

# MATERIALS SCIENCE AND ENGINEERING: RESEARCH, MS

This is a named option within the Materials Science and Engineering MS (<http://guide.wisc.edu/graduate/materials-science-engineering/materials-science-engineering-ms/>).

The Research named option in the Materials Science and Engineering MS is designed for students wishing to conduct research during their program. This program takes approximately two years to complete and a thesis is required.

## ADMISSIONS

### ADMISSIONS

Please consult the table below for key information about this degree program's admissions requirements. The program may have more detailed admissions requirements, which can be found below the table or on the program's website.

Graduate admissions is a two-step process between academic programs and the Graduate School. **Applicants must meet the minimum requirements (<https://grad.wisc.edu/apply/requirements/>) of the Graduate School as well as the program(s).** Once you have researched the graduate program(s) you are interested in, apply online (<https://grad.wisc.edu/apply/>).

Requirements	Detail
Fall Deadline	December 15
Spring Deadline	September 1
Summer Deadline	December 15
GRE (Graduate Record Examinations)	Not required.
English Proficiency Test	Every applicant whose native language is not English, or whose undergraduate instruction was not exclusively in English, must provide an English proficiency test score earned within two years of the anticipated term of enrollment. Refer to the Graduate School: Minimum Requirements for Admission policy: <a href="https://policy.wisc.edu/library/UW-1241">https://policy.wisc.edu/library/UW-1241</a> ( <a href="https://policy.wisc.edu/library/UW-1241/">https://policy.wisc.edu/library/UW-1241/</a> ).
Other Test(s) (e.g., GMAT, MCAT)	n/a
Letters of Recommendation Required	3

Applicants are expected to have a BS in the physical sciences or engineering. Undergraduate studies normally would include mathematics through differential equations, at least one year each of general physics and chemistry, a course in physical chemistry or modern physics, and an elementary course in properties of materials. Applicants may be admitted

with deficiencies. These must be made up as soon as possible after entering the program.

### APPLICATION

Required application materials:

- Academic transcripts (unofficial)
- English proficiency scores (<https://grad.wisc.edu/apply/requirements/#english-proficiency>), if applicable
- Three letters of recommendation
- Statement of purpose (<https://grad.wisc.edu/apply/prepare/>)
- Resume

Admission to the University of Wisconsin–Madison Graduate School (<http://grad.wisc.edu/>) is a prerequisite for admission to study materials science. A minimum GPA of 3.0/4.0 is required. Admission is highly selective. Most admitted applicants have an undergraduate GPA above 3.5. However, full consideration will be given to all applicants meeting the UW–Madison Graduate School requirements.

Use the online application (<https://grad.wisc.edu/apply/>) to begin your application. All documents should be uploaded with your application. To be considered for fellowships, all application materials are due by the fall deadline.

### INTERNATIONAL APPLICANTS

International degree-seeking applicants must prove English proficiency using the Graduate School's requirements (<https://grad.wisc.edu/apply/requirