

University of Wisconsin-Madison Materials Science and Engineering Graduate Handbook

Preface

This handbook describes the PhD and Research Master's degree programs in Materials Science and Engineering at UW-Madison.

The formal and official set of requirements for courses, exams, and other activities required for graduation are available in the UW-Madison Graduate School Guide, at <https://guide.wisc.edu/>. This handbook provides additional information about the policies that serve to implement the requirements of the Guide and provides information useful to students and faculty participating in the program.

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1. Requirements for students starting from a bachelor's degree and enrolling directly in the PhD program

These requirements apply to students entering graduate school with the intent to pursue a PhD with a bachelor's degree and no further advanced degree. These students will earn a Master's in Materials Science and Engineering on their way to the PhD. Requirements for students entering with a Master's degree in materials or a related field are given in Section 2. Students who have earned a Master's degree in an unrelated field may elect to follow the requirements in this section and earn a second Master's in Materials Science and Engineering.

1.1 Courses

Course requirements are listed in the UW-Madison Graduate School Guide, at <https://guide.wisc.edu/>. Additional requirements are associated with the PhD minor and are also listed in the Guide.

The same course may not satisfy more than one requirement. For example, if MSE 530 is taken as a materials core course, it could not be used as a materials elective course or as part of an Option B minor. In addition, only one mathematics course may be counted as a materials core or materials elective course.

Before registering for the second semester of courses, students must submit to the Graduate Coordinator a plan for all 24 credits, including the core courses, elective courses, and the minor, signed by the student and the advisor. Students are not required to follow this course plan in detail, since future course offerings cannot be predicted with certainty. Students and advisors are encouraged to update the course plan, but updated versions are not required to be submitted.

Before the student undertakes the thesis proposal exam, the student's research advisor must sign the form available from the Graduate Coordinator approving the five courses taken to fulfill the materials core and materials electives requirements. The student must also submit an approved doctoral minor form.

The Graduate School requires that a PhD student earns at least 51 total credits, at least half of which must be at the graduate level. Thus, MS&E graduate students are required to take at least 25 additional credits of research study (24 course credits + 2 credits for MS&E 900 + 25 research study credits = 51 total credits) beyond the required lecture or laboratory courses. These credits may be research credits, additional courses, or a combination of both. For research credits, students should register for the following courses:

1. Before earning the Master's degree, students should register for MS&E 790.
2. After earning the Master's degree, they should register for MS&E 890.
3. Once they have achieved dissertator status, they should register for MS&E 990.

All course requirements are subject to modification or substitution to better serve the research needs of the student. To request a change, submit a letter to the Graduate Coordinator signed by the student and advisor proposing a change and explaining how the change will better suit the student's needs, especially as it pertains to their research. Course substitutions and other curriculum variances are decided by the department Associate Chair of Graduate Studies, subject to appeal to the Materials Science and Engineering Graduate Affairs Committee.

1.2 Materials Elective Courses

Materials elective courses must be selected from the list available in the UW-Madison Graduate School Guide, at <https://guide.wisc.edu/>. Note that elective courses are not taught every semester and that many of them are not taught every year. Check the course timetable for offerings in each semester and consult the Graduate Coordinator for information on typical course offering schedules.

Students or faculty may request that a course be added to the list by submitting a letter to the Graduate Coordinator including the course syllabus and explaining why the course is a materials-centric course. The course catalog description is not a sufficient replacement for a syllabus.

1.3 Qualifying Exam

Purpose: The qualifying exam is an assessment of whether students have sufficient background in the areas of materials science and engineering relevant to their research to undertake graduate research. As such, it is intended to test knowledge of undergraduate-level materials science and engineering. However, one way to solidify basic knowledge of a topic is to study it at a more advanced level, so graduate-level coursework will help prepare students to take the qualifying exam. The qualifying exam will also assess students' ability to explain concepts and to synthesize knowledge that is taught in separate classes at the undergraduate level.

Format: The qualifying exam consists of an oral examination covering two subjects, each with a committee of two faculty members. The student and the student's advisor choose the two subjects from the five core subjects. For each subject, the list contains a list of topics within that subject; resources for studying such as courses, textbooks, monographs, or online resources; at least three sample questions; and at least two faculty members qualified as examiners on that topic. For each academic year, once all the students select the subjects, the department graduate study secretary will assign groups of two faculty members as the examination committee for each core subjects.

