220

Chemical Engineering

Thermodynamics I

Hacettepe University
Department of Chemical Engineering
Spring Semester

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KMU220 Section 23 Instructor

- Selis Önel, PhD
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- Web: <http://yunus.hacettepe.edu.tr/~selis>
- Office hours: Tuesday 1:00-2:00

Who am I?

- **Post Doctoral Studies in Engineering in Medicine (2008)**

Specializing in Nonequilibrium Solidification during preservation of biomaterials

Harvard University and Massachusetts General Hospital, Boston, MA, USA

- **Ph.D. in Mechanical Engineering (2006)**

Specializing in Mathematical Modeling in Materials Science and Engineering

Northeastern University, Boston, MA, USA

Advisor: Dr. Teiichi Ando

- **M.S. in Chemical Engineering (2000)**

Specializing in Heat and Mass Transfer and Energy Optimization

Middle East Technical University, Ankara, Turkey

Advisor: Dr. Güniz Gürüz

- **B.S. in Chemical Engineering (1997)**

Middle East Technical University, Ankara, Turkey

- **Lycee Diploma, Mathematics Section (1992)**

American Collegiate Institute, İzmir, Turkey

Course Objectives

- Introduce fundamental concepts of Chemical Engineering Thermodynamics
- You will learn about:
 - Thermodynamic concepts
 - Laws of Thermodynamics
- This course will help you to:
- ??? Write how you think this course will help you in your career

Syllabus

1	Introduction: The scope of thermodynamics
2,3	The first law and other basic concepts: Internal energy; the first law of thermodynamics; energy balance for closed system
4	First law analysis for a control volume: Mass and energy balances for open systems
5,6	Volumetric properties of pure fluids: PVT behavior of pure substances, the ideal gas, tables of thermodynamic properties
7	Midterm 1
8	The second law of thermodynamics
9,10	Entropy
11	Second law analysis for a control volume
12	Production of power from heat: Heat engines
13	Midterm 2
14	Refrigeration: the vapor-compression cycle, the heat pump

Lectures

Time: 10.00 AM-12.30 PM Tuesday

Block class with just one 15 min. break

● Location: D9

● Activities:

- Present new material
- Announce reading and homework
- Take quizzes and midterms

Make-ups given only for emergencies

Discuss potential conflicts *beforehand*

Recitation at the end of each class

● Purpose:

- Discuss homework, quizzes, exams
- Hand back graded quizzes, exams
- Discuss concepts from lecture

Recitation minutes will be at the end of each class as necessary

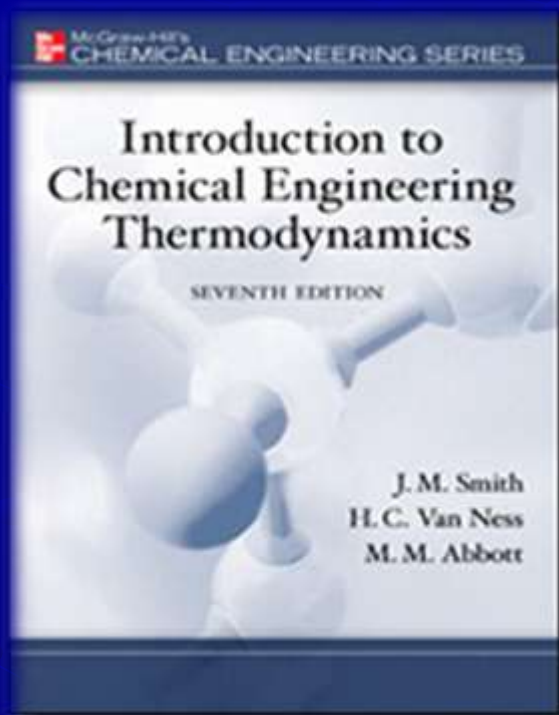
No Labs?

