

MATS6001: Fundamentals of Materials Synthesis and Processing

Callaghan

Semester 1 - 2024



THE UNIVERSITY OF
NEWCASTLE
AUSTRALIA

Welcome to the Course of MATS6001 on Fundamental of Materials Synthesis and Processing

OVERVIEW

Course Description	This course introduces students to the building blocks and processes involved in fabrication of nanomaterials. In particular, students will develop a critical understanding the relationship between synthesis and resultant material's properties. Upon completion of this course, students will have attained the appropriate foundation knowledge for future courses in the program.
Academic Progress Requirements	Nil
Assumed Knowledge	Fundamental knowledge of Physics or Chemistry.
Contact Hours	Callaghan Lecture Face to Face On Campus 3 hour(s) per week(s) for 13 week(s) starting Week 1 Tutorial Face to Face On Campus 1 hour(s) per week(s) for 13 week(s) starting Week 1
Unit Weighting Workload	10 Students are required to spend on average 120-140 hours of effort (contact and non-contact) including assessments per 10 unit course.

COURSE OUTLINE

CONTACTS

Course Coordinator **Callaghan**
Prof Ajayan Vinu
Ajayan.Vinu@newcastle.edu.au
(02) 4921 8669
Consultation: Consultation by appointment

Teaching Staff Other teaching staff will be advised on the course Canvas site.

School Office **School of Engineering**
EAG03
EA Building
Callaghan
SENG-Admin@newcastle.edu.au
9.00am-1.00pm and 2.00pm-5.00pm (Monday to Friday)

SYLLABUS

Course Content

1. Atomic structure, bonding, and phase of materials
2. Solid state reaction (calcination)
3. Activation cum calcination
4. Hydrothermal reaction
5. Soft and hard templating
6. Soft-chemical reaction
7. Advanced synthetic procedure for synthesizing low dimensional nanomaterials
8. Scientific communication for industry
9. Managing and synthesising research literature

Course Learning Outcomes

On successful completion of this course, students will be able to:

1. Explain the mechanisms and key features of current and emerging processing techniques employed to fabricate nanomaterials.
2. Organise and communicate complex information following professional scientific communication standards.
3. Use scientific methods and literature to evaluate nanomaterial synthesis techniques.
4. Select and justify the use of fabrication techniques given a lists of requirements and constraints.

Course Materials

Recommended Reading:

- New Directions in Solid State Chemistry- Rao & Gopalakrishnan
- Physico-Chemical Properties of Nanomaterials-Pleus & Murashov
- Physical Fundamentals of Nanomaterials-Zhang
- Advances in Nanomaterials: Fundamentals, Properties and Applications-Balasubramanian
- Materials Science and Engineering: an introduction, William D Callister,2006, 7th Ed
- Solid State chemistry and its applications, West,2014,2E Student Edition
- Literature Review :A Step-by-Step guide for Students, Ridley Dana,2012

SCHEDULE

Week	Week Begins	Topic	Learning Activity	Assessment Due
1	26 Feb	Atomic structure, bonding, and phase of materials		
2	4 Mar	Atomic structure, bonding, and phase of materials		
3	11 Mar	Atomic structure, bonding, and phase of materials		Quiz-1
4	18 Mar	Solid state reaction (calcination)/Activation cum calcination		Quiz-1 Assignment Due
5	25 Mar	Hydrothermal reaction		
6	1 Apr	Managing and synthesising research literature	Lecture and classroom discussion	Topics for Synthesis of literature distributed
7	8 Apr	Scientific communication for industry		
Mid-Semester Recess				
Mid-Semester Recess				
8	29 Apr	Soft and hard templating		Synthesis of literature report due
9	6 May	Soft and hard templating		Topics for Fabrication recommendations proposal to be distributed
10	13 May	Advanced synthesis procedure for synthesizing low dimensional nanomaterials	Demonstration of synthesis of nanomaterials using soft-templating technique (Lab demonstration)	
11	20 May	Advanced synthetic procedure for synthesizing low dimensional nanomaterials		
12	27 May	Summary of the synthesis procedures for nanomaterials		
13	3 Jun	Revision of topics		Fabrication recommendations proposal - submissions due
Examination Period				Formal examination on the due date
Examination Period				

ASSESSMENTS

This course has 4 assessments. Each assessment is described in more detail in the sections below.