Examiners must also prepare for the exam. One week before the exam, the examiner must submit at least one exam question covering their subject to the other committee members and the department Associate Chair of Graduate Studies. This will allow the examiners to consider synergies between the subjects in a given exam. The question will also be placed in a library of questions for each subject to ensure uniformity across various exams, guide new examiners to the appropriate level of the questions, and to update the example question lists for each subject. The exam of each subject will take up to 45 minutes. The updated question list of each subject will be distributed to the examiners of the same subject before the exam. The examiners will start with their prepared questions, but may ask any other questions in addition (may be from the library).

Assessment: After all the students complete the exam for each subject, the committee will determine whether or not each student has passed that subject. Should the student not pass a subject, the examiners for that subject will document in writing the reason the student did not pass the subject. If this is a first attempt, the examiners will recommend in writing resources for the student to prepare for a retest.

Students must attempt the qualifying exam within 12 months of the start of their first semester enrolled (summer sessions do not count for this rule.) The qualifying exam will be offered within one month when the semester starts. A student who fails one or more subjects on a first attempt must retake the exam within four months of the first attempt. The student may retake the failed

subjects, or may switch to a different subject or subjects. Example schedules for students who matriculate at different times of year are shown in the table below.

Matriculation semester	1st exam attempt	2nd exam attempt
September 2025	August/September 2026	January 2027
January 2026	January 2027	May 2027

Students who fail one or more qualifying exams in the second attempt may not continue to PhD-level study in Materials Science and Engineering. They may elect to complete a terminal Master's degree in Materials Science and Engineering or they may leave the Materials Science and Engineering graduate program without a degree. Students who face these outcomes may elect to pursue a complaint through the Materials Science and Engineering graduate student grievance procedure in Section 5. The student's advisor can, if they choose, submit a document to the committee with his/her opinions that they may want to share with the committee at this stage.

Because the oral exam format may be unfamiliar to students, the required introductory seminar course, MSE 900, will incorporate preparation for this type of exam in the spring semester. That preparation will include training and practice in interactively solving problems in a real-time discussion environment, including relevant skills in verbal and visual presentation, framing problems and formulating responses in real time, working with partial information, listening effectively, answering effectively, and reaching an audience. These are essential skills for modern, team-based science and engineering practice.

The five core subjects are:

- Thermodynamics
- Structure of Materials
- Electronic, Optical and Magnetic Materials
- Soft Materials
- Metallic and Ceramic Materials

1.4 Thesis Proposal Exam

Students must complete a thesis proposal exam, typically by the end of their fourth semester. The exam consists of a written document, a presentation, and an oral defense with the student's thesis committee. This exam must be completed by the end of the fifth semester enrolled. Enrollment for the sixth semester will be blocked for students who have not passed the thesis proposal exam.

The written document is a forward-looking proposal for a plan of research that merits awarding of a PhD. It should:

1. Identify a problem, question, or hypothesis in science or engineering and identify its potential impact on society.
2. Summarize the state of the relevant literature.

3. Summarize the student's research to date. (If the thesis proposal represents a shift in topic, the summary of research to date can be presented as an appendix to the main text.)
4. Propose a program of research designed to solve the problem, answer the question, or test the hypothesis. Include analysis of potential critical path elements, decision points, and anticipated obstacles. Summarize the anticipated impact, both technical and societal, if the research is successful.

The document should be no more than 30 double-spaced pages including figures but not including references or title page. Margins, character size, and reference formats should follow typical guidelines for a research proposal to a federal agency such as NSF, DOE, or NIH. The report must be circulated to the committee no less than two weeks before the examination date.

The presentation should mimic the report, focusing on proposing new research and summarizing research to date. The planned presentation should be no more than 30 minutes to leave time for an oral examination by the committee.

The committee consists of five faculty. It must include the student's advisor, at least three members from MS&E (including affiliate faculty) and members with tenure homes in at least two different departments. Up to one member may be from any of the following categories, as approved by the department Associate Chair of Graduate Studies: academic staff (including emeritus faculty), visiting faculty, faculty from other institutions, scientists, research associates, and other individuals deemed qualified by the Associate Chair of Graduate Studies. All members of the committee must be physically or virtually present for the exam, unless an exception is granted by the department Associate Chair of Graduate Studies.

The goal of the thesis proposal exam is to assess the student's research performance to date, research plan, and presentation, and to provide feedback from the committee, especially on the future research plan. If the committee feels the proposal or presentation are inadequate, they can request revisions to the document or require the student to retake the thesis proposal exam.

