Materials Science and Engineering
MATS4005

Composites and Functional Materials

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Course Staff

<table>
<thead>
<tr>
<th>Name</th>
<th>Room</th>
<th>Contact Information</th>
<th>Consultation hours:</th>
</tr>
</thead>
</table>
| Prof. Alan Crosky     | Room 241, School of Materials Science and Engineering (Building E10) | Phone: 9385 4424  
  a.crosky@unsw.edu.au | by appointment                  |
| Dr Danyang Wang       | Room 239, School of Materials Science and Engineering (Building E10) | Phone: 9385 7170  
  dy.wang@unsw.edu.au | by appointment                  |
Course Objective

The objective of this course is to develop a sound understanding in the relationships between structure, processing and properties of composite materials and also of a range of electronic device materials.

Timetable

<table>
<thead>
<tr>
<th>Day</th>
<th>Time</th>
<th>Location</th>
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<tbody>
<tr>
<td>Tuesday</td>
<td>10:00 – 12:00</td>
<td>Ainsworth 102 (J17-102)</td>
</tr>
<tr>
<td>Friday</td>
<td>09:00 – 11:00</td>
<td>Chem. Sci. M11 (F10-M11)</td>
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Your Course at a Glance

<table>
<thead>
<tr>
<th>What you will learn</th>
<th>Weeks</th>
<th>Assessment task</th>
</tr>
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<tbody>
<tr>
<td>Overview of semiconductor materials and physics</td>
<td>1</td>
<td>Assignment</td>
</tr>
<tr>
<td>Theories of semiconducting behaviour</td>
<td>1-2</td>
<td></td>
</tr>
<tr>
<td>Basic semiconductor devices</td>
<td>2-3</td>
<td></td>
</tr>
<tr>
<td>Methods of single crystal growth and purification</td>
<td>3-4</td>
<td></td>
</tr>
<tr>
<td>Device fabrication: Oxidation and epitaxy</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Device fabrication: Lithographic methods, diffusion and ion implantation</td>
<td>5-6</td>
<td></td>
</tr>
<tr>
<td>Philosophy of a composite</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Reinforcement and matrix materials.</td>
<td>6-7</td>
<td></td>
</tr>
<tr>
<td>Mechanical behaviour of composites</td>
<td>9-11</td>
<td>Assignment</td>
</tr>
<tr>
<td>Fabrication techniques</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>Composite applications</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>Assignment due Week 6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Midsession exam Week 8</td>
<td></td>
<td></td>
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<tr>
<td>Assignment due Week 12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Final exam</td>
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Course Content

Polymer matrix, metal matrix and ceramic matrix composites; Nanocomposites; Mechanical behaviour of composites; Physico-chemical characteristion Fabrication techniques. Design with composites; Applications; Material processes used in the fabrication of electronic devices such as single crystal growth, implantation, lithography, etching and thin film growth; Methods of device packaging; Sources of failure and methods of fault diagnosis in devices; Dielectric and ferroelectric materials.
Assessment

<table>
<thead>
<tr>
<th>Assessment Task</th>
<th>Fraction</th>
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<tbody>
<tr>
<td><strong>Assignment 1</strong>: You will undertake a task involving the application of the topics covered in Weeks 1-6. Due: Week 7</td>
<td>15%</td>
</tr>
<tr>
<td><strong>Midsession Quiz</strong>: This examination will be the final examination for the topics learnt in Weeks 1-6 Held: Week 8</td>
<td>35%</td>
</tr>
<tr>
<td><strong>Assignment 2</strong>: You will undertake a group task involving the application of the topics covered in Weeks 1-5. The task will involve submission of a group report. You will be asked to rate the performance of your group members and this will moderate your individual mark for your group assignment by ± 30% Due: Week 12</td>
<td>15%</td>
</tr>
<tr>
<td><strong>Final Exam</strong>: The final exam will assess your learning of the topics covered in Weeks 7-12. It will be 2 hrs in duration and will be held during the final exam period.</td>
<td>35%</td>
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**NOTE:** Students who fail to achieve a score of at least 40% for the overall exam component (i.e., mid-session exam and final exam marks combined), but achieve a final mark >50% for the course, will be awarded a UF (Unsatisfactory Fail) for the course.

Please refer to the UNSW guide to grades: [https://student.unsw.edu.au/grades](https://student.unsw.edu.au/grades)

References

**Functional Materials**


**Composite Materials**

• Composite Airframe Structures, M.C-Y Niu, Conmilit Press, Hong Kong, 1992

Learning and Teaching Philosophy Underpinning the Course
(based on UNSW Learning Guidelines)

• Students are actively engaged in the learning process.
  
  It is expected that, in addition to attending classes, students will read, write, discuss, and engage in analysing the course content.

• Effective learning is supported by a climate of inquiry where students feel appropriately challenged.
  
  Students are expected to be challenged by the course content and to challenge their own preconceptions, knowledge, and understanding by questioning information, concepts, and approaches during class and study.

• Learning is more effective when students’ prior experience and knowledge are recognised and built on.
  
