UNSW Course Outline

MATS4001 Secondary Processing of Metals - 2024

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General Course Information

Course Code : MATS4001
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 : Undergraduate
Units of Credit : 6

Useful Links

Handbook Class Timetable

Course Details & Outcomes

Course Description

This course will provide advanced knowledge in solidification, welding (emphasis on effect of welding on microstructure, HAZ etc.), fundamentals of metal working (including hot working, Zener-Hollomon parameter, dynamic recovery and recrystallization and cold working, formability,

residual stresses, powder metallurgy and sintering, machining, recrystallisation phenomena. Emphasis on the effect of processing conditions on microstructure and hence properties. Common classes of magnesium alloys, copper alloys and cast irons to be taught illustrating some of the principles involved.

The course will be delivered through lectures and is for students in the final years of their materials science /and engineering degrees.

Course Aims

The aim of this course is to introduce students to the principles and practice of secondary processing of metals. Emphasis will be given to relevant physical metallurgy theories that underpin these processes. These methods will be illustrated with respect to commercial cast irons, magnesium and copper alloys.

Course Learning Outcomes

Course Learning Outcomes
CLO1 : Make informed decisions in recommending selection of processing methods by applying metal deformation and forming theories based on knowledge of secondary metal processing.
CLO2 : Relate the microstructure of processed materials to processing conditions and behaviour in service.
CLO3 : Critically analyse the problems relating to metal deformation, deformed metal recovery and recrystallisation, solidification, welding, etc. using knowledge of metal deformation and restoration, solidification in secondary metal processing.
CLO4 : Communicate in the written format using correct terminology.
CLO5 : Conduct online research for literature review and case studies in the field of secondary metal processing.
CLO6 : Collaborate with peers to solve problems relating to materials and processing method selection.

Course Learning Outcomes	Assessment Item
CLO1 : Make informed decisions in recommending selection of processing methods by applying metal deformation and forming theories based on knowledge of secondary metal processing.	• Final Exam • Mid-Term Test • Assignment 2
CLO2 : Relate the microstructure of processed materials to processing conditions and behaviour in service.	• Assignment 1 • Final Exam • Mid-Term Test • Assignment 2
CLO3 : Critically analyse the problems relating to metal deformation, deformed metal recovery and recrystallisation, solidification, welding, etc. using knowledge of metal deformation and restoration, solidification in secondary metal processing.	• Assignment 1 • Final Exam • Mid-Term Test
CLO4 : Communicate in the written format using correct terminology.	• Assignment 1 • Assignment 2 • Final Exam • Mid-Term Test
CLO5 : Conduct online research for literature review and case studies in the field of secondary metal processing.	• Assignment 2
CLO6 : Collaborate with peers to solve problems relating to materials and processing method selection.	• Assignment 2

Learning and Teaching Technologies

Moodle - Learning Management System

Learning and Teaching in this course

Lectures will be delivered in person throughout the term. Students may review the recorded lectures through blackboard collaborate or echo 360.

Assessments

Assessment Structure

Assessment Item	Weight	Relevant Dates
Final Exam Assessment Format: Individual	40%	
Assignment 1 Assessment Format: Individual	10%	Start Date: 05/06/2024 12:00 AM Due Date: 30/06/2024 12:00 AM Post Date: 05/06/2024 12:00 AM
Mid-Term Test Assessment Format: Individual	40%	
Assignment 2 Assessment Format: Group	10%	

Assessment Details

Final Exam

Assessment Overview

You will complete a final exam within the UNSW exam period. The exam will cover the content taught in lectures from week 7 to week 10. You will summarise and show your knowledge of secondary processing techniques for metals.

The exam will last 2 hours, and typical questions include: short answer questions, multiple choice questions and compound multiple choice questions.

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.

Feedback may be available through inquiry with the course teaching staff.

