

EMA 4120 Physical Metallurgy I
Section 3006—Fall Semester 2018
Instructor: Burton Patterson

1. Catalog Description: An in-depth discussion of fundamentals of physical metallurgy and microstructure evolution. Credits: 3 hours.
2. Pre-requisites: EMA 3050- Introduction to Inorganic Materials
3. Course Objectives:
 - a. to familiarize the student with those terms, concepts, and definitions (i.e. jargon) used to describe the properties and processes of common engineering metals.
 - b. to reacquaint the student with those fundamental principles of chemistry and physics which predetermine and control behavior of metals in response to external forces, whether mechanical, physical (electrical, magnetic, optical, thermal) or chemical in nature.
 - c. to develop a fundamental understanding of the relationships between material composition, structure, and properties resulting from synthesis, processing or service.
 - d. to develop an understanding of the testing procedures used to characterize some of the more common physical properties for engineering metals, and how these properties should be used when specifying conditions where optimum performance without failure can be expected.
 - e. to develop an understanding of the atomistic and defect structures, and how they result in the microstructure and influence the properties of metals.
 - f. to develop an understanding of the processes occurring in metals during heating that influence the microstructure and properties.
 - g. to develop an understanding of the effects of alloying of metals upon the microstructure and properties.
4. Contribution of course to meeting the professional component - This is a 3 credit course. It provides 3 credits towards engineering sciences.
5. Relationship of course to program outcomes - This course addresses the following MSE Program outcomes (note: Numbers refer to the list of MSE Program outcomes found at <http://mse.ufl.edu/students/prospective/undergraduate.html#outcomes>):
 1. Ability to apply knowledge of mathematics, science, and engineering to materials systems. (Low coverage)
 4. Ability to apply and integrate knowledge of structure, properties, processing, and performance to solve materials selection and design problems within realistic constraints. (High coverage)
 6. Ability to identify, formulate, and solve engineering problems. (Medium coverage)
 8. Ability to communicate effectively in both oral and written form. (Medium coverage)
 9. Understanding of the economic impact of engineering solutions. (Low coverage)

10. Understanding of the global, societal, and environmental impact of engineering solutions. (Low coverage)
 12. Knowledge of contemporary issues. (Medium coverage)
 13. Ability to use the techniques, skills, and tools needed for practice as a materials engineer. (Low coverage)
6. Instructor: Burton R. Patterson
- a. Office: =113 Nuclear Reactor Annex
 - b. Telephone: 352-846-3781
 - c. E-mail address: patters@mse.ufl.edu
 - d. Office hours: TBD, or make an appointment, or just drop in.
7. Teaching Assistant - none
8. Class Times: T Periods 2-3 (8:30-10:25am)
R Period 3 (9:35-10:25am)
9. Laboratory: None
10. Class Location: Weil 0273
11. Materials and Supplies Fees: None
12. Textbooks Required
- a. Title: *Transformations in metals*
 - b. Author: Paul G. Shewmon
 - c. Publisher: IA Books
 - d. Publication date: 2006
 - e. ISBN number: 8189617184
13. Recommended Reading: (a) *Physical Metallurgy Principles* by R. Abbaschian, et al.
(b) Per instruction and various handouts during course
14. Course Outline (**Approximate**)
- a. Week 1: Course introduction and review of metals and microstructures
 - b. Week 2: Chapter 1- Dislocations
 - c. Week 3: Chapter 2- Diffusion
 - d. Week 4: Chapter 3- Recovery, Recrystallization, Grain growth, **Exam 1**
 - e. Weeks 5-7: Recovery, Recrystallization, Grain growth (cont.)
 - f. Week 8: Chapter 4-Equilibrium in alloys (Thermodynamics, phase diagrams)
 - g. Week 9: Chapter 5- Solidification, **Exam 2**
 - h. Weeks 10-11: Solidification (cont.),
 - i. Week 12: Chapter 6- Phase transformations near equilibrium **Exam 3**
 - j. **Nov 22: Thanksgiving Holiday (No class)**
 - k. Week 13-15: Phase transformations near equilibrium (cont.)
 - l. **Dec 5: Exam 4, on last class day**

15. Attendance and Expectations: Attendance is strongly encouraged, but will not be recorded. While attendance is not mandatory, periodic unannounced pop-quizzes based on recent class material will be given at beginning of classes. Arrival on time is expected. Turn off all telephones before entering classroom.

16. Grading – Exams 1- 4, 20% each
Homework and Pop Quizzes-20%

Homework is due at the beginning of class, but will be accepted at my office until 4pm of the date due. Pop quizzes will be given periodically, usually at the start of class, to encourage keeping up with lecture material. Late homework will be accepted with a penalty.

Grading Scale: 93-100 A, 90-92 A⁻, 88-89 B⁺, 83-87 B, 80-82 B⁻, 78-79 C⁺, 73-77 C, 70-72 C⁻, 68-69 D⁺, 63-67 D, 60-62 D⁻, <60 E).

A C⁻ will not be a qualifying grade for critical tracking courses. In order to graduate, students must have an overall GPA and an upper-division GPA of 2.0 or better (C or better).

Note: a C⁻ average is equivalent to a GPA of 1.67, and therefore, it does not satisfy this graduation requirement. For more information on grades and grading policies, please visit: <https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>

17. Make-up Exam Policy: No exam make-up without **prior approval of instructor**.

18. Web Site: <https://lss.at.ufl.edu/>

The following will be posted on this site

- a. Power point files of the lecture materials
- b. Supplemental reading
- c. Homework assignments and due dates
- d. Important information about class schedule and revised schedule
- e. Course syllabus

19. Honesty Policy – All students admitted to the University of Florida have signed a statement of academic honesty committing themselves to be honest in all academic work and understanding that failure to comply with this commitment will result in disciplinary action. This statement is a reminder to uphold your obligation as a UF student and to be honest in all work submitted and exams taken in this course and all others.

20. Accommodation for Students with Disabilities – Students Requesting classroom accommodation must first register with the Dean of Students Office. That office will provide the student with documentation that he/she must provide to the course instructor when requesting accommodation.

21. UF Counseling Services –Resources are available on-campus for students having personal problems or lacking clear career and academic goals. The resources include:

- UF Counseling & Wellness Center, 3190 Radio Rd, 392-1575, psychological and psychiatric services.
- Career Resource Center, Reitz Union, 392-1601, career and job search services.

22. Software Use – All faculty, staff and student of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.