Course Outline

MATS6111

Processes in Materials Engineering

Materials Science and Engineering

Science

T2, 2022

1. Staff

Position	Name	Email	Consultation times and locations	Contact Details
Course Convenor	Prof. Jianqiang Zhang	j.q.zhang@unsw.edu.au	Room 348, School of Materials Science and Engineering (Building E10), by appointment	Phone: 9385 5025
Lecturer	A/Prof. Farshid Pahlevani	f.pahlevani@unsw.edu.au	Room 445, School of Materials Science and Engineering (Building E10), by appointment	Phone: 9385 4433

2. Course information

Units of credit: 6

Pre-requisite(s): None

Timetabling website: TBA

Teaching times and locations:

Part 1:	Lecture	Lecture	Lecture
Day	Monday	Wednesday	Friday
Location	Online	Online	Online
Time	2-4pm	2-4pm	3-5pm
Weeks	1,2,4,5	1-4	1-5

Part 2:	Lecture	Lecture
Day	Monday	Wednesday
Location	Online	Online
Time	4-6pm	2-4pm
Weeks	7-9	7-9

2.1 Course summary

Solidification, welding (emphasis on effect of welding on microstructure, HAZ's etc), fundamentals of metal working (including hot working, Zener-Hollomon parameter, dynamic recovery and recrystallization and cold working including slip line field theory, slab and upper bound analyses, formability, residual stresses), recrystallisation phenomena.

This course shall also focus on several advanced topics including: Specialty alloys such as; shape memory alloys, TWIP and TRIP steels, ultra-lightweight alloys, amorphous alloys, high entropy alloys and the associated processing technologies or fundamental mechanisms surrounding them. It shall also cover severe plastic deformation techniques and superplastic forming processes of metals.

2.2 Course aims

To develop an intimate understanding of the principles and practice of specialised secondary processing of advanced metal alloys. Emphasis will be given to relevant physical metallurgy and metal-physics-based theories that underpin these processes. These methods will be illustrated with respect to advanced and exploratory metal processing techniques.

2.3 Course learning outcomes (CLO)

At the successful completion of this course you (the student) should be able to:

1. Understand the principles underlying mechanisms of metal deformation processes, yielding and hardening.
2. Understand the role of crystal structure and microstructural features in the performance of metallic materials
3. Relate the microstructure of processed materials to processing conditions and behaviour in service.
4. Make informed decisions in recommending selection of processing methods of metals.

2.4 Relationship between course and program learning outcomes and assessments

Course Learning Outcome (CLO)	LO Statement	Program Learning Outcome (PLO)	Related Tasks & Assessment
CLO 1	Understand the principles….	1.2 & 1.3	1, 2, 3 & 4
CLO 2	Understand the role…	1.2 & 1.3	1, 2, 4
CLO 3	Relate the microstructure…	1.1, 1.2 & 1.3	1, 2 & 3
CLO 4	Make informed decisions…	1.1, 1.2 ,1.3 & 2.1	1, 2, 3 & 4

3. Strategies and approaches to learning

3.1 Learning and teaching activities

(based on UNSW Learning Guidelines)

- Students are actively engaged in the learning process.

It is expected that, in addition to attending classes, students read, write, discuss, and are engaged in solving problems on the secondary and advanced processing of materials, and their effects on the mechanical and processing properties of these materials.

Effective learning is supported by a climate of inquiry where students feel appropriately challenged.

• Learning is more effective when students' prior experience and knowledge are recognised and built on.

This course is built on prior knowledge of materials science & engineering and physical metallurgy.

• Students become more engaged in the learning process if they can see the relevance of their studies to professional and disciplinary contexts

Students will be asked to analyse the role of materials processing in understanding various functional, microstructural & mechanical phenomena in materials science and how these properties influence the science and engineering of existing and new advanced materials.

3.2 Expectations of students

- Students must attend at least 80% of all classes with the expectation that students only miss classes due to illness or unforeseen circumstances
- Students must read through lecture notes and lab sheets prior to class
- During class, students are expected to engage actively in class discussions
- Students should work through lecture, tutorial and textbook questions
- Students should read through the relevant chapters of the prescribed textbook.
- Students should complete all assessment tasks and submit them on time.
- Students are expected to participate in online discussions through the Moodle page

4. Course schedule and structure

This course consists of 38 hours of class contact hours. You are expected to take an additional 112 hours of non-class contact hours to complete assessments, readings and exam preparation.

Week	Topics	Activity
1-2	Recrystallisation Phenomena	
3-4	Fundamentals of metal working (including hot working, Zener-Hollomon parameter, dynamic recovery and recrystallization and cold working including slip line field theory, slab and upper bound analyses, formability, residual stresses), Common classes of copper alloys	Assignment 1
5	Revision	Mid-term exam (open book online)
7	Background Session on Materials Processing Specialty Alloys, examples of different metallic alloys with specific properties and their application	
8	Specialty processing and phase transformations Severe Plastic Deformation and its benefits and usage in industrial application	
9	Superplasticity and Superplastic Forming, how we can use this property to produce products	
10	Revision	Assignment 2

