

## MATSCI 160/170: Nanomaterials Design (Fall 2023)

<b>Instructor</b>	Dr. Haoxue Yan Contact: <a href="mailto:haoxuey@stanford.edu">haoxuey@stanford.edu</a> , please include "[MatSci160-170]" in the subject line Lecturer, Materials Science and Engineering Durand Building Room 117 Office Hours: <b>Wed. 5-6pm in Durand 117</b> or <a href="https://calendly.com/haoxuey">https://calendly.com/haoxuey</a>
<b>Course Assistant</b>	Rahi Mirafatab-Salo ( <a href="mailto:rahi.mirafatab-salo@stanford.edu">rahi.mirafatab-salo@stanford.edu</a> ) Magdalena Ravello ( <a href="mailto:mravello@stanford.edu">mravello@stanford.edu</a> ) Office Hours: <b>Mon. 3-4 pm in Durand 114</b> Thur. 3-4 pm on <a href="#">Zoom</a>
<b>Meetings</b>	<b>STLC 119</b> Lecture: Mon/Wed 1:30 – 2:20 PM Discussion Sessions: Fri 1:30 – 2:30 PM

### Description:

This course is designed for students interested in exploring the cutting edge of nanoscience and nanotechnology. Students will learn several fundamental concepts related to nanomaterials synthesis and characterization that are commonly used in research and industrial settings, including self-assembly, soft lithography, VLS growth, and nanoparticle size control. In lieu of traditional labs, students will attend weekly discussion sections aimed at priming students to think like a materials engineer. Through these discussions, students will explore how to design an effective experiment, how to identify research gaps, and how to write a compelling grant proposal.

Course Units: 4 units for MATSCI 160 (undergraduates only), 3 units for MATSCI 170

Prerequisites: E-50 or equivalent Introduction to Materials Science course

Textbook: No required textbooks. Relevant papers/chapters will be distributed via Canvas.

### Learning Goals: *By the end of this course, you will be able to ...*

- Describe various techniques used to synthesize nanomaterials and justify their uses
- Explain how to characterize important properties of nanomaterials
- Summarize the important objectives, methods, findings, and conclusions of a scientific report
- Perform a literature search to identify an important research gap
- Design a logical set of experiments aimed at answering a specific set of scientific questions
- Investigate new applications for nanomaterials and their impacts on society

### Grading

Participation	10%
Discussion "Prelabs"	20%
Assignment 1 – Experimental Design	20%
Assignment 2 – Project Design	25%
Assignment 3 – Grant Proposal	25%

**Grading Note:** All Prelabs and Assignments must be submitted in order to receive a passing grade. Attendance in discussion is required and attendance in lecture is strongly encouraged. You are allowed one

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excused absence for discussion sections but must notify the course assistants (CAs) at least 24 hours before the scheduled discussion section. Failure to notify the CAs will result in an unexcused absence.

<b>Course Format</b>	Lectures will focus on applications of nanotechnology and fundamentals of nanomaterials synthesis and characterization. Discussion sections will build off these concepts, engaging students to think critically about experimental design and the steps we must take before entering the lab. Attendance is required in order to stay up to speed on course content. Students are also encouraged to bring an internet-connected device to discussion to actively participate in all discussion activities.
<b>Course Participation</b>	Course participation consists of arriving to discussion sections on time, being prepared for each section by reading the relevant papers prior to discussion, completing all “Prelab” assignments, and engaging in all group activities. Students are expected to work together on discussion activities in order to engage collaboratively with the course material. Students are also strongly encouraged to regularly attend weekly office hours and study groups. These sessions are intended to foster peer-to-peer learning to solidify course concepts and strengthen student learning.
<b>Office Hours (OH)</b>	During OH, we are happy to review content from lecture or discussion, answer questions about “Prelabs” or Assignments, chat about nanomaterials applications and your research interests, or discuss any other questions or concerns you might have. I recommend attending OH even if you don’t have any questions. Listening in on the conversation might spark a new question you hadn’t thought of! You are encouraged to form study groups to collaborate on course assignments outside of class.
<b>Late Policy</b>	All “Prelabs” are due at 9 AM PT on Thursdays. Late “Prelab” assignments will not be accepted since they are required for active participation during discussion. If needed, you may choose to turn in one of your first two Assignments up to two days late without penalty by notifying the CAs at least 24 hours before the assignment deadline. Otherwise, 20% of your assignment grade will be deducted per day late with no exceptions. Late Grant Proposals will not be accepted.