The retake must occur within three months of the first exam. In the rare case that a student fails the thesis proposal exam twice, the student may not continue PhD study. The student may elect to fulfill the requirements and earn a terminal Master's degree in Materials Science and Engineering, or the student may leave the Materials Science and Engineering graduate program without a degree. Students who face these outcomes may elect to pursue a complaint through the Materials Science and Engineering graduate student grievance procedure in the UW-Madison Graduate School Guide.

Upon passing the thesis proposal exam, students continuing onward to the PhD have fulfilled the requirements for a Master's degree in Materials Science and Engineering. Also upon passing the thesis proposal exam, students earn dissertator status.

1.5 Dissertator status

Students are eligible to obtain "dissertator status" following requirements in the UW-Madison Graduate School Guide, at <https://guide.wisc.edu/>. Further information regarding dissertator status is available on the Graduate School website (<https://grad.wisc.edu/acadpolicy>).

1.6 Thesis defense

The thesis defense consists of preparation and deposition of a thesis, a public seminar on the thesis research, and an oral defense before the thesis committee. The composition of the thesis

committee follows the same rules as the thesis proposal exam committee and is usually the same individuals.

The student must prepare a thesis presenting their original research following the rules and guidelines set forth by the UW Graduate School, currently described at <https://grad.wisc.edu/current-students/doctoral-guide/>. The thesis must be circulated to the committee no less than two weeks before the defense date.

The defense consists of an open, public seminar, then a closed session with the committee for the oral examination. The seminar describes the student's research resulting in significant new contributions to human knowledge in both a technical (science and engineering) and a broader societal context. It should be modeled after the hour-long departmental research seminars. In the closed session, the committee will question the student about the student's research, both as presented in the seminar and in the thesis, including topics such as technical details about past work, implications for the field and society as a whole, and possible future directions.

The committee may pass the student, require revisions to the thesis, or fail the student on the exam. A student who fails the thesis defense may not continue PhD study or earn a PhD in the Materials Science and Engineering graduate program. The student may elect to fulfill the requirements and earn a terminal Master's degree in Materials Science and Engineering if they have not already done so, or the student may leave the Materials Science and Engineering graduate program without a degree. Students who face these outcomes may elect to pursue a complaint through the Materials Science and Engineering graduate student grievance procedure in Section 5.

2. Requirements for students starting from a master's degree and enrolling directly in the PhD program

These requirements cover students who (1) have already earned a Master's degree in MS&E or a related field and (2) do not wish to earn a MS&E Master's from UW.

Course requirements are listed in the UW-Madison Graduate School Guide, at <https://guide.wisc.edu/>. Additional requirements are associated with the PhD minor and are also listed in the Guide.

Students must satisfy all of the requirements for the PhD given in the preceding section. However, they may request that courses taken as part of a previous Master's degree at another institution serve to satisfy a portion of the requirements. Students will have one month after matriculation to identify that they wish to follow this track to their Ph.D. and to submit all their course substitution requests. Course substitutions will not be considered later in the student's PhD studies.

To make such a request, the student should submit a request to the graduate coordinator describing (1) the course from a previous institution; (2) the UW course equivalent; (3) the MS&E course requirement that will be satisfied. The request must include sufficient information to determine if the courses are equivalent. Typically, a syllabus listing the course textbook and lecture topics is sufficient. A course catalog description is typically insufficient. Courses taken while enrolled as an undergraduate student at another institution will not be considered for substitution. This includes courses at the graduate level taken while the student is enrolled as an undergraduate.

If a request is not approved, the student must fulfill the corresponding requirement at the University of Wisconsin-Madison.

If one or more course substitutions are accepted, the student will not earn a Master's degree in Materials Science and Engineering from UW-Madison as part of their PhD studies.

2.1 Qualifying Exam, Thesis Proposal Exam, and Thesis Defense

Students on this track must pass the qualifying exam, thesis proposal exam, and thesis defense as described above, on the same schedule with respect to their matriculation date. Students who fail one of these exams will have the opportunity to earn a terminal Master's degree in MS&E, even if they have been granted a course substitution.

3. Requirements for the Terminal Master's Degrees

The MS&E department offers 1) a terminal Master's degree with thesis and 2) a terminal coursework Master's degree in Materials Engineering.

3.1 Terminal Master's degree with thesis

3.1.1 Courses

Course requirements are listed in the UW-Madison Graduate School Guide, at <https://guide.wisc.edu/>. Additional requirements are associated with the PhD minor and are also listed in the Guide.