	Assessment Name	Due Date	Involvement	Weighting	Learning Outcomes
1	Processing Techniques Quiz	21-03-2024	Individual	10%	1
2	Synthesisation Survey Report	02-05-2024	Individual	20%	2, 3
3	Fabrication Recommendations Proposal	06-06-2024	Individual	40%	1, 2, 3
4	Final Exam	14-06-2024	Individual	30%	1, 3, 4

Late Submissions

The mark for an assessment item submitted after the designated time on the due date, without an approved extension of time, will be reduced by 10% of the possible maximum mark for that assessment item for each day or part day that the assessment item is late. Note: this applies equally to week and weekend days.

Assessment 1 - Processing Techniques Quiz

Assessment Type	Quiz
Purpose	To assess the student engagement with the topic as a form of continuous engagement
Description	Multiple choice type and/or short answer type questions will be asked in the quiz
Weighting	10%
Due Date	21-03-2024
Submission Method	Formal Exam
Assessment Criteria	
Return Method	In Class
Feedback Provided	In Class - .
Opportunity to Reattempt	Students WILL NOT be given the opportunity to reattempt this assessment.

Assessment 2 - Synthesisation Survey Report

Assessment Type	Written Assignment
Purpose	To assess the ability of the student to apply techniques for synthesis of Literature
Description	A short literature review and synthesis report from a selected topic of interest will be submitted by the students
Weighting	20%
Due Date	02-05-2024
Submission Method	Online
Assessment Criteria	Assessment rubric will be discussed in class
Return Method	Online
Feedback Provided	Returned Work - .
Opportunity to Reattempt	Students WILL NOT be given the opportunity to reattempt this assessment.

Assessment 3 - Fabrication Recommendations Proposal

Assessment Type	Proposal / Plan
Purpose	To assess the deep knowledge gained by the students about various methods of synthesis and test their objectivity in selection of synthesis methods
Description	Student will be submitting a written proposal on methods of synthesis of nanomaterials from a choice of challenging materials.
Weighting	40%
Due Date	06-06-2024
Submission Method	Online
Assessment Criteria	Assessment rubric will be discussed in class
Return Method	Online

Feedback Provided	Returned Work - .
Opportunity to Reattempt	Students WILL NOT be given the opportunity to reattempt this assessment.

Assessment 4 - Final Exam

Assessment Type	Formal Examination
Purpose	To assess the overall theoretical understanding of the student in the subject
Description	A formal exam containing short and long answer type questions will be conducted as per the exam Schedule of the University.
Weighting	30%
Due Date	14-06-2024
Submission Method	In Class
Assessment Criteria	Assessment rubric will be discussed in class
Return Method	Online
Feedback Provided	No Feedback - .
Opportunity to Reattempt	Students WILL NOT be given the opportunity to reattempt this assessment.

ADDITIONAL INFORMATION

Grading Scheme

This course is graded as follows:

Range of Marks	Grade	Description
85-100	High Distinction (HD)	Outstanding standard indicating comprehensive knowledge and understanding of the relevant materials; demonstration of an outstanding level of academic achievement; mastery of skills*; and achievement of all assessment objectives.
75-84	Distinction (D)	Excellent standard indicating a very high level of knowledge and understanding of the relevant materials; demonstration of a very high level of academic ability; sound development of skills*; and achievement of all assessment objectives.
65-74	Credit (C)	Good standard indicating a high level of knowledge and understanding of the relevant materials; demonstration of a high level of academic achievement; reasonable development of skills*; and achievement of all learning outcomes.
50-64	Pass (P)	Satisfactory standard indicating an adequate knowledge and understanding of the relevant materials; demonstration of an adequate level of academic achievement; satisfactory development of skills*; and achievement of all learning outcomes.
0-49	Fail (FF)	Failure to satisfactorily achieve learning outcomes. If all compulsory course components are not completed the mark will be zero. A fail grade may also be awarded following disciplinary action.