### List of Assignments:

#### Discussion “Prelabs”:

3-5 short answer questions based on assigned readings (journal articles, book chapters). Assigned weekly before scheduled discussion section. **Due Thursdays at 9 AM PT**

#### Assignment 1: Experimental Design:

Create an experimental protocol for a self-assembled monolayer via soft contact printing. Must include detailed explanation and justification for approach. **Due Tue 10/24**

#### Assignment 2: Project Design:

Building off the previous assignment, create a research plan to design and characterize a silicon nanowire anode for a lithium-ion battery. Construct a proposed figure plan of all required experiments with justification for your approach. **Due Tue 11/26**

#### Assignment 3: Grant Proposal:

Finally, you are tasked with writing a mock research proposal on a nanomaterial of your choice. You will need to come up with an appropriate research topic by performing a literature review and identifying a gap in the field and design a set of studies to accomplish your goals. This assignment will include several checkpoints before the final assignment submission. **Due Tue 12/12**

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## What to Expect from Me

I am here to guide your learning this quarter and facilitate active and collaborative learning inside and outside of the classroom. I will strive for an inclusive classroom experience; any suggestions are always welcomed. We will not be able to cover every topic, but readings, handouts, links, and other resources will be provided for you to learn more about nanomaterials and experimental design. I will do my best to give you ample feedback on your assignments and provide support whenever needed, so please don't hesitate to reach out for help when you need it. The best way to reach me is via email and you can expect me to respond within 24 hours. Additionally, you are strongly encouraged to reach out to our CAs Rahi and Magdalena, who will be leading all discussion sections this quarter. We are all here to support your learning and help you discover what it means to think like a materials engineer.

## What I Expect of You

First and foremost, I expect everyone to actively participate and work with each other alongside of the teaching team to establish a culture of respect. Students typically enter this course with varying levels of past experiences in MatSci. I will do my best to teach to all students, but we will collectively learn the most if everyone helps contribute to the collaborative learning environment. I encourage you to help your fellow classmates as much as you can and help each other succeed!

This class should challenge you as we endeavor concepts related to nanomaterials and experimental design. But I believe everyone can succeed with some effort. Lectures and discussions will help guide you through our learning goals, **but most of your learning this quarter will occur outside of our scheduled class time**. This means you will need to work both individually and with your peers to get the most out of this class. Here are some helpful tips to succeed this quarter:

- a) **Come prepared to all discussion sections and be ready to collaborate with your classmates.** The best way to do this is to read the assigned materials and complete the "Prelabs" to the best of your ability. Use the Prelab questions to identify what you know and what you don't know so you can ask follow-up questions during discussion.
- b) **Actively attend lecture and ask questions.** All lecture slides will be shared after each class, so I don't expect you write everything down. Instead, I recommend jotting down 1-2 ideas per slide to help you remember the broader context and significance of each topic we discuss. If you miss a lecture or if a topic is unclear, send me an email to schedule a 1-on-1 meeting to review the course content. We will walk through the slides and answer any questions you might have. You are also welcome to come to OH to review course content.
- c) **Plan ahead for the Assignments.** The assignments in this course are quite different from a typical lab report and will challenge you to think like a materials engineer. As a result, I strongly recommend that you dedicate sufficient time to complete them to the best of your ability and hone in on our learning objectives. Start reading the assignment documents when you receive them, plan your responses, ask questions, and get feedback before you formally sit-down to write out responses. Note that Assignment 3 will be introduced in Week 5 and several checkpoints (e.g. "Prelabs" and blog posts) will be incorporated to help you prepare.

Furthermore, Rahi, Magdalena, and I are committed to helping you succeed in this course, so please let us know if you have any suggestions for how we can better support your learning this quarter. Additionally, there are many other campus partners here to help you navigate your time at Stanford. Please utilize any and all of the resources found below as needed and don't hesitate to reach out to the teaching team if you need help getting connected to any of these campus services.

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## Tentative Course Schedule

		Monday	Tuesday	Wednesday	Thursday	Friday
Sep.	Week 1	25	26	27 Lecture 1	28	29 Discussion 1
	W2	1 Lecture 2	2 Assignment 1 Posted	3 Lecture 3	4	5 Discussion 2
October	W3	8 Lecture 4	9	10 Lecture 5	11	12 Discussion 3
	W4	16 Lecture 6	17	18 Lecture 7	19	20 Discussion 4
	W5	23 Lecture 8	24 Assignment 1 Due	25 Lecture 9	26 Assignment 2 Posted	27 Discussion 5
	W6	30 Lecture 10	31	1 Lecture 11	2	3 Discussion 6
	W7	6 Lecture 12	7	8 Lecture 13	9	10 Discussion 7
November	W8	13 Lecture 14	14	15 Lecture 15	9	17 A2 work session
	W9	20	21	22	23	24
	Thanksgiving Break --- Assignment 2 Due Nov. 26 <sup>th</sup>					
	W10	27 Lecture 16	28	29 Mini-presentation #1	30	1 Mini-presentation #2
	W11	4 Lecture 18	5	6 Lecture 19	7	8 Discussion 10
December	W12	11	12 Assignment 3 Due	13	14	15

