

UNIVERSITY OF ILLINOIS
College of Engineering
Department of Materials Science and Engineering

Fall 2016: **MSE 443**

DESIGN OF ENGINEERING ALLOYS

Instructor: Pascal Bellon, 312D MSEB, 265-0284, bellon@illinois.edu
Lecture: MWF 9-9:50 am, Room 4101 MSEB
Office Hours: by appointment
Website: <https://compass2g.illinois.edu/>

Assigned textbook: **Structure and properties of engineering alloys**, W. F. Smith, 2nd Edition.
620.16 SM68S1993 (Engineering reserve)

Recommended books:

Alloying, understanding the basics, ASM, Ed. J. R. Davis (reserve).
Physical metallurgy handbook, A. K. Sinha, 669.9 Si64p (reference).
ASM Handbook, Desk Edition and vols. 1-20, Q.669.1Am35mabr (reference);
Steels, R.W.K. Honeycombe & H.K.D.H. Bhadeshia, 669.96142h757s1996 (reference).
Materials Selection in Mechanical Design, M. Ashby, 1992, 620.11AS34M (reference)

Course Outline: 9 modules

1. Iron-carbon alloy system (Chaps 1 & 2)
2. Carbon and alloy steels (Chaps. 3 & 4)
3. Stainless steels (Chap. 7)

4. Copper alloys (Chap. 6)
5. Nickel alloys (Chap. 11)
6. Intermetallics and superalloys (class notes, Chap. 11)

7. Aluminum alloys (Chap. 5)
8. Titanium alloys (Chap. 10)
9. Refractory metal alloys (Chap. 13)

Grading: 10% Homework: Reading assignments due on Monday
Problem assignments due on Friday when no quiz
20% in-class quizzes: 9/2; 9/16; 9/30; 10/28; 11/11; 12/2 (keep 4 best scores)
10% Group presentation (second half of semester)
20% mid-term exam: Friday 10/14 (during class session)
40% Comprehensive final exam: Friday December 16th, 8:00 to 11:00 am

ACTIVE LEARNING APPROACH

1/ Learning is an interactive process

- Implement and develop methods to increase your learning efficiency.

2/ Come prepared to class

- Read and reflect on assigned reading in textbook before lecture; prepare and post questions and answers on course website.
- Read and study assigned articles and questions.

3/ Participate actively to class

- Ask and answer questions.
- Be involved in group discussions and other in-class activities.
- Share with the class your interests in certain alloys and applications.

GRADING POLICIES

You are expected to have read the Student Code section related to Academic Integrity (http://admin.illinois.edu/policy/code/article1_part4_1-401.html). All infractions listed in the Student Code, including cheating and plagiarism, will result in penalties in accordance with the Student Code. If you have any question regarding what constitutes an infraction, contact me.

QUIZZES

There will be 6 in-class quizzes throughout the semester (roughly one every two weeks). Each quiz will run over 15 minutes, and your overall quiz grade will be the average of your four best scores.

GROUP PRESENTATION

10% of the grade of this course will be based on a group paper presented, each group comprised of 4 students. You are free to choose your group members. The topic of your presentation should be specific and well defined, with a focus on alloy developments, or materials selection, or novel processing, characterizing, and manufacturing techniques. Suggested topics are listed below but feel free to propose your own topic, and I will indicate promptly whether it is a suitable topic. Your topic will need to make some contact with we will cover in class this semester. In all cases, each group will need my approval to make sure that the topics are well defined and there is no overlap. The presentations will be scheduled in the second half of the semester. Each presentation will consist of a 15-20 minutes Powerpoint oral presentation. You will **not** have to write a paper in addition to giving your presentation. Your grade will be determined based on your slides and on the quality of your oral presentation.

Possible General Topics (you will need to focus on one specific point):

- Additive manufacturing applied to metallic materials
- Materials Genome Initiative and Integrated Computational Materials Engineering (ICME) (http://www.whitehouse.gov/sites/default/files/microsites/ostp/materials_genome_initiative-final.pdf; <http://materialsinnovation.tms.org/docs/pdfs/ICMEProgress.pdf>)
- Materials selection, e.g., in musical (wind) instruments or other applications
- Critical alloying elements (http://energy.gov/sites/prod/files/DOE_CMS2011_FINAL_Full.pdf)
- Novel materials processing techniques, e.g., joining by friction stir welding.
- Novel characterization techniques, e.g., electron backscattered diffraction (EBSD), atom probe tomography (APT).
- Advanced superalloys for jet engines
- Advanced magnesium alloys for automotive applications
- Advanced cast irons (austempered ductile irons)
- Role of materials recycling in materials selection

Run > Hide > Fight

Emergencies can happen anywhere and at any time. It is important that we take a minute to prepare for a situation in which our safety or even our lives could depend on our ability to react quickly. When we're faced with any kind of emergency – like fire, severe weather or if someone is trying to hurt you – we have three options: Run, hide or fight.



Run

Leaving the area quickly is the best option if it is safe to do so.

- ▶ Take time now to learn the different ways to leave your building.
- ▶ Leave personal items behind.
- ▶ Assist those who need help, but consider whether doing so puts yourself at risk.
- ▶ Alert authorities of the emergency when it is safe to do so.



Hide

When you can't or don't want to run, take shelter indoors.

- ▶ Take time now to learn different ways to seek shelter in your building.
- ▶ If severe weather is imminent, go to the nearest indoor storm refuge area.
- ▶ If someone is trying to hurt you and you can't evacuate, get to a place where you can't be seen, lock or barricade your area, silence your phone, don't make any noise and don't come out until you receive an Illini-Alert indicating it is safe to do so.



Fight

As a last resort, you may need to fight to increase your chances of survival.

- ▶ Think about what kind of common items are in your area which you can use to defend yourself.
- ▶ Team up with others to fight if the situation allows.
- ▶ Mentally prepare yourself – you may be in a fight for your life.

Please be aware of persons with disabilities who may need additional assistance in emergency situations.

Other resources

- ▶ police.illinois.edu/safe for more information on how to prepare for emergencies, including how to run, hide or fight and building floor plans that can show you safe areas.
- ▶ emergency.illinois.edu to sign up for Illini-Alert text messages.
- ▶ **Follow the University of Illinois Police Department** on Twitter and Facebook to get regular updates about campus safety.