MATS6111

Processes in Materials Engineering

Course Outline
Session 1, 2016
Course Objectives

To develop 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.

Course staff

<table>
<thead>
<tr>
<th>Name</th>
<th>Room</th>
<th>Phone</th>
<th>Email</th>
<th>Consultation hours:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr Kevin J Laws</td>
<td>Room 301, School of Materials Science and Engineering (Building E10)</td>
<td>9385 5234</td>
<td><a href="mailto:k.laws@unsw.edu.au">k.laws@unsw.edu.au</a></td>
<td>by appointment</td>
</tr>
<tr>
<td>Senior Lecturer</td>
<td></td>
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<tr>
<td>A/Prof. Sammy Chan</td>
<td>Room 245, School of Materials Science and Engineering (Building E10)</td>
<td>9385 4441</td>
<td><a href="mailto:sli.chan@unsw.edu.au">sli.chan@unsw.edu.au</a></td>
<td>by appointment</td>
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<tr>
<td>Lecturer</td>
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<tr>
<td>A/Prof. Jianqiang Zhang</td>
<td>Room 348, School of Materials Science and Engineering (Building E10)</td>
<td>9385 5025</td>
<td><a href="mailto:j.q.zhang@unsw.edu.au">j.q.zhang@unsw.edu.au</a></td>
<td>by appointment</td>
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<tr>
<td>Lecturer</td>
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</tbody>
</table>
Timetable

WEEKS 1-12

<table>
<thead>
<tr>
<th>Day</th>
<th>Time</th>
<th>Location</th>
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</thead>
<tbody>
<tr>
<td>Tuesday</td>
<td>11:00-13:00</td>
<td>Ainsworth Bldg G02 (K-J17-G02)</td>
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<tr>
<td></td>
<td>14:00-16:00</td>
<td>Ainsworth Bldg G02 (K-J17-G02)</td>
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WEEKS 7-12

<table>
<thead>
<tr>
<th>Day</th>
<th>Time</th>
<th>Location</th>
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<tbody>
<tr>
<td>Friday</td>
<td>11:00-13:00</td>
<td>Webster 251 (K-G14-251)</td>
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Your Course at a Glance

NOTE: Students must attend classes for MATS4001 in weeks 1-6. MATS4001 attendance in weeks 7-12 is optional but strongly recommended.

MATS4001 Secondary Processing of Metals
Tuesday 11:00-13:00 & Thursday 14:00-16:00 Ainsworth Bldg G02 (K-J17-G02)

<table>
<thead>
<tr>
<th>Week</th>
<th>Topic (Lecturer)</th>
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<tbody>
<tr>
<td>1</td>
<td>Recrystallisation Phenomena (JZ)</td>
</tr>
<tr>
<td>2</td>
<td>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), Common classes of copper alloys (JZ)</td>
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<tr>
<td>3</td>
<td>Review of solidification theory &amp; practice. Common classes of magnesium alloys &amp; cast irons (SC)</td>
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<td>4</td>
<td>Welding, effect of welding on microstructure, HAZ’s, etc. (SC)</td>
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<tr>
<td>5</td>
<td>Powder metallurgy and sintering, machining (SC)</td>
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MATS6111 Processes in Materials Engineering
Friday 11:00-13:00 Webster 251 (K-G14-251)

<table>
<thead>
<tr>
<th>WEEK</th>
<th>Topic (Lecturer)</th>
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<tbody>
<tr>
<td>7</td>
<td>Specialty Alloys and Phase Transformations (KJL)</td>
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<tr>
<td>8</td>
<td>Advanced Casting &amp; Rapid Solidification Processes (KJL)</td>
</tr>
<tr>
<td>9</td>
<td>Metal Rolling, Extrusion and Superplastic Forming of Amorphous Alloys (KJL)</td>
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<tr>
<td>10</td>
<td>Advanced Metal Fusion &amp; Bonding Processes (KJL)</td>
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<tr>
<td>11</td>
<td>Subtractive, Additive and Powder-based Manufacturing of metals (KJL)</td>
</tr>
<tr>
<td>12</td>
<td>Topic Presentations held, Staff Performance Review (KJL)</td>
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</tbody>
</table>

(JZ)  = Associate Professor Jianqiang Zhang,
(SC)  = Associate Professor Sammy Chan,
(KJL) = Dr Kevin J Laws
Course Description

This course shall focus on fundamentals of solidification, welding, metal working, dynamic recovery and recrystallization and cold working including slip line field theory, slab and upper bound analyses, formability, residual stresses), powder metallurgy and sintering, machining, recrystallisation phenomena. This course shall also focus on several advanced topics including: Advanced casting and solidification, semi-solid processing of composite and non-equilibrium microstructures; rapid solidification processing in the production of non-equilibrium microstructures, superplastic forming of amorphous alloys, 3D printing/additive and subtractive manufacturing and specialty alloying of metal-alloy components.

