

# MATERIALS SCIENCE AND ENGINEERING, PHD

## REQUIREMENTS

### MINIMUM GRADUATE SCHOOL REQUIREMENTS

Review the Graduate School minimum academic progress and degree requirements (<http://guide.wisc.edu/graduate/#policiesandrequirements>), in addition to the program requirements listed below.

### MAJOR REQUIREMENTS

#### MODE OF INSTRUCTION

Face to Face	Evening/ Weekend	Online	Hybrid	Accelerated
Yes	No	No	No	No

#### Mode of Instruction Definitions

**Accelerated:** Accelerated programs are offered at a fast pace that condenses the time to completion. Students typically take enough credits aimed at completing the program in a year or two.

**Evening/Weekend:** Courses meet on the UW–Madison campus only in evenings and/or on weekends to accommodate typical business schedules. Students have the advantages of face-to-face courses with the flexibility to keep work and other life commitments.

**Face-to-Face:** Courses typically meet during weekdays on the UW–Madison Campus.

**Hybrid:** These programs combine face-to-face and online learning formats. Contact the program for more specific information.

**Online:** These programs are offered 100% online. Some programs may require an on-campus orientation or residency experience, but the courses will be facilitated in an online format.

### CURRICULAR REQUIREMENTS

#### Requirement Detail

Minimum Credit Requirement	51 credits
Minimum Residence Credit Requirement	32 credits
Minimum Graduate Coursework Requirement	26 credits must be graduate-level coursework. Refer to the Graduate School: Minimum Graduate Coursework (50%) Requirement policy: <a href="https://policy.wisc.edu/library/UW-1244">https://policy.wisc.edu/library/UW-1244</a> ( <a href="https://policy.wisc.edu/library/UW-1244/">https://policy.wisc.edu/library/UW-1244/</a> ).

Overall Graduate GPA Requirement 3.00 GPA required. Refer to the Graduate School: Grade Point Average (GPA) Requirement policy: <https://policy.wisc.edu/library/UW-1203> (<https://policy.wisc.edu/library/UW-1203/>).

Other Grade Requirements n/a

Assessments and Examinations **Qualifying Exam**

- Students must pass a qualifying exam in Materials Science and Engineering. The 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. The exam consists of an oral examination covering two subjects, each with a committee of two faculty members. The exam must be attempted within 13 months of the start of the student's first semester enrolled. If the first attempt is not passed, a second attempt is required within four months.

#### Preliminary Exam

- Students must pass a preliminary exam / thesis proposal exam. The exam consists of a written document, a presentation, and an oral defense with the student's doctoral committee. The written document is a forward-looking proposal for a plan of research that merits awarding of a PhD. The presentation should mimic the report, focusing on proposing new research and summarizing research to date. This exam is typically undertaken by the end of the fourth semester enrolled and must be undertaken by the end of the fifth semester. If the first attempt is not passed, a second attempt is required within three months. Students may earn the Materials Science and Engineering master's degree the semester they pass their preliminary exam.

#### Doctoral Dissertation

- Students must prepare a doctoral dissertation, present it in a public seminar, defend it in closed examination by their doctoral committee, and deposit it with the Graduate School. 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 not pass the student on the exam.

Language Requirements None.

Graduate School Breadth Requirement All doctoral students are required to complete a doctoral minor or graduate/professional certificate. Refer to the Graduate School: Breadth Requirement in Doctoral Training policy: <https://policy.wisc.edu/library/UW-1200> (<https://policy.wisc.edu/library/UW-1200/>).

If students choose a distributed minor (Option B), they must select a topic or theme and three courses around that theme. At least one course must be graduate level (numbered 700 or above or has graduate course attribute). There are no other restrictions on the course department or topic.

## REQUIRED COURSES

All course requirements are subject to modification or substitution to better serve the research needs of the student. Refer to the "Policies (p. )" tab for information on course substitutions.

Before registering for the second semester, students must submit an advisor approved course plan to the graduate coordinator. Students are not restricted to this plan. Students and advisors are encouraged to update the plan. Updated versions are not required to be submitted.