- No lab/application section with this class

However

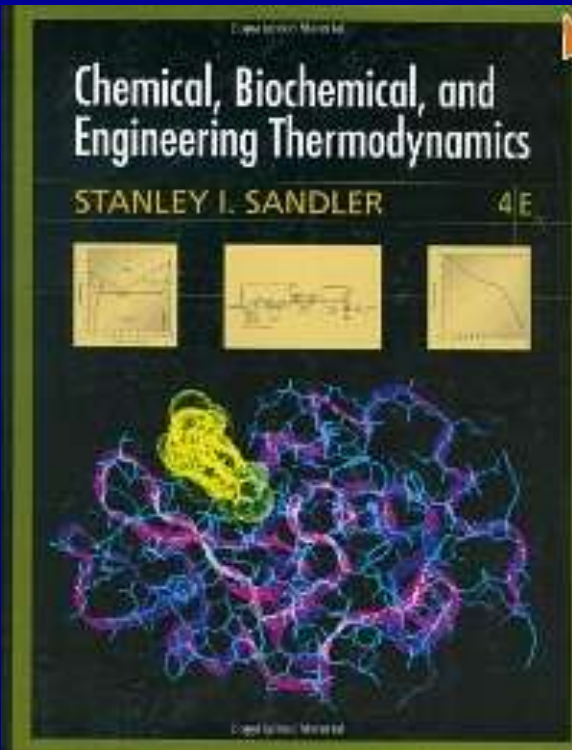
- There might be visits to certain labs in our/various departments
- Purpose: To learn more about thermodynamics by relating lecture material with observations. To learn to properly formulate and write engineering reports and proposals.

Course Materials



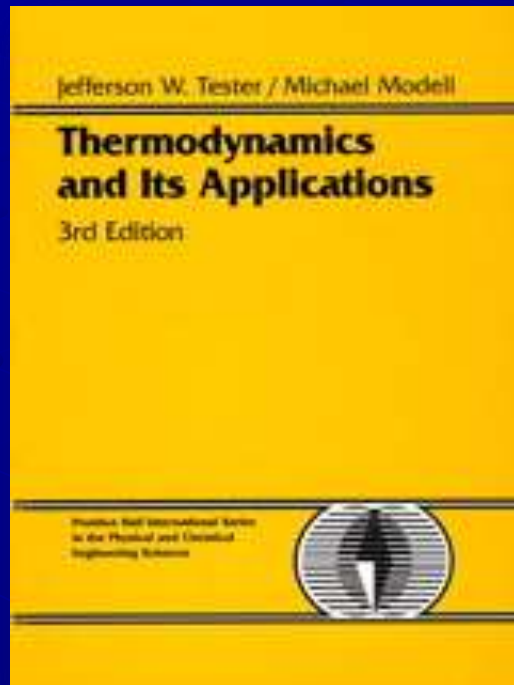
- J. M. Smith, H. C. Van Ness, M. M. Abbott, Introduction to Chemical Engineering Thermodynamics, 7th edition, McGraw-Hill, 2005

Optional Course Materials



- Stanley I. Sandler, Chemical, Biochemical, and Engineering Thermodynamics, 4th edition, John Wiley and Sons Inc., 2006

Optional Course Materials



- J. W. Tester, M. Modell, Thermodynamics and Its Applications, 3rd edition, Prentice Hall, 1997

Course Website

● <http://yunus.hacettepe.edu.tr/~selis/teaching.html>

- Syllabus
- Lecture notes (some of them)
- Homework questions
- Answer keys
- Grades
- Announcements

Grading

My goal is that you to learn the material and make a high grade in the course!

- Homeworks 10%
- Midterm I and II 30%
- Weekly in-lecture quizzes 20%
 - Based on class content or core homework problems
- Written final exam 40%

Grading

- The grade for the midterm test may be raised by reworking the test out of class and turning it in within one week after the exam
- Final test grade will then be 65% in-class and 35% at-home. Bonus points may be added to the at-home grade for creativity in presentation