The same course may not satisfy more than one requirement. For example, if MSE 530 is taken as a materials core course, it could not be used as a materials elective course. In addition, only one mathematics course may be counted as a materials core or materials elective course. The list of approved materials elective courses and the procedure to request that a course be added to the list is given in Section 1.

Before registering for the second semester of courses, students must submit to the Graduate Coordinator a plan for all 15 credits. Students are not required to follow this course plan in detail, since future course offerings cannot be predicted with certainty. Students and advisors are encouraged to update the course plan once a semester, but updated versions do not need to be submitted. Before the student can defend a thesis, the student's research advisor must sign a form available from the Graduate Coordinator approving the five courses taken to fulfill the materials core and materials electives requirements.

The Graduate School requires that a MS student earn at least 30 total credits. Thus, MS&E graduate students are required to take at least 13 credits of research study (15 course credits + 2 credits of MS&E 900 + 13 research study = 30 total credits). M.S. degree students should register for research credits in MS&E 790.

3.1.2 Master's thesis defense

The student must prepare and defend a master's thesis covering appropriate independent science or engineering research undertaken by the student. The format and procedures must conform to the Graduate School rules for a master's thesis, currently found at <https://grad.wisc.edu/current-students/masters-guide/>. The master's thesis should represent significant science or engineering research work and progress but does not need to report a substantial new contribution to human knowledge. The thesis must be circulated to the committee at least two weeks before the defense.

The student must present the thesis project to a committee of faculty, then defend the thesis in an oral examination. The committee consists of three faculty: the student's advisor and two other faculty members from MS&E (primary or affiliated with MS&E). Committee members must represent at least two different tenure homes. All members of the committee must be physically or virtually present for the exam.

The committee may pass the student, require revisions to the thesis, or fail the student on the exam. Students who fail the thesis defense will not earn a Master's degree in Materials Science and Engineering and will leave the program without a degree. Students who face these outcomes may elect to pursue a complaint through the Materials Science and Engineering graduate student grievance procedure in Section 5.

3.2 Terminal coursework Master's in Materials Engineering

Course requirements are listed in the UW-Madison Graduate School Guide, at <https://guide.wisc.edu/>. Additional requirements are associated with the PhD minor and are also listed in the Guide.

The following categories of courses may not be used to satisfy the 30 credit requirement:

- Audited courses
- Courses taken pass/fail
- Courses below the 300 level

3.2.1 Graduate coursework (50%) requirement

The Graduate School minimum graduate coursework (50%) requirement states that at least 50% of credits applied toward the program's graduate degree credit requirement (15 of 30 credits) must be courses designed for graduate work as designated in Guide.

3.2.2 UW–Madison Materials Science and Engineering undergraduate coursework

With program approval, students who received a Materials Science and Engineering BS at UW-Madison are allowed to count up to 7 credits from the Department of Materials Science and Engineering at UW-Madison numbered 300 or above toward the minimum graduate degree credit requirement. These credits must be taken in excess of the undergraduate degree requirements. If that coursework is numbered 700 or above it may be used to satisfy the minimum graduate coursework (50%) requirement. No credits can be counted toward the minimum graduate residence credit requirement.

4. PhD Minor in Materials Science and Engineering

The MS&E department offers a minor in Materials Science and Engineering for students studying towards a PhD in other disciplines. The doctoral minor consists of at least 9 credits (typically 3 courses) of MS&E courses. Within those nine credits, 6 must be at the 400 level or above, and 3 must be at the 700 level or above (or meet the 50% Graduate Coursework Requirement). Students must earn a B or higher in every course. Transfer credits cannot be used to fulfill the minor requirements.

5. Hostile and Intimidating Behavior (Bullying)

From the UW Madison website on [Hostile and Intimidating Behavior](#):

Hostile and intimidating behavior, sometimes known by the shorthand term “bullying,” is defined in university policy as “unwelcome behavior pervasive or severe enough that a reasonable person would find it hostile and/or intimidating and that does not further the University’s academic or operational interests.”...Hostile and intimidating behavior can occur both within and across employment sectors – faculty on faculty, faculty on staff, [faculty on student, student on student], ..., it must be addressed and corrected. Hostile and intimidating behavior is prohibited by university policy. The grievance process is described in detail in the UW-Madison Graduate School Guide. The Website for Hostile and Intimidating Behavior Principles and Policies also has [useful information](#).