\* Subject to change via in-class communications or announcements on Canvas

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### **COVID and Absence Policies**

All of us are starting the new academic year under unique circumstances. While I am excited to be returning to in-person instruction, we are still in the midst of a pandemic and we must remain committed to keeping each other safe while participating in this course. We will follow all campus policies regarding in-person instruction, so please make sure to check the [COVID-19 Health Alerts](#) site regularly for updates. If you are required to take an extended medical absence from the course, please let me know as soon as possible so that we can create a plan for how to proceed.

This quarter, lectures will be recorded and only distributed for the purposes of supporting students dealing with an extended medical absence from class. Due to the highly interactive course components and need for collaborative learning to accomplish the course learning goals, lecture recordings will not be otherwise distributed to students and discussion sections will not be recorded. Students that miss a lecture or discussion due to a short-term illness or other non-medical reason should contact a member of the teaching team to schedule an appointment to make up the missed material.

### **Course Privacy Statement**

As noted in the University's [recording and broadcasting courses policy](#), students may not audio or video record class meetings without permission from the instructor. If the instructor grants permission or if the teaching team posts videos themselves, students may keep recordings only for personal use and may not post recordings on the Internet, or otherwise distribute them. These policies protect the privacy rights of instructors and students, and the intellectual property and other rights of the university. Students who need lectures recorded for the purposes of an academic accommodation should contact the [Office of Accessible Education](#).

### **Stanford Honor Code**

Discussion sections in this course will be highly interactive and we expect you to work collaboratively with your peers on assignments. However, you will be evaluated as an individual and are expected to cite sources and individuals from whom you have learned and borrowed as a display of academic, intellectual, and creative integrity. Failure to do so is a violation of Stanford's Honor Code and is a serious offense, even when the violation is unintentional. Conduct prohibited by the Honor Code includes all forms of academic dishonesty, including representing others' work as one's own. Please review [Stanford's Honor Code](#), [these recommendations](#) from the Office of Community Standards, and [documentation and citation resources](#) from the Hume Center for Writing and Speaking. When in doubt, please contact your discussion section CA or the instructor. Note that further instructions on citing sources for Assignments will be provided.

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## Campus Resources

### Academic Advising

650-723-2426

[advising@stanford.edu](mailto:advising@stanford.edu)

<http://undergrad.stanford.edu/academic-advising-stanford>

### Academic Skills Coaching

<http://academicskills.stanford.edu>

### Confidential Support Team

419 Lagunita Drive

650-736-6933 (M–F, 8:30 AM – 5 PM)

650-725-9955 (24/7)

<https://vaden.stanford.edu/get-help-now/confidential-support-team>

### Counseling and Psychological Services (CAPS)

866 Campus Drive, 2nd Floor

650-723-3785

<https://caps.stanford.edu>

### COVID Health Alerts

<https://healthalerts.stanford.edu/>

### Graduate Life Dean

650-736-7078 (M–F, 8 AM – 5 PM)

650-723-7288 (after 5 PM and weekends, enter Pager ID 25085)

<http://glo.stanford.edu>

### Office of Accessible Education (OAE)

563 Salvatierra Walk

650-723-1066

<http://oae.stanford.edu>

### Re-Approaching Stanford

<https://reapproaching.stanford.edu/>

### Residence Deans (RDs)

650-504-8022 (24/7 Dean On Call)

<http://resed.stanford.edu/student-support>

### Stanford Learning Lab

563 Salvatierra Walk (3rd Floor)

650-497-7561

<http://learninglab.stanford.edu>

### The Bridge Peer Counseling Center

581 Capistrano Way

650-723-3392

<https://thebridge.stanford.edu>

### The Hub – Student Tech Support

Lathrop Library

518 Memorial Way

650-723-9407

<http://thehub.stanford.edu>

### Vaden Health Center

866 Campus Drive

650-498-2336

<https://vaden.stanford.edu>

### Virtual Well Being

<https://vaden.stanford.edu/virtualwellbeing>

### Wellness Resources at Stanford

<https://undergrad.stanford.edu/academic-planning/cardinal-compass/student-handbook/wellness>

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