Request for Fix-it

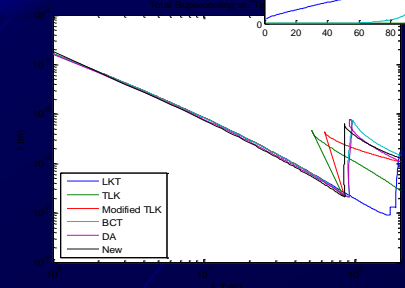
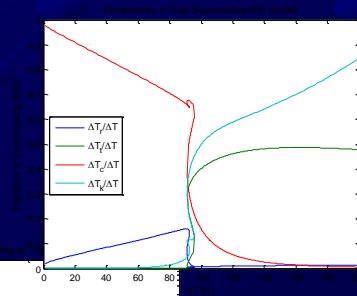
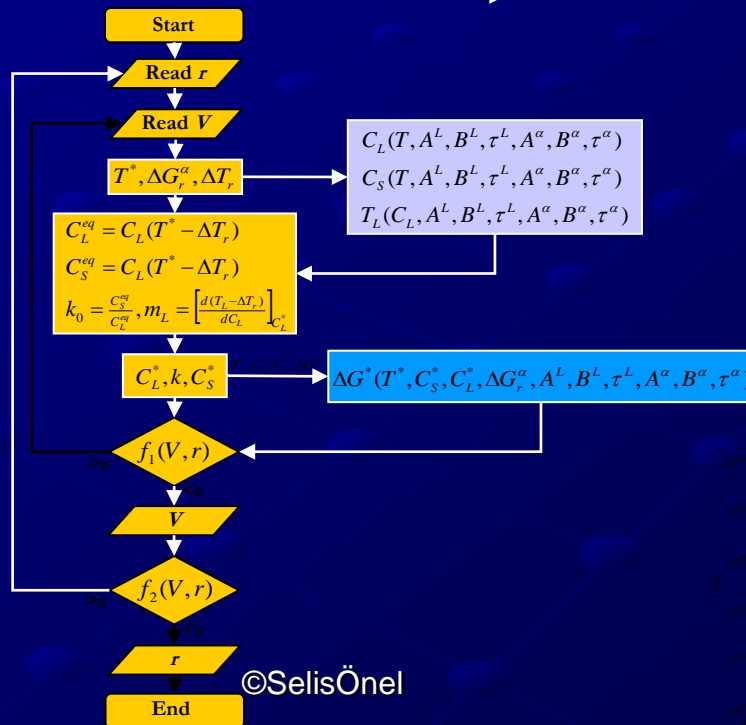
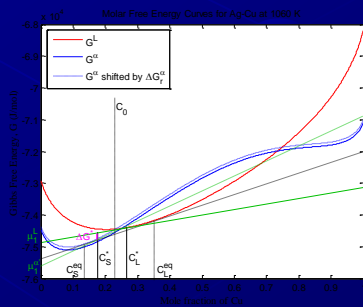
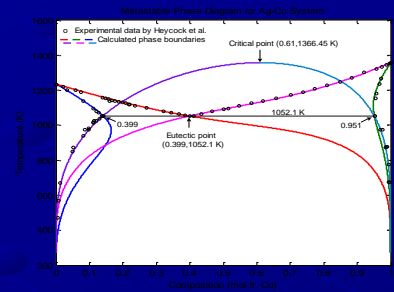
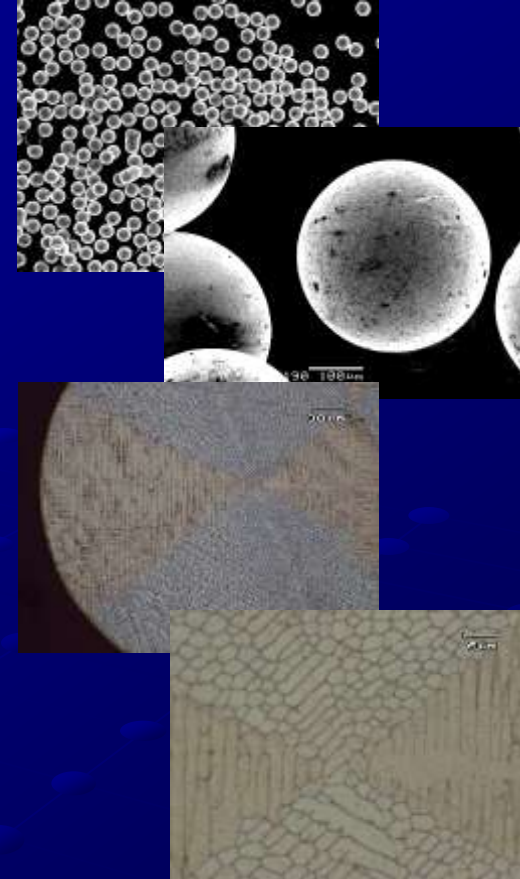
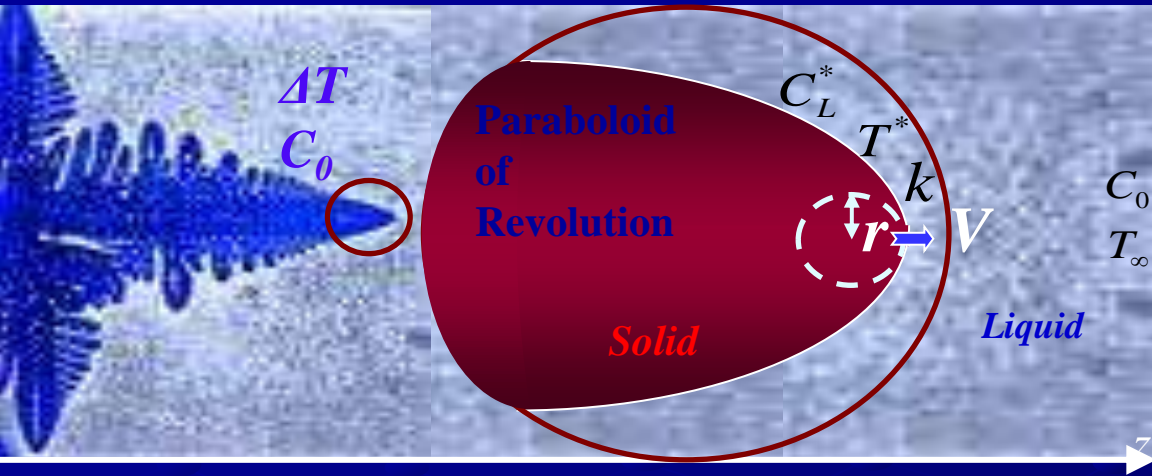
- Any thoughtful suggestions and requests are welcome
- Do not suffer in silence and wait to go home or the weekend to learn the stuff: if something you thought you understood becomes unclear, or after half an hour of lecturing the instructor is still making no sense whatsoever, raise your hand and ask a question. You can always come to my office to ask questions or share your opinions

