UNSW Course Outline

MATS6105 Chemical Properties of Materials - 2024

Published on the 10 Sep 2024

General Course Information

Course Code : MATS6105
Year : 2024
Term : Term 3
Teaching Period : T3
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

Degradation of engineering materials via corrosion or oxidation occurs in many applications. This first part of this postgraduate course teaches students the fundamental aspects of corrosion and oxidation, the many mechanisms of how corrosion and oxidation proceed, and

how to minimise and control the rate at which these phenomena occur. Students will understand the practical consequences of corrosion and oxidation and the role of materials selection and design in reducing these phenomena to extend the lifespan of engineered components. This part of the course is taught through lectures and a laboratory component. In the second part of the course, the students will explore the characteristics of electric double layers and application of Pourbaix Diagrams to predict and interpret electrochemical behaviour and real corrosion situations. . Finally, students will apply their knowledge of electrode kinetics toelectrocatalysis and in fuel cells use these concepts to understand the mechanisms in energy systems such as batteries and fuel cells.

Course Aims

The aim of this course is to develop students' knowledge of electrochemistry in materials technology, chemical processes, electrochemical energy systems, as well as common ways materials degrade by corrosion and oxidation and how this can be prevented or mitigated through corrosion prevention techniques. The course will focus on real-world applications through the use of case studies and examples. The course will also provide an observational and hands-on experience through a laboratory-based materials testing and results analysis exercise.

Course Learning Outcomes

Course Learning Outcomes
CLO1 : Identify and explain the relationships between material chemistry, microstructures and environments in relation to corrosion, oxidation and electrochemical energy systems.
CLO2 : Explain the types and mechanisms by which corrosion and oxidation occur and the key parameters and material properties that affect degradation rates.
CLO3 : Justify the selection of appropriate materials and protection strategies to be used in practical scenarios where resistance to corrosion is required.
CLO4 : Explain advanced electrochemistry concepts and their application in materials technology and electrochemical energy systems.

Course Learning Outcomes	Assessment Item
CLO1 : Identify and explain the relationships between material chemistry, microstructures and environments in relation to corrosion, oxidation and electrochemical energy systems.	• Corrosion Laboratory Report • Assignments • Mid-term Test
CLO2 : Explain the types and mechanisms by which corrosion and oxidation occur and the key parameters and material properties that affect degradation rates.	• Corrosion Laboratory Report • Assignments • Mid-term Test
CLO3 : Justify the selection of appropriate materials and protection strategies to be used in practical scenarios where resistance to corrosion is required.	• Group Project • Mid-term Test
CLO4 : Explain advanced electrochemistry concepts and their application in materials technology and electrochemical energy systems.	• Group Project • Corrosion Laboratory Report • Assignments • Mid-term Test

Learning and Teaching Technologies

Moodle - Learning Management System | Echo 360

Assessments

Assessment Structure

Assessment Item	Weight	Relevant Dates
Group Project Assessment Format: Group	30%	Start Date: Please refer to information sheet Due Date: Please see information sheet
Corrosion Laboratory Report Assessment Format: Individual	10%	Start Date: As per your timetable Due Date: 10/10/2024 05:00 PM
Assignments Assessment Format: Individual	30%	Start Date: See Assessment Outline Due Date: See Assessment Outline
Mid-term Test Assessment Format: Individual	30%	Start Date: 21/10/2024 10:00 AM Due Date: 21/10/2024 12:00 PM

Assessment Details

Group Project

Assessment Overview

Report: You will be expected to form a project group of 3-4 students to perform a detailed review of the literature on a topical area selected by the group, based on the course materials in the second part of the course and approved by the lecturer. Assessment weighting of the report = 25%

Presentation: Each group will give a 7-10 minute oral presentation based on the group's project. Assessment weighting of the presentation = 5%

The group project and the presentation will provide you with an opportunity in working as a group, to conduct detailed research on a topic covered in the second part of the course.

Approximate timeline:

Week 5: You will be provided information on the Group Research Project

Week 7: You should now form your own research group. Alternatively, you may give the lecturer your names via email before Week 8, and they will put you into a group. A group contract will be submitted by the spokesperson of your group before Week 8.

Week 8: Your group should by now have chosen a project topic and received approval from the

lecturer.
Week 10 Your research group is expected to submit the group research report in Week 10. Your group will also deliver the presentation in Week 10.

