UNSW Course Outline

MATS6111 Processes in Materials Engineering - 2024

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General Course Information

Course Code : MATS6111
Year : 2024
Term : Term 2
Teaching Period : T2
Is a multi-term course? : No
Faculty : Faculty of Science
Academic Unit : School of Materials Science & Engineering
Delivery Mode : In Person
Delivery Format : Standard
Delivery Location : Kensington
Campus : Sydney
Study Level : Postgraduate
Units of Credit : 6

Useful Links

Handbook Class Timetable

Course Details & Outcomes

Course Description

This course will cover two key areas of focus across a series of lectures.

The first section will provide students with advanced knowledge in metal working (including hot working, Zener-Hollomon parameter, dynamic recovery and recrystallization and cold working,

formability, residual stresses), and recrystallisation phenomena, with emphasis on the effect of processing conditions on microstructure (and hence properties). Common classes of copper alloys will be taught illustrating some of the principles involved.
The second section will 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 will also cover severe plastic deformation techniques and superplastic forming processes of metals.

Course Aims

The aim of this course is to provide 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. It will introduce new approach in material selection and usage of different materials.

Course Learning Outcomes

Course Learning Outcomes
CLO1 : Explain the principles underlying mechanisms of metal deformation processes, yielding and hardening.
CLO2 : Evaluate the performance of metallic materials based on an understanding of their crystal structure and microstructural features.
CLO3 : Relate the microstructure of processed materials to processing conditions and behaviour in service.
CLO4 : Select appropriate processing methods for different alloy applications based on knowledge of the relationship among alloy composition, processing and property.

Course Learning Outcomes	Assessment Item
CLO1 : Explain the principles underlying mechanisms of metal deformation processes, yielding and hardening.	• Mid-term Exam • Topical literature review • Final Exam
CLO2 : Evaluate the performance of metallic materials based on an understanding of their crystal structure and microstructural features.	• Assessment 1 • Mid-term Exam • Final Exam
CLO3 : Relate the microstructure of processed materials to processing conditions and behaviour in service.	• Assessment 1 • Topical literature review • Mid-term Exam
CLO4 : Select appropriate processing methods for different alloy applications based on knowledge of the relationship among alloy composition, processing and property.	• Assessment 1 • Topical literature review • Final Exam

Learning and Teaching Technologies

Moodle - Learning Management System | Echo 360 | Blackboard Collaborate

Learning and Teaching in this course

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.

Assessments

Assessment Structure

Assessment Item	Weight	Relevant Dates
Assessment 1 Assessment Format: Individual	10%	
Mid-term Exam Assessment Format: Individual	40%	
Topical literature review Assessment Format: Individual	10%	
Final Exam Assessment Format: Individual	40%	

Assessment Details

Assessment 1

Assessment Overview

In this task, you will answer questions on carefully-designed cases to demonstrate your knowledge learnt in this part of the course. The areas assessed will include hot deformation using Sellars-Tegart equation, Zener-Hollamon parameter, recrystallisation kinetic analysis, and JMAK Model application. It is expected that this practice will build up your ability in fundamental metal working theories and the dynamic and static restoration processes in secondary metal processing.

The assignment is released to you in Week 2. An early release can ensure some feedback returned before the census date.

Feedback will be given in two weeks after submission, including the marked assignments and overall comments on how the class performed.

Course Learning Outcomes

- CLO2 : Evaluate the performance of metallic materials based on an understanding of their crystal structure and microstructural features.
- CLO3 : Relate the microstructure of processed materials to processing conditions and behaviour in service.
- CLO4 : Select appropriate processing methods for different alloy applications based on knowledge of the relationship among alloy composition, processing and property.

Mid-term Exam

Assessment Overview

In this task, you will answer questions pertaining to the material learnt in Weeks 1-5, covering metal deformation, recovery and recrystallisation, application of theory to solve practical problems in the secondary metal processing processes.
It is a 1.5 h exam carried out during the scheduled class at the end of Week 5. The exam assesses your ability in understanding the concepts and theories in metal deformation and restoration and solving problem skills for the given cases.

Feedback: You will receive your mark in two weeks after the exam. Overall comments and worked solutions may be provided to the class.

Course Learning Outcomes

- CLO1 : Explain the principles underlying mechanisms of metal deformation processes, yielding and hardening.
- CLO2 : Evaluate the performance of metallic materials based on an understanding of their crystal structure and microstructural features.
- CLO3 : Relate the microstructure of processed materials to processing conditions and behaviour in service.

Topical literature review

Assessment Overview

In this task, you will be expected to provide a short report highlighting your own innovative approach toward the given topic. The ideas are to provide the best solution using the concepts in the course for the given topic while the solution can be very new. Implementation or applicability is not the critical factor, and marks will only be based on your approach to solve the given challenge. The Assessment needs to be submitted by the end of part two of course (exact date

to be provided). The length should not be more than three standard A4 length and formatting is free style.

Feedback will be given two weeks after submission of the assignment and take the form of the mark for the assignment, overall comments on how the class performed, any common areas that were not answered correctly. Additionally, personal feedback and how each student performed may be given.