Assessment

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<tr>
<th>Assessment Task</th>
<th>Fraction</th>
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<tr>
<td><strong>Assignment 1:</strong> Due: Week 6 (Jianqiang Zhang)</td>
<td>10%</td>
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<tr>
<td><strong>Midsession Quiz:</strong> The mid-term exam includes questions pertaining to the material learnt in Weeks 1-6 Held: Week 8</td>
<td>40%</td>
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<tr>
<td><strong>Topical Literature Review:</strong> A detailed review of literature on a topical area selected by the student based on course material Due: Week 11</td>
<td>25%</td>
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<tr>
<td><strong>White Paper Research Proposal:</strong> A short mock research project proposal written by the student for an research area of interest based on course material Due: Week 11</td>
<td>10%</td>
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<tr>
<td><strong>Class Topical Presentation:</strong> A 7-10 minute oral presentation given to the class based on the student’s selected literature review topic Held: Week 12</td>
<td>15%</td>
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References

- D.Hull and D.J.Bacon, *Introduction to Dislocations*, 3rd Ed., 1988
Learning and teaching philosophy underpinning the course

Based on UNSW Learning Guidelines

The course is designed for students to actively engage in the learning process and analyse and synthesise the content in a real world environment.

- **Students are engaged actively 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>How the course relates to other course offerings and overall program(s) in the discipline</td>
<td>The course applies physical metallurgy concepts to advanced secondary processing of metals. Mechanical properties and phase equilibria and metastability knowledge associated with materials is also called upon.</td>
</tr>
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</table>
| Graduate attributes which will be gained through the course¹ | • Ability to communicate effectively  
• Capacity for creativity and innovation  
• Ability to manage information and documentation  
• Understanding of professional and ethical responsibilities, and commitment to them  
• Ability to function effectively as an individual  
• Capacity for lifelong learning and professional development  
• Professional attitudes |
| Expected learning outcomes | In doing this course, you will learn to:  
• Make informed decisions in recommending selection of processing methods.  
• Relate the microstructure of processed materials to processing conditions and behaviour in service.  
You will also learn to:  
• Think critically in decision making and problem-solving |
| Teaching strategies | Core concepts, theories and approaches will be covered in lectures.  
|                     | These concepts will be synthesised in a practical context in the laboratory sessions.  
|                     | Extensive use will be made of case studies to exemplify processing methods  
|                     | Problem design and solution will be learnt through assignments  
|                     | Teaching material, including course outline, notes, problems, assignments, case studies and course announcements are available on the Course Moodle 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?**

Plagiarism is the presentation of the thoughts or work of another as one’s own.* Examples include:

- direct duplication of the thoughts or work of another, including by copying material, ideas or concepts from a book, article, report or other written document (whether published or unpublished), composition, artwork, design, drawing, circuitry, computer program or software, web site, Internet, other electronic resource, or another person’s assignment without appropriate acknowledgement;
- paraphrasing another person’s work with very minor changes keeping the meaning, form and/or progression of ideas of the original;
- piecing together sections of the work of others into a new whole;
- presenting an assessment item as independent work when it has been produced in whole or part in collusion with other people, for example, another student or a tutor; and
- claiming credit for a proportion a work contributed to a group assessment item that is greater than that actually contributed.†

For the purposes of this policy, submitting an assessment item that has already been submitted for academic credit elsewhere may be considered plagiarism.

Knowingly permitting your work to be copied by another student may also be considered to be plagiarism.

Note that an assessment item produced in oral, not written, form, or involving live presentation, may similarly contain plagiarised material.

The inclusion of the thoughts or work of another with attribution appropriate to the academic discipline does not amount to plagiarism.

The Learning Centre website is main repository for resources for staff and students on plagiarism and academic honesty. These resources can be located via:

**www.lc.unsw.edu.au/plagiarism**

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.

* Based on that proposed to the University of Newcastle by the St James Ethics Centre. Used with kind permission from the University of Newcastle
† Adapted with kind permission from the University of Melbourne.

Continual course improvement

• Students will be asked to provide evaluative feedback through the UNSW's Course and Teaching Evaluation and Improvement (CATEI) process at the end of the course
• 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://my.unsw.edu.au/student/atoz/SpecialConsideration.html). Medical certificates or other appropriate documents must be included. Students should also advise the lecturer of the situation.
• Assignments/lab reports submitted after the deadline 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 (www.studentequity.unsw.edu.au). Early notification is essential to enable any necessary adjustments to be made.

Rules for Exams

Rules governing conduct during exams are given at: https://my.unsw.edu.au/student/academiclife/assessment/examinations/examinationrules.html - Rulesfortheconductofexaminations

Note that the use of mobile phones or music players in an exam room will constitute Academic Misconduct.