Feedback will be given two weeks after submission and presentation, including your marked report and presentation marking rubric, and overall comments on how the class performed

Course Learning Outcomes

- CLO3 : Justify the selection of appropriate materials and protection strategies to be used in practical scenarios where resistance to corrosion is required.
- CLO4 : Explain advanced electrochemistry concepts and their application in materials technology and electrochemical energy systems.

Assignment submission Turnitin type

This assignment is submitted through Turnitin and students can see Turnitin similarity reports.

Generative AI Permission Level

No Assistance

This assessment is designed for you to complete without the use of any generative AI. You are not permitted to use any generative AI tools, software or service to search for or generate information or answers.
For more information on Generative AI and permitted use please see here.

Corrosion Laboratory Report

Assessment Overview

This laboratory exercise and demonstration assesses your knowledge of class content and observations made within the laboratory for samples provided.

The laboratory exercise will familiarise you with typical laboratory corrosion testing methods, and the theory associated with these methods.

This laboratory exercise and submitted report are worth 10% of your final grade.

The laboratory exercise is typically timetabled in Week 4.

The laboratory results will be unique to each lab session. These results will be provided to you at the end of all laboratory sessions for you to analyse and assess.

You will provide your analysis of the results in the form of a report using the format provided,

typically due one week after the laboratory exercise takes place.

Feedback on your performance will be provided two weeks after submission of the report, in the form of your mark, an accepted answer sheet and overall comments on how the class performed and common areas that were not completed correctly.

Course Learning Outcomes

- CLO1 : Identify and explain the relationships between material chemistry, microstructures and environments in relation to corrosion, oxidation and electrochemical energy systems.
- CLO2 : Explain the types and mechanisms by which corrosion and oxidation occur and the key parameters and material properties that affect degradation rates.
- CLO4 : Explain advanced electrochemistry concepts and their application in materials technology and electrochemical energy systems.

Assessment Length

See Lab Sheet

Submission notes

Via moodle portal

Assignment submission Turnitin type

Not Applicable

Generative AI Permission Level

No Assistance

This assessment is designed for you to complete without the use of any generative AI. You are not permitted to use any generative AI tools, software or service to search for or generate information or answers.
For more information on Generative AI and permitted use please see here.

Assignments

Assessment Overview

You will complete 2 short assignments: one for Part 1 of the course (worth 10% of the course mark) and one for Part 2 of the course (worth 20% of the course mark).

The aim of these assignments is to develop your understanding of, and ability to apply, concepts covered in lectures and to explore real-world applications of the course content in industry and research. The assignments will be in the form of either an essay topic or a set of questions

requiring a combination of written and numerical answers.

The assignments will typically be due in Weeks 3 and 9.

Feedback will be given two weeks after submission of the assignment and take the form of the mark for the assignment, and either overall comments on how the class performed and common areas that were not answered correctly, or personal feedback on your individual performance.

Course Learning Outcomes

- CLO1 : Identify and explain the relationships between material chemistry, microstructures and environments in relation to corrosion, oxidation and electrochemical energy systems.
- CLO2 : Explain the types and mechanisms by which corrosion and oxidation occur and the key parameters and material properties that affect degradation rates.
- CLO4 : Explain advanced electrochemistry concepts and their application in materials technology and electrochemical energy systems.

Submission notes

Via moodle portal

Assignment submission Turnitin type

Not Applicable

Generative AI Permission Level

No Assistance

This assessment is designed for you to complete without the use of any generative AI. You are not permitted to use any generative AI tools, software or service to search for or generate information or answers.
For more information on Generative AI and permitted use please see here.

Mid-term Test

Assessment Overview

The mid-term test will be held in class, usually in Week 7, and will cover the topics taught in Weeks 1-5.

The test will be ~2 hrs in duration and will assess your understanding of the concepts taught in both lectures and laboratory activities, through a combination of multiple-choice, numerical and descriptive questions.

Feedback will be given two weeks after the test and will take the form of the mark and overall comments on how the class performed and common areas that were not answered correctly.

Hurdle requirement: you must achieve at least 35% in the mid-term test, as well as an average of at least 45% across the mid-term test and final exam, to receive a passing grade in the course.

