







# MTSC 780

## Advanced Materials Science

Fall 2022

<b>Introduction</b>	<p>This course covers the physical fundamentals of material science with in-depth development of principles controlling the formation of the structure of engineering materials as function of different processing methods. Topics include crystal structures, defects, dislocation theory, and phase diagrams, diffusion, interfaces and microstructures, solidification, phase transformations, and physical properties of hard and soft materials.</p>
<b>Methods</b>	<p>This is a course in which topics are presented by the instructor. The prerequisite knowledge includes general physics and basic material science and math. There will be three assignments, one paper and an in-class oral presentation.</p> <p>Cutting-edge topics related to materials science will be presented and discussed throughout class sessions with concurrent mentored activities that illustrate the discussion material.</p>
<b>Results</b>	<ol style="list-style-type: none"> <li>1. Increase student understanding of how chemistry, atomic arrangement, microstructure and processing control the physical properties of hard and soft materials.</li> <li>2. Establish connections between materials science and other fields of science and engineering.</li> <li>3. Be able to identify and solve physical problems in materials science, both in course work and in future research and work.</li> </ol>

### Class Essentials

➤ CONTACT INFORMATION	
<b>Dr. Wubin Bai</b>	<ul style="list-style-type: none"> <li> Office Location: A700 Kenan Labs</li> <li> Email: <a href="mailto:wbai@unc.edu">wbai@unc.edu</a></li> <li> Office phone: (617) 949-9089</li> <li> Office Hours: Tue &amp; Thu 2:30 pm – 3:30 pm</li> </ul>
➤ LOGISTICS	
<ul style="list-style-type: none"> <li> <b>Class meeting times</b> Monday &amp; Wednesday 2:30 pm – 3:45 pm</li> <li> <b>Class meeting location</b> Murray Hall 1129</li> </ul>	<p><b>Required Texts:</b> <i>Materials Science and Engineering: An Introduction</i> William D. Callister, JR, David G. Rethwisch, Wiley</p> <p>Additional readings will also be assigned during the semester.</p>

# Course Content

## ➤ COURSE TOPICS

- Atomic and crystal structures;
- Structure of crystalline solids;
- Defects and interfaces;
- Thermodynamics and phase diagrams;
- Diffusion;
- Dislocations and strengthening mechanisms;
- Physical Properties of hard and soft materials;
- Polymer structures and processing;
- Applications of hard and soft materials;

## ➤ COURSE SCHEDULE

The current course calendar is available in Canvas

## ➤ STUDENT RESOURCES

### SEE, SAY, DO SOMETHING

We're happy you are here and eager to learn. Despite our best intentions to follow a plan, life may throw us a curve ball.

CAPS is strongly committed to addressing the mental health needs of a diverse student body through timely access to consultation and connection to clinically appropriate services, whether for short or long-term needs. Go to their website: <https://caps.unc.edu/> or visit their facilities on the third floor of the Campus Health Services building for a walk-in evaluation to learn more. (source: Student Safety and Wellness Proposal for EPC, Sep 2018)

If you or someone you know is experiencing some distress or you are concerned about the well-being of a student, please report it here: <https://deanofstudents.unc.edu/carereport>. It is important to support one another. If you see something, say, and do something.

### Title IX Resources

Any student who is impacted by discrimination, harassment, interpersonal (relationship) violence, sexual violence, sexual exploitation, or stalking is encouraged to seek resources on campus or in the community. Please contact the Director of Title IX Compliance (Adrienne Allison – [Adrienne.allison@unc.edu](mailto:Adrienne.allison@unc.edu)), Report and Response Coordinators in the Equal Opportunity

### ACCESSIBILITY RESOURCES

The University of North Carolina at Chapel Hill facilitates the implementation of reasonable accommodations, including resources and services, for students with disabilities, chronic medical conditions, a temporary disability or pregnancy complications resulting in barriers to fully accessing University courses, programs and activities.

Accommodations are determined through the Office of Accessibility Resources and Service (ARS) for individuals with documented qualifying disabilities in accordance with applicable state and federal laws. See the ARS Website for contact information: <https://ars.unc.edu> or email [ars@unc.edu](mailto:ars@unc.edu).