6. Grievance Procedure

Students who feel they have been unfairly treated or otherwise have a grievance related to the policies and procedures for graduate study in the Materials Science and Engineering Department may choose to initiate a formal grievance procedure. Before taking this step, however, students are encouraged to discuss their grievance directly with the person or persons involved. Respectful, professional, direct communication can often reach a more satisfactory resolution to an issue more quickly than a formal grievance procedure.

The grievance process is described in detail in the [UW-Madison Graduate School Guide](#).

Version date: 5/17/17

7. MS&E graduate program expectations

Adopted April 19, 2021

The MS&E graduate program is guided by expectations for the conduct of students and faculty that help to establish a safe, collegial, and productive environment facilitating scientific discovery and professional development. These expectations reflect professional guidelines provided by the UW-Madison College of Engineering and the UW-Madison Graduate School.

The specific expectations of the program are:

1. Intellectual and professional integrity

MS&E graduate students and their faculty mentors are expected to show respect for the profession and for those working in it. Research activities will be conducted without plagiarism, with proper attribution of work with collaborators, and with respect for applicable professional ethical considerations, such as those associated with the involvement of human subjects.

2. Safe and environmentally responsible conduct of research

Research in the MS&E graduate program is expected to be conducted with a high level of respect for the safety of the students, faculty, and other participants. Students and faculty must observe the requirements defined at the research group, department, college, and university for safe and environmentally responsible research. Faculty are expected to develop and maintain lab safety plans, to appoint a safety coordinator within their labs, and to advise students of the safety training required for work in their groups. Students are expected to seek and to obtain the required safety training, to remain up-to-date with required recurrent training, and to follow the safety guidelines at all times.

3. Professional research environment

Students and faculty are expected to contribute to a collegial professional research environment, practicing mutual respect for all students, faculty, and staff. The MS&E department strives to create an environment free from harassment, bias, and hostile and intimidating behavior. Students supported by teaching assistant appointments are expected to balance the time commitments to research and teaching after consultation with their advisor and the faculty member responsible for the course to which they are assigned. These arrangements may evolve during the course of the student's PhD program.

These expectations include responsiveness to communications, including (as applicable) a regular schedule of meetings and response to electronic communication during defined working hours. Students and faculty are expected (as required) to participate in group meetings and individual or small-group collaborative meetings, and lab activities such as those associated with mentoring other students and maintaining a safe working environment. Students are not expected to provide personal assistance for faculty advisors or to perform other duties outside of their university research, teaching and service commitments.

Students and faculty are expected to be aware of issues in implicit bias, sexual harassment, and ethical conduct of research.

4. Professional development and achievement in research

Students are expected to develop and to maintain a set of research goals with the potential to lead

to outputs such as research publications, the development of intellectual property, and scientific presentations. Research goals can include original research discoveries, contributions to the scientific literature, and other outputs as mutually agreed by the student and faculty advisor. These goals must be reached in agreement with the faculty mentors. Students are expected to conduct their research within the intellectual property guidelines associated with their source of financial support (e.g. the requirements of the Bayh-Dole act for federally supported research).

5. Ongoing clear communications about expectations and feedback on student progress

Students and faculty will have regular communications about the progress that students are making towards their degree requirements and expectations for the conduct of research. Students can offer feedback about faculty using the College of Engineering's annual GOALS survey or through direct communication with the MS&E Chair, the MS&E Associate Chair for PhD Study, or the College of Engineering Assistant Dean for Graduate Study. The MS&E department will include a discussion of these expectations as part of the required student orientation activities.

Students can expect clear communications from faculty about their progress in the program, feedback on research and educational issues, and the progress towards the degree.

8. Revision history

Adopted by the MS&E Graduate Governance Committee 1/26/16.

Revised:

1. 9/12/16: Add permanent course numbers of graduate courses taught within MS&E.
2. 12/16/16 and 5/23/17: Correct permanent MS&E course numbers in elective course list.
3. 5/23/17: Add statement that list of existing qualifying exam topics will be circulated.
4. 7/12/17: Add Assistant Dean for Graduate Affairs as the grievance policy contact. Add Parental Leave Policy for Graduate Student Assistants
5. 5/1/18: Change qualifying exam regulations
6. 11/8/18: Revised curriculum for terminal Master's degree and PhD minor.
7. 8/31/21: Formal degree requirements now appear in the UW-Madison Graduate School Guide, linked below.
8. 1/19/22: Add section on hostile and intimidating behavior