Course Learning Outcomes

- CLO1 : Make informed decisions in recommending selection of processing methods by applying metal deformation and forming theories based on knowledge of secondary metal processing.
- CLO2 : Relate the microstructure of processed materials to processing conditions and behaviour in service.
- CLO3 : Critically analyse the problems relating to metal deformation, deformed metal recovery and recrystallisation, solidification, welding, etc. using knowledge of metal deformation and restoration, solidification in secondary metal processing.
- CLO4 : Communicate in the written format using correct terminology.

Detailed Assessment Description

The exam will be 2hrs in duration and held in the final exam period. It will cover the second part of the course (weeks 7– 10).

Hurdle rules

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.

Assignment 1

Assessment Overview

You will complete this question-based assignment, with carefully designed cases for you to use your knowledge learnt in this part of the course to solve some practical problems covering the areas of 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 : Relate the microstructure of processed materials to processing conditions and behaviour in service.
- CLO3 : Critically analyse the problems relating to metal deformation, deformed metal recovery and recrystallisation, solidification, welding, etc. using knowledge of metal

deformation and restoration, solidification in secondary metal processing.
- CLO4 : Communicate in the written format using correct terminology.

Detailed Assessment Description

Using knowledge learnt in first part of the course to solve problems in hot working and restoration process by calculation and description

Assignment submission Turnitin type

This is not a Turnitin assignment

Mid-Term Test

Assessment Overview

You will complete the mid-term test which includes 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 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 : Make informed decisions in recommending selection of processing methods by applying metal deformation and forming theories based on knowledge of secondary metal processing.
- CLO2 : Relate the microstructure of processed materials to processing conditions and behaviour in service.
- CLO3 : Critically analyse the problems relating to metal deformation, deformed metal recovery and recrystallisation, solidification, welding, etc. using knowledge of metal deformation and restoration, solidification in secondary metal processing.
- CLO4 : Communicate in the written format using correct terminology.

Detailed Assessment Description

The mid-term exam includes questions pertaining to the materials learnt in weeks 1-4

Assessment Length

2 h

Hurdle rules

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

Assignment 2

Assessment Overview

You will work as a group to write a 2000-3000 word report on the production and processing of two metal components in an object of your choice.

Using the concepts taught in weeks 7-10 and online literature you will describe how the two metal components would be made from starting material to the finished product.

You will be placed in group in week 7 and the report will be due in week 10.

Feedback will be given two weeks after submission of the assignment and take the form of the mark for the assignment.

Course Learning Outcomes

- CLO1 : Make informed decisions in recommending selection of processing methods by applying metal deformation and forming theories based on knowledge of secondary metal processing.
- CLO2 : Relate the microstructure of processed materials to processing conditions and behaviour in service.
- CLO4 : Communicate in the written format using correct terminology.
- CLO5 : Conduct online research for literature review and case studies in the field of secondary metal processing.
- CLO6 : Collaborate with peers to solve problems relating to materials and processing method selection.

Detailed Assessment Description

Group assignment

General Assessment Information

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	Recrystallization phenomena
Week 2 : 3 June - 9 June	Lecture	Recrystallization 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	Review of solidification theory and practice
Week 8 : 15 July - 21 July	Lecture	Review of solidification theory and practice, Common classes of magnesium alloys and cast irons
Week 9 : 22 July - 28 July	Lecture	Welding, effect of welding on microstructure, HAZ's, etc.
Week 10 : 29 July - 4 August	Lecture	Metal forming processes: forging, rolling and extrusion, Revision

Attendance Requirements

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

Course Resources

Prescribed Resources

There are no prescribed resources for this course

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.

Course Evaluation and Development

The course is continually evaluated based on the myExperience data collected every year.

Students are encouraged to provide additional feedback on the course via email throughout the term.

Staff Details

Position	Name	Email	Location	Phone	Availability	Equitable Learning Services Contact	Primary Contact
	Jianqiang Zhang					No	Yes
	Akif Kaynak					No	No

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