Code	Title	Credits
<b>Materials Research Seminar</b>		<b>2</b>
Students must complete at least 2 credits of the following course for two consecutive semesters.		
M S & E 900	Materials Research Seminar	
<b>Materials Core Courses</b>		<b>9</b>
Students must complete three core courses (9 credits) from the following list:		
M S & E 521	Advanced Polymeric Materials	
M S & E 530	Thermodynamics of Solids	
M S & E 551	Structure of Materials	
M S & E 752	Advanced Materials Science: Phase Transformations	
Graduate level math course (students may only count one of the following as materials core course)		
E P/E M A 547	Engineering Analysis I	
CBE 660	Intermediate Problems in Chemical Engineering	
MATH 703	Methods of Applied Mathematics 1	
MATH 704	Methods of Applied Mathematics-2	
PHYSICS 721	Theoretical Physics-Electrodynamics	
<b>Materials Elective Courses</b>		<b>6</b>
Students must complete at least 6 credits from the "Materials Elective Courses" list.		
<b>Additional Coursework and/or Research (see below table)</b>		<b>25</b>
<b>Breadth</b>		<b>9</b>
<b>Total Credits</b>		<b>51</b>

## Additional Coursework and/or Research Requirement

- Before earning the master's degree, students should register for M S & E 790 Master's Research or Thesis.

- After earning the master's degree, students should register for M S & E 890 Pre-Dissertator's Research.
- Once in dissertator status, students should register for M S & E 990 Research and Thesis.

## Materials Elective Courses

The same course may not satisfy more than one requirement. For example, if M S & E 530 Thermodynamics of Solids is taken as a "Materials Core Course", it could not be used as a "Materials Elective Course". Only one mathematics course may fulfill a "Materials Core Course" or "Materials Elective Course". Refer to the "Policies" tab for information on how to enroll in a course outside of the list below.

Code	Title	Credits
M S & E 401	Special Topics in Materials Science and Engineering	1-3
M S & E/CHEM 421	Polymeric Materials	3
M S & E/N E 423	Nuclear Engineering Materials	3
M S & E/N E 433	Principles of Corrosion	3
M S & E 434	Introduction to Thin-Film Deposition Processes	3
M S & E 441	Deformation of Solids	3
M S & E 448	Crystallography and X-Ray Diffraction	3
M S & E 451	Introduction to Ceramic Materials	3
M S & E 456	Electronic, Optical, and Magnetic Properties of Materials	3
M S & E 460	Introduction to Computational Materials Science and Engineering	3
M S & E 461	Advanced Metal Casting	3
M S & E/M E 462	Welding Metallurgy	3
M S & E 463	Materials for Elevated Temperature Service	3
M S & E 465	Fundamentals of Heat Treatment	3
M S & E/CIV ENGR/ G L E/GEOSCI 474	Rock Mechanics	3
M S & E 521	Advanced Polymeric Materials	3
M S & E 530	Thermodynamics of Solids	3
M S & E/E M A 541	Heterogeneous and Multiphase Materials	3
M S & E 550	Materials Fundamentals	3
M S & E 551	Structure of Materials	3
M S & E 553	Nanomaterials & Nanotechnology	3
M S & E 560	Fundamentals of Atomistic Modeling	3
M S & E 570	Properties of Solid Surfaces	3
M S & E 648	Advanced X-ray Scattering Methods in Materials Science and Engineering	3
M S & E 660	Mesoscale Modeling of Materials	3
M S & E 748	Structural Analysis of Materials	3
M S & E 750	Imperfections and Mechanical Properties	3
M S & E 752	Advanced Materials Science: Phase Transformations	3
M S & E 756	Structure and Properties of Advanced Electronic Materials	3

M S & E 760	Molecular Modeling of Materials	3
M S & E 803	Special Topics in Materials Science	1-3
B M E/PHM SCI 430	Biological Interactions with Materials	3
B M E/M E 615	Tissue Mechanics	3
BIOCHEM/ CHEM 704	Chemical Biology	3
CBE 540	Polymer Science and Technology	3
CBE 747	Advanced Colloid and Interface Science	3
CHEM 652	Chemistry of Inorganic Materials	3
CHEM 653	Chemistry of Nanoscale Materials	3
CHEM 654	Materials Chemistry of Polymers	2-3
CHEM 664	Physical Chemistry of Macromolecules	2-3
CHEM 721	Instrumental Analysis	3-4
E C E 745	Solid State Electronics	3
GEOSCI 765	Crystal Chemistry	3
PHYSICS 415	Thermal Physics	3
PHYSICS 551	Solid State Physics	3
PHYSICS 715	Statistical Mechanics	3
PHYSICS 751	Advanced Solid State Physics	3