Course Learning Outcomes

- CLO1 : Explain the principles underlying mechanisms of metal deformation processes, yielding and hardening.
- CLO3 : Relate the microstructure of processed materials to processing conditions and behaviour in service.
- CLO4 : Select appropriate processing methods for different alloy applications based on knowledge of the relationship among alloy composition, processing and property.

Final Exam

Assessment Overview

This task includes questions pertaining to the material learnt in Weeks 7-9, covering all topics related to different specialty alloys and their application, processing condition and their manufacturing process.
It is a 2 h exam carried out at the end of Term. The exam assesses your ability in understanding the concepts and theories in specialty alloys and their application and restoration and solving problem skills for the given cases.

Feedback on this task is available via consultation with the course coordinator.

Course Learning Outcomes

- CLO1 : Explain the principles underlying mechanisms of metal deformation processes, yielding and hardening.
- CLO2 : Evaluate the performance of metallic materials based on an understanding of their crystal structure and microstructural features.
- CLO4 : Select appropriate processing methods for different alloy applications based on knowledge of the relationship among alloy composition, processing and property.

General Assessment Information

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.

Grading Basis

Standard

Course Schedule

Teaching Week/Module	Activity Type	Content
Week 0 : 20 May - 26 May	Other	O-week
Week 1 : 27 May - 2 June	Lecture	Recrystallisation Phenomena
Week 2 : 3 June - 9 June	Lecture	Recrystallisation Phenomena
Week 3 : 10 June - 16 June	Lecture	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)
Week 4 : 17 June - 23 June	Lecture	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)
Week 5 : 24 June - 30 June	Lecture	Common classes of copper alloys, revision
Week 6 : 1 July - 7 July	Other	No teaching
Week 7 : 8 July - 14 July	Lecture	Background Session on Materials Processing Specialty Alloys, examples of different metallic alloys with specific properties and their application
Week 8 : 15 July - 21 July	Lecture	Specialty processing and phase transformations Severe Plastic Deformation and its benefits and usage in industrial application
Week 9 : 22 July - 28 July	Lecture	Lecture about superplasticity
Week 10 : 29 July - 4 August	Other	Finalising the assessment and revision of course materials

Attendance Requirements

Students are strongly encouraged to attend all classes and review lecture recordings.

Course Resources

Prescribed Resources

n/a

Recommended 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.

Additional Costs

n/a

Course Evaluation and Development

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.

Staff Details

Position	Name	Email	Location	Phone	Availability	Equitable Learning Services Contact	Primary Contact
Lecturer	Jianqiang Zhang					No	No
Convenor	Farshid Pahlevani					No	Yes

Other Useful Information

Academic Information

Upon your enrolment at UNSW, you share responsibility with us for maintaining a safe, harmonious and tolerant University environment.

You are required to:

- Comply with the University's conditions of enrolment.
- Act responsibly, ethically, safely and with integrity.
- Observe standards of equity and respect in dealing with every member of the UNSW community.
- Engage in lawful behaviour.
- Use and care for University resources in a responsible and appropriate manner.
- Maintain the University's reputation and good standing.

For more information, visit the UNSW Student Code of Conduct Website.

Academic Honesty and Plagarism

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. 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, plagiarism and the use of AI in assessments can be located at:

- The Current Students site,
- The ELISE training site, and
- The Use of AI for assessments site.

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

Submission of Assessment Tasks

Penalty for Late Submissions

UNSW has a standard late submission penalty of:

- 5% per day,
- for all assessments where a penalty applies,
- capped at five days (120 hours) from the assessment deadline, after which a student cannot submit an assessment, and
- no permitted variation.

Any variations to the above will be explicitly stated in the Course Outline for a given course or assessment task.

Students are expected to manage their time to meet deadlines and to request extensions as early as possible before the deadline.

Special Consideration

If circumstances prevent you from attending/completing an assessment task, you must officially apply for special consideration, usually within 3 days of the sitting date/due date. You can apply

by logging onto myUNSW and following the link in the My Student Profile Tab. Medical documentation or other documentation explaining your absence must be submitted with your application. Once your application has been assessed, you will be contacted via your student email address to be advised of the official outcome and any actions that need to be taken from there. For more information about special consideration, please visit: https://student.unsw.edu.au/special-consideration

Important note: UNSW has a "fit to sit/submit" rule, which means that if you sit an exam or submit a piece of assessment, you are declaring yourself fit to do so and cannot later apply for Special Consideration. This is to ensure that if you feel unwell or are faced with significant circumstances beyond your control that affect your ability to study, you do not sit an examination or submit an assessment that does not reflect your best performance. Instead, you should apply for Special Consideration as soon as you realise you are not well enough or are otherwise unable to sit or submit an assessment.

Faculty-specific Information

Additional support for students

- The Current Students Gateway
- Student Support
- Academic Skills and Support
- Student Wellbeing, Health and Safety
- Equitable Learning Services
- UNSW IT Service Centre
- Science EDI Student Initiatives, Offerings and Guidelines