  Coursework, tutorials, assignments, laboratories, examinations, and other forms of learning and assessment are intended to provide students with the opportunity to cross-reference these activities in a meaningful way with their own experience and knowledge.

• Students become more engaged in the learning process if they can see the relevance of their studies to professional and disciplinary contexts.
The course content is designed to incorporate both theoretical and practical concepts, where the latter is intended to be applicable to real-world situations and contexts.

### Course Information

<table>
<thead>
<tr>
<th>Units of credit</th>
<th>6</th>
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<tbody>
<tr>
<td><strong>How the course relates to other course offerings and overall program(s) in the discipline</strong></td>
<td>The course is built on prior courses in mathematics, mechanical behaviour, polymers, phase equilibria, physical metallurgy, microscopy and crystallography.</td>
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</table>
| **Graduate attributes which will be gained through the course** | • Ability to communicate effectively  
• Capacity for creativity and innovation  
• Ability to manage information and documentation  
• Ability to function effectively as an individual  
• Ability to work effectively in multidisciplinary and multicultural teams  
• Capacity for lifelong learning and professional development  
• Professional attitudes |
| **Expected learning outcomes** | In doing this course, you will learn to:  
• Describe relationships between materials structures, properties and processes  
• Make informed decisions in materials selection for engineering design  
You will also learn to:  
• Think critically in decision making and problem-solving  
• Communicate with correct terminology  
• Conduct online research |
| **Teaching strategies** | • Core concepts, theories and approaches to solving problems in composites and device materials to be covered in lectures. Examples will be provided to demonstrate these principles in materials science and engineering.  
• It is expected that students attending classes are prepared for discussion.  
• An on-line group project will be provided to give you the opportunity to synthesise the course content. The group project will provide a part of your assessment.  
• Teaching material, including the course outline, assignments, examples of solutions of problems, and course announcements are available the Course Blackboard website. |

1 *Based on the professional attributes given in Engineers Australia National Generic Competency Standards - Stage 1 Competency Standard for Professional Engineers and UNSW Graduate Attributes.*

### Academic Honesty and Plagiarism

**What is Plagiarism?**

All details regarding plagiarism can be found here: [https://student.unsw.edu.au/plagiarism](https://student.unsw.edu.au/plagiarism)
It is important to understand what plagiarism is. The general concept is plagiarism is using the words or ideas of others and passing them off as your own. Examples of plagiarism, including self-plagiarism, are:

- **Copying**
  Using the same or very similar words to the original text or idea without acknowledging the source or using quotation marks. This includes copying materials, ideas or concepts from a book, article, report or other written document, presentation, composition, artwork, design, drawing, circuitry, computer program or software, website, internet, other electronic resource, or another person's assignment, without appropriate acknowledgement.

- **Inappropriate paraphrasing**
  Changing a few words and phrases while mostly retaining the original structure and/or progression of ideas of the original, and information without acknowledgement.

  This also applies in presentations where someone paraphrases another’s ideas or words without credit and to piecing together quotes and paraphrases into a new whole, without appropriate referencing.

- **Collusion**
  Presenting work as independent work when it has been produced in whole or part in collusion with other people. Collusion includes,
  - students providing their work to another student before the due date, or for the purpose of them plagiarising at any time
  - paying another person to perform an academic task and passing it off as your own
  - stealing or acquiring another person's academic work and copying it
  - offering to complete another person’s work or seeking payment for completing academic work.

  This should not be confused with academic collaboration.

- **Inappropriate citation**
  Citing sources which have not been read, without acknowledging the 'secondary' source from which knowledge of them has been obtained.

- **Self-plagiarism**
  ‘Self-plagiarism’ occurs where an author republishes their own previously written work and presents it as new findings without referencing the earlier work, either in its entirety or partially.

  Self-plagiarism is also referred to as 'recycling', 'duplication', or 'multiple submissions of research findings' without disclosure. In the student context, self-plagiarism includes re-using parts of, or all of, a body of work that has already been submitted for assessment without proper citation.

  The Learning Centre also provides substantial educational written materials, workshops, and tutorials to aid students, for example, in:
  - correct referencing practices;
  - paraphrasing, summarising, essay writing, and time management;
  - appropriate use of, and attribution for, a range of materials including text, images, formulae and concepts.

  Individual assistance is available on request from The Learning Centre.

  Students are also reminded that careful time management is an important part of study and one of the identified causes of plagiarism is poor time management. Students should allow
sufficient time for research, drafting, and the proper referencing of sources in preparing all assessment items.

Continual Course Improvement

- At the end of the course, students will be asked to provide evaluative feedback through myExperience, the University’s course and teaching evaluation and improvement process.
- Students are encouraged to address any problems regarding teaching of this course at the annual staff-student meeting.
- Student comments on teaching during the session are welcome and will be appreciated.
- At times students may be asked to answer a short questionnaire for feedback on the course.

Administrative Matters

- Students should attend at least 80% of all classes.
- Students unable to submit assignments on time or attend the mid-session quizzes or final exams on health grounds should make a request for special consideration. 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 for Exams

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