Grading

Late Submission of Work

- Problem sets are due exactly one week after the date they are posted on the course web site
- Extensions cost 10% of your grade for each 24 hour beyond the deadline, up to a maximum of 30%
- Medical and beyond-your-control problems will be dealt with individually
- Plant trips and other scheduled activities are not beyond your control--allocate your time to accomplish all your obligations

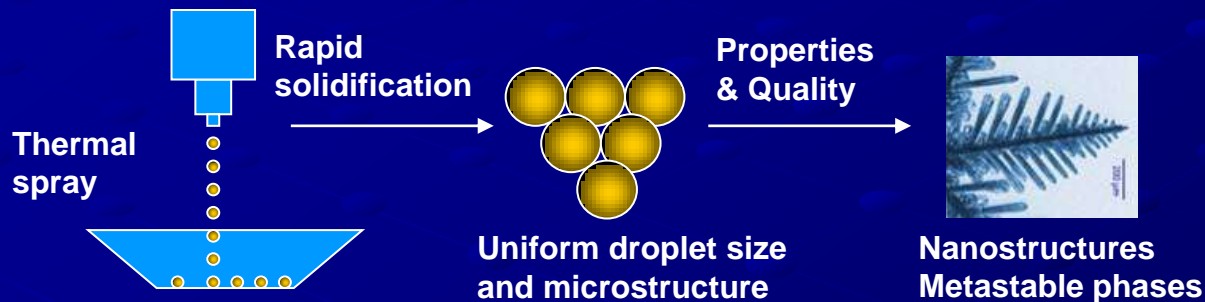
Mathematical Modeling of Crystal Growth



Modeling Nonequilibrium Phase Transformations

Advanced materials: automotive, aerospace, semiconductor, electronic industries

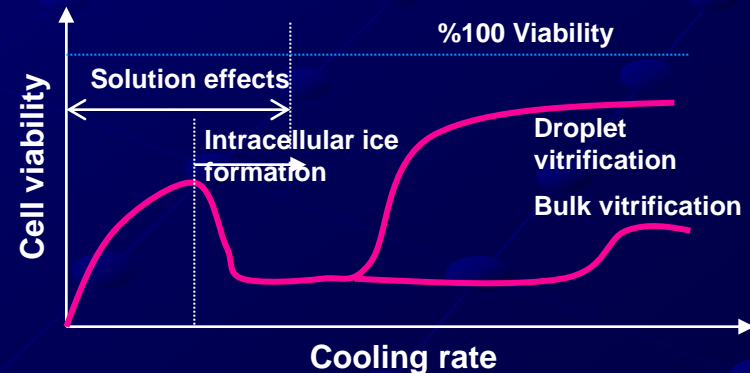
Purpose → Controlling the nano-structures of advanced materials that form during rapid solidification



Improves mechanical, chemical, thermal, electrical, magnetic, optical properties

Biomedicine: “Cryobiology”!

Purpose → Reducing the amount of poisonous cryoprotectants and formation of ice crystals detrimental to cells during the freezing/vitrification of cells for cryopreservation



HW I

- Write in a few sentences or bullets how thermodynamics will help you in your career.