Course Outline

MATS6001

Fundamentals of Materials Processing

Materials Science and Engineering

Science

T1, 2022

1. Staff

Position	Name	Email	Consultation times and locations	Contact Details
Course Convenor	Dr Kevin Laws	k.laws@unsw.edu.au	Room 301, School of Materials Science and Engineering (Building E10), by appointment	Phone: 9385 5234
Lecturer	Prof Sean Li	sean.li@unsw.edu.au	Room 520 Materials Science and Engineering (Bldg E10) by appointment	Phone: 9385 5986

2. Course information

Units of credit: 6

Pre-requisite(s): None

Timetabling website: http://timetable.unsw.edu.au/2022/MATS6001.html

Teaching times and locations:

	Lecture	Lecture	Lecture
Day	Tuesday	Wednesday	Thursday
Location	Online	Online	Online
Time	16:00 - 18:00	16:00 - 18:00	13:00 - 15:00
Weeks	1-5, 7-10	1-5, 7-10	1-5, 7-10

2.1 Course summary

This first section of this course includes an introduction to processing of inorganic materials, semiconductor processing, single crystal growth of Si, GaAs, carbon-based material, thin film processing (physical and chemical vapour deposition), sputtering and pulse laser deposition method advanced nanostructures such as nanoparticles, nanowires, nanotubes, wet chemical methods, electro-less and electrochemical methods. In addition, this course will cover sustainable materials processing- waste plastic, electronics waste processing and sustainable iron and Steel making.

Course material covered in the second section includes secondary metals processing such as fixed and continuous casting processes including sand-box casting, investment casting, die-casting, slab and twin-roll strip-casting; metal billet and sheet rolling; tube and bar extrusion; forging techniques; Powder consolidation techniques including hot isostatic pressing and spark plasma sintering; Soldering, Brazing and Welding, Subtractive manufacturing including multi-axis milling, machining, grinding and spark erosion; Additive manufacturing including typical 3D printing techniques such as extrusion melting, selective laser melting/sintering, e-beam melting and droplet ejection.

2.2 Course aims

This course covers selected topics in materials processing including elements of both extractive metallurgy and secondary processing methods. Students will understand the basic elements of operations of processing used in primary metal refinement and assorted secondary processing and shaping methods such as casting, rolling, welding and powder metallurgy.

2.3 Course learning outcomes (CLO)

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

1. Explain the basic concepts and economic drivers in materials processing.
2. Identify the distinguishing features of different types of primary and secondary processing techniques and their commercial applications.
3. Develop problem-solving skills with regards to identifying and applying processing methods, techniques and conditions specific real-world applications.
4. Communicate with correct processing method terminology

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	Explain…	3	1, 2, 3 & 4
CLO 2	Identify…	2, 3 & 5	1, 2, 3 & 4
CLO 3	Develop…	4 & 5	1, 2, 3 & 4
CLO 4	Communicate…	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 primary and secondary processing of materials, and their effects on the functional and mechanical 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 chemistry.

- *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 materials.

Lectures: The core concepts will be taught in lectures, students will have access to the lectures notes before class for annotation during the lecture. Students will be engaged in the learning process through class discussions and problem-solving questions independently and working together with partners and groups.

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 48 hours of class contact hours. You are expected to take an additional 102 hours of non-class contact hours to complete assessments, readings and exam preparation spread over the term.

Week	Topics			Activity
1	Intro to Inorganic Materials (SL)	Semiconductor Properties (SL)	Semiconductor Materials Processing and Single Crystal Growth (SL)	
2	Thin Film Technology – Vacuum Evaporation (SL)	PLD and CVD methods (SL)	Nanomaterials Processing (SL)	
3	(Quiz 1)	Nanoparticles, Nanowires, CNT and Graphene (SL)	Chemical Processing of Materials (SL)	Quiz 1
4	Sustainable Materials Processing (SL)	Course Study Review (SL)	Mid-Term exam	Mid-term exam
5				
6				
7	Intro to Materials Processing (KJL)	Primary Metals Processing (KJL)	Casting Processes (I) (KJL)	
8	Casting Processes (II) (KJL)	Metal Rolling & Extrusion (KJL)	Forging Processes (KJL)	
9	(Quiz 2)	Joining Processes (I) (KJL)	Joining Processes (II) (KJL)	Quiz 2
10	Additive & Subtractive Manufacturing (KJL)	Course Study Review (KJL)		

5. Assessment

5.1 Assessment tasks

Assessment task	Description	Weight	Due date
Assessment 1: Quiz 1	Students will be assessed on course material (Weeks 1-3)	10%	Week 3
Assessment 2: Mid-term exam	The examination will be 2 hours in duration and held during class time. Students will be assessed on course material (Weeks 1-4). You will be assessed in understanding and ability to apply theory and technology learnt throughout the course in a Q & A context.	40%	Week 4
Assessment 3: Quiz 2	Students will be assessed on course material (Weeks 5-9)	10%	Week 9
Assessment 4: Final exam	The examination will be 2 hours in duration and held during the examination period. Students will be assessed on metals processing course material (Weeks 5-10). You will be assessed in understanding and ability to apply theory and technology learnt throughout the course in a Q & A context.	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

- Assessment criteria and standards will be available on the course Moodle pages
- Students are required to pass both the mid-term and final examinations to pass the course
- Rules governing conduct during exams are given at: https://student.unsw.edu.au/exam-rules

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.
- 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.

- Assessment tasks are to be completed in class during the allocated time and handed in at the conclusion of the task.

5.4. Feedback on assessment

Quizzes: 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.

Midsession exams: Students will receive their marked exams indicating what questions were answered correctly and incorrectly. Overall comments and worked solutions 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. C. Campbell, ***Metal Fabrication*** ASM International 2013, ISBN:978-1-62708-018-7
- Joanna R. Groza, James F. Shackelford, ***Materials Processing Handbook*** 2007, ISBN 9780849332166.
- William F. Smith**, *Principles of Materials Science and Engineering*** 3rd edition 1999, ISBN 978-0072396591.

[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