### Community Standards in Our Course and Mask Use.

This spring semester, while we are in the midst of a global pandemic, all enrolled students are required to wear a mask covering your mouth and nose at all times in our classroom. This requirement is to protect our educational community — your classmates and me — as we learn together. If you choose not to wear a mask, or wear it improperly, I will ask you to leave immediately, and I will submit a report to the [Office of Student](#)

<p>and Compliance Office (<a href="mailto:reportandresponse@unc.edu">reportandresponse@unc.edu</a>), Counseling and Psychological Services (confidential), or the Gender Violence Services Coordinators (<a href="mailto:gvsc@unc.edu">gvsc@unc.edu</a>; confidential) to discuss your specific needs. Additional resources are available at <a href="http://safe.unc.edu">safe.unc.edu</a>.</p>	<p><u>Conduct</u>. At that point you will be disenrolled from this course for the protection of our educational community. An exemption to the mask wearing community standard will not typically be considered to be a reasonable accommodation. Individuals with a disability or health condition that prevents them from safely wearing a face mask must seek alternative accommodations through the <u>Accessibility Resources and Service</u>. For additional information, see <u>Carolina Together</u>.          Spring 2022 Course Delivery: As long as it is possible to do so safely, we will be meeting in person this semester. I understand the ongoing COVID-19 pandemic may require changes to this plan and will be monitoring the situation closely. If I need to change the format of the course temporarily due to outbreaks of illness, I will announce this via email and the course Sakai site.</p>
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## Assignments & Evaluation

➤ YOUR COURSE GRADE – SEE CALENDAR FOR DETAILS AND DUE DATES											
<b>60%: assignments</b>	Three assignments (20 points each): The assignments are homework sets that will cover topics discussed during the lectures. The assignments will be graded and discussed in the classroom. You are allowed to collaborate on the assignments and turn in one answer set (group of 3-4 max). List the names on the cover page and who did what.										
<b>30%: Final report</b>	Summarized review report and presentation on a topic of your choice: The term paper will consist of a critical review of a topic that relates to your research or a topic discussed in this course. The term paper will be due on Friday, November 12th. The paper should not be more than 5 pages (Times New Roman, font size 11, use line spacing 1.5).										
<b>10%: Attendance</b>	<p>Attendance will be graded as follows:</p> <table style="margin-left: 20px;"> <tr><td>No absences</td><td>A+</td></tr> <tr><td>One absence</td><td>A</td></tr> <tr><td>Two-three absences</td><td>B</td></tr> <tr><td>Four-five absences</td><td>C</td></tr> <tr><td>Six or more absences</td><td>F</td></tr> </table> <p>Absences for which an excuse is provided (professional letterhead required) will be recorded and not affect the attendance grade. Likewise, one absence for which advance notice is given by phone or in person will not affect the attendance grade. Any significant tardy or early departure from class will be considered as an absence. Also, anyone who has more than five unexcused absences will receive an "F" grade for the course.            Bonus points can be given based on class interaction</p>	No absences	A+	One absence	A	Two-three absences	B	Four-five absences	C	Six or more absences	F
No absences	A+										
One absence	A										
Two-three absences	B										
Four-five absences	C										
Six or more absences	F										
<b>100%: total</b>											
➤ GRADE INTERPRETATION & HONOR CODE											
Your final course grade will be determined from a standard scale:	<b>ACADEMIC HONESTY</b>										

A	94+	There will be clear communication if assignments are individual or group. For individual assignments, while I encourage collaboration, it is a violation of the honor code if student duplicates work or obtains solutions from another student and submits it on their own. Please reference the honor code: <a href="http://honor.unc.edu">http://honor.unc.edu</a> .
A-	90.0 - 93.9	
B+	87.0 - 89.9	
B	84.0 - 86.9	
B-	80.0 - 83.9	
C+	77 - 79.9	
C	74 - 76.9	
C-	70 - 73.9	
D+	67 - 69.9	
D	60 - 66.9	
F	<60	

### ➤ CLASS RECORDING POLICIES

The University may record meetings of this class for educational purposes. These recordings will be shared only with students enrolled in the course for purposes of academic instruction only. Your instructor will communicate to you how you may access any available recordings.

Unauthorized student recording of classes on personal devices or on any other format is prohibited.

Students requesting the use of assistive technology as an accommodation should contact [Accessibility Resources & Service](#). Other students must obtain express permission from the department to record the class, and the University will only grant such permission in extraordinary circumstances in which the student otherwise lacks access to a recording made by the University or instructor. Students shall not copy, reproduce, or distribute any recordings of their classes, and students shall delete any recordings at the conclusion of the course.

Any violation of these prohibitions or restriction on the making, use, copying, or distribution of recording of classes shall constitute an honor code violation.

**I reserve to right to make changes to the syllabus, including project due dates and test dates (excluding the officially scheduled final examination), when unforeseen circumstances occur. These changes will be announced as early as possible so that students can adjust their schedules.**