Course Learning Outcomes

- CLO1 : Identify and explain the relationships between material chemistry, microstructures and environments in relation to corrosion, oxidation and electrochemical energy systems.
- CLO2 : Explain the types and mechanisms by which corrosion and oxidation occur and the key parameters and material properties that affect degradation rates.
- CLO3 : Justify the selection of appropriate materials and protection strategies to be used in practical scenarios where resistance to corrosion is required.
- CLO4 : Explain advanced electrochemistry concepts and their application in materials technology and electrochemical energy systems.

Assessment Length

90 mins

Submission notes

Test paper to be submitted at end of test

Assignment submission Turnitin type

Not Applicable

Generative AI Permission Level

No Assistance

This assessment is designed for you to complete without the use of any generative AI. You are not permitted to use any generative AI tools, software or service to search for or generate information or answers.
For more information on Generative AI and permitted use please see here.

General Assessment Information

Short Extensions:

The School of Materials Science and Engineering has reviewed its range of assignments and projects to determine their suitability for automatic shortextensions as set out by the UNSW Short Extension Policy. After consultation with teaching staff and examination of our course offerings, we consider our current deadline structures already accommodate the possibility of unexpected circumstances that may lead students to require additional days for submission.

Consequently, the School does not offer the Short Extension provision in its MATS courses but students, if needed, can apply for formal Special Consideration via the usual procedure.

Grading Basis

Standard

Requirements to pass course

You are required to achieve a mark of at least 45% weighted average for the mid-term test to pass the course, otherwise an Unsatisfactory Fail (UF) grade may be awarded.

Course Schedule

Teaching Week/Module	Activity Type	Content
Week 1 : 9 September - 15 September	Lecture	Monday, 10am-12pm: Introduction to the course; Introduction to corrosion & corrosion control
	Lecture	Wednesday, 2pm-4pm: Electrochemical reactions
	Lecture	Thursday, 11am-1pm: Types of corrosion
Week 2 : 16 September - 22 September	Lecture	Monday, 10am-12pm: Thermodynamics of corrosion 1 - Electromotive force & Nernst equation
	Lecture	Wednesday, 2pm-4pm: Thermodynamics of corrosion 2 - Introduction to Pourbaix diagrams
	Lecture	Thursday, 11am-1pm: Electrode kinetics 1
Week 3 : 23 September - 29 September	Lecture	Monday, 10am-12pm: Electrode kinetics 2
	Lecture	Wednesday, 2pm-4pm: Passivity & pitting
	Lecture	Thursday, 11am-1pm: Atmospheric corrosion
	Assessment	Corrosion assignment due (end of week)
Week 4 : 30 September - 6 October	Lecture	Monday, 10am-12pm: Corrosion in Soil & Bio-Corrosion
	Lecture	Wednesday, 2pm-4pm: Corrosion Under Stress 1 - Stress Corrosion Cracking
	Lecture	Thursday, 11am-1pm: Corrosion Under Stress 2 - Hydrogen Damage & Corrosion Fatigue
	Laboratory	See your lab schedule time, report due end of Week 5.
Week 5 : 7 October - 13 October	Assessment	Lab Report Due - Thursday, 5pm.
	Lecture	Introduction to the Second Part of the Course Introduction to the Second Part of the Course This will be a pre-recorded lecture introducing the materials covered in the second part of the course. Detailed information on the Group Project will be given. An online Q&A session will be arranged in Week 5.
Week 7 : 21 October - 27 October	Assessment	Monday 10am-12pm MID-TERM TEST: : PART 1 CORROSION & CORROSION CONTROL HELD IN CLASS
	Lecture	Wednesday 2pm - 4pm Structure of Electric Double Layer (Lecture will be conducted online)
Week 8 : 28 October - 3 November	Lecture	Wednesday 2pm - 4pm More applications of Pourbaix diagrams (Lecture will be conducted online)
Week 9 : 4 November - 10 November	Lecture	Monday 10am - 12noon Advanced electrode kinetics and applications 1
	Lecture	Wednesday 2pm - 4pm Advanced electrode kinetics and applications 1
	Lecture	Thursday 11am - 1pm Advanced electrode kinetics and applications 1
Week 10 : 11 November - 17 November	Assessment	Monday 11am - 1pm Group project report

Attendance Requirements

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

Staff Details

Position	Name	Email	Location	Phone	Availability	Equitable Learning Services Contact	Primary Contact
Lecturer	Sammy Chan		Room 245, Hilmer Building	02 93854441	Via email appointment	No	Yes
	Kevin Laws		E10 (Hilmer) Office 301		via email appointment	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