*Skills are those identified for the purposes of assessment task(s).

Attendance

Attendance/participation will be recorded in the following components:

- Lecture (Method of recording: Manual)
- Tutorial (Method of recording: Manual)

Communication Methods

Communication methods used in this course include:

Course Evaluation

Each year feedback is sought from students and other stakeholders about the courses offered in the University for the purposes of identifying areas of excellence and potential improvement.

Oral Interviews (Vivas)	As part of the evaluation process of any assessment item in this course an oral examination (viva) may be conducted. The purpose of the oral examination is to verify the authorship of the material submitted in response to the assessment task. The oral examination will be conducted in accordance with the principles set out in the Oral Examination (viva) Procedure . In cases where the oral examination reveals the assessment item may not be the student's own work the case will be dealt with under the Student Conduct Rule .
Academic Misconduct	All students are required to meet the academic integrity standards of the University. These standards reinforce the importance of integrity and honesty in an academic environment. Academic Integrity policies apply to all students of the University in all modes of study and in all locations. For the Student Academic Integrity Policy, refer to https://policies.newcastle.edu.au/document/view-current.php?id=35 .
Adverse Circumstances	<p>The University acknowledges the right of students to seek consideration for the impact of allowable adverse circumstances that may affect their performance in assessment item(s). Applications for special consideration due to adverse circumstances will be made using the online Adverse Circumstances system where:</p> <ol style="list-style-type: none">1. the assessment item is a major assessment item; or2. the assessment item is a minor assessment item and the Course Co-ordinator has specified in the Course Outline that students may apply the online Adverse Circumstances system;3. you are requesting a change of placement; or4. the course has a compulsory attendance requirement. <p>Before applying you must refer to the Adverse Circumstance Affecting Assessment Items Procedure available at: https://policies.newcastle.edu.au/document/view-current.php?id=236</p>
Important Policy Information	<p>The Help button in the Canvas Navigation menu contains helpful information for using the Learning Management System. Students should familiarise themselves with the policies and procedures at https://www.newcastle.edu.au/current-students/respect-at-uni/policies-and-procedures that support a safe and respectful environment at the University.</p>

Graduate Profile Statements

This course builds students' capacity in the following University of Newcastle Bachelor of Engineering Graduate Profile Statements (based on 2011 Engineers Australia revised Stage 1 Competency Standards for Professional Engineers):

UON Att.	University of Newcastle Bachelor of Engineering Graduate Profile Statements/ Engineers Australia Stage 1 competency statements	Taught	Practised	Assessed	Skill Level (1-4)
	Professional Attributes				
11	3.1. Ethical conduct and professional accountability	x		x	2
12	3.2. Effective oral and written communication in professional and lay domains.	x	x	x	3
13	3.3. Creative, innovative and pro-active demeanour.				
14	3.4. Professional use and management of information.	x	x	x	3
15	3.5. Orderly management of self, and professional conduct.				
16	3.6. Effective team membership and team leadership.				
	Engineering Ability				
7	2.1. Application of established engineering methods to complex engineering problem solving.	x		x	2
8	2.2. Fluent application of engineering techniques, tools and resources.				
9	2.3. Application of systematic engineering synthesis and design processes.	x		x	2
10	2.4. Application of systematic approaches to the conduct and management of engineering projects.				
	Knowledge Base				
1	1.1. Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline.	x	x	x	3
2	1.2. Conceptual understanding of the, mathematics, numerical analysis, statistics, and computer and information sciences which underpin the engineering discipline.				
3	1.3. In-depth understanding of specialist bodies of knowledge within the engineering discipline.	x	x	x	3
4	1.4. Discernment of knowledge development and research directions within the engineering discipline.	x	x	x	3
5	1.5. Knowledge of contextual factors impacting the engineering discipline.				
6	1.6. Understanding of the scope, principles, norms, accountabilities and bounds of contemporary engineering practice in the specific discipline.				

This course outline was approved 31/01/2024 by the Head of School. No alteration of this course outline is permitted without Head of School approval. If a change is approved, students will be notified and an amended course outline will be provided in the same manner as the original.

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