5. Assessment

5.1 Assessment tasks

Assessment task	Description	Weight	Due date
Assessment 1:	The assignment covers the topics taught in Weeks 1-4, namely recrystallisation and fundamental metal working theories, such as Zener-Hollamon parameter, dynamic restoration processes, slip line field theory etc)	10%	Week 4
Mid-term quiz:	The mid-term exam includes questions pertaining to the material learnt in Weeks 1-4	40%	Week 5 (Friday, 1 July, 3-5pm)
Topical literature review:	The assignment will cover the topics taught in week 7 and 8. It will be about creating a new approach toward materials performance	10%	Week 10
Final exam:	The final examination will be held during the exam period and include questions on course material from Weeks 7-9	40%	Final exam period

Further information

UNSW grading system: https://student.unsw.edu.au/grades

UNSW assessment policy: https://student.unsw.edu.au/assessment

5.2 Assessment criteria and standards

- Students who fail to achieve a score of at least 35% for both the mid-term exam and the final exam, and an average exam mark of 45%, but achieve a final mark >50% for the course, may still be awarded a UF (Unsatisfactory Fail) for the course.
- Please refer to the UNSW guide to grades: https://student.unsw.edu.au/grades

5.3 Submission of assessment tasks

- UNSW operates under a Fit to Sit/ Submit rule for all assessments. If a student wishes to submit an application for special consideration for an exam or assessment, the application must be submitted prior to the start of the exam or before an assessment is submitted. If a student sits the exam/ submits an assignment, they are declaring themselves well enough to do so. Information on this process can be found here: https://student.unsw.edu.au/special-consideration. Medical certificates or other appropriate documents must be included. Students should also advise the lecturer of the situation.
- Unless otherwise specified in the task criteria, all assignments must be uploaded via Moodle prior to the due date for submission.
- Assignments/lab reports submitted after the due date for submission will receive a 10% of maximum grade penalty for every day late, or part thereof.
- Students who have a disability that requires some adjustment in their teaching or learning environment are encouraged to discuss their study needs with the course coordinator prior to, or at the commencement of, their course, or with the Equity Officer (Disability) in the Equity and

Diversity Unit: https://student.unsw.edu.au/disability. Early notification is essential to enable any necessary adjustments to be made.

- Rules governing conduct during exams are given at: https://student.unsw.edu.au/exam-rules

5.4. Feedback on assessment

Assignments: Marks will be given two weeks after submission of the assignment. Overall comments on how the class performed and any common areas that were not answered correctly would be given. Additionally, personal feedback and how each student performed may be given.

Midsession exams: Students will receive their marks two weeks after mid-term exam. Overall comments may be provided to the class.

Final exam: Students will receive their final mark.

6. Academic integrity, referencing and plagiarism

Referencing is a way of acknowledging the sources of information that you use to research your assignments. You need to provide a reference whenever you draw on someone else's words, ideas or research. Not referencing other people's work can constitute plagiarism.

Further information about referencing styles can be located at https://student.unsw.edu.au/referencing

Academic integrity is fundamental to success at university. Academic integrity can be defined as a commitment to six fundamental values in academic pursuits**:** honesty, trust, fairness, respect, responsibility and courage.[1] At UNSW, this means that your work must be your own, and others' ideas should be appropriately acknowledged. If you don't follow these rules, plagiarism may be detected in your work.

Further information about academic integrity and **plagiarism** can be located at:

- The *Current Students* site https://student.unsw.edu.au/plagiarism**,** and
- The *ELISE* training site http://subjectguides.library.unsw.edu.au/elise/presenting

The *Conduct and Integrity Unit* provides further resources to assist you to understand your conduct obligations as a student: https://student.unsw.edu.au/conduct.

7. Readings and resources

- F.J. Humphreys and M. Hatherly, Recrystallization and Related Annealing Phenomena, 2nd Edition, Pergamon Press, Oxford, 2004
- D.Hull and D.J.Bacon, *Introduction to Dislocations*, 3rd Ed., 1988
- R.W.K.Honeycombe, The Plastic Deformation of Metals, 2nd ed., 1984
- G.E.Dieter, *Mechanical Metallurgy*, 3rd Ed., 1988
- R.E.Reed-Hill and R. Abbaschian, *Physical Metallurgy Principles*, 1992
- R.E. Smallman and R. Bishop, *Metals and Materials*, 1996
- R.E. Smallman, Modern Physical Metallurgy, 1985.

[1] International Center for Academic Integrity, 'The Fundamental Values of Academic Integrity', T. Fishman (ed), Clemson University, 2013.

8. Administrative matters

School Office: Room 137, Building E10 School of Materials Science and Engineering
School Website: http://www.materials.unsw.edu.au/
Faculty Office: Robert Webster Building, Room 128
Faculty Website: http://www.science.unsw.edu.au/

9. Additional support for students

- The Current Students Gateway: https://student.unsw.edu.au/
- Academic Skills and Support: https://student.unsw.edu.au/academic-skills
- Student Wellbeing, Health and Safety: https://student.unsw.edu.au/wellbeing
- Disability Support Services: https://student.unsw.edu.au/disability-services
- UNSW IT Service Centre: https://www.it.unsw.edu.au/students/index.html
- Assessment Implementation Procedure: https://www.gs.unsw.edu.au/policy/documents/assessmentimplementationprocedure.pdf
- Special Consideration: https://student.unsw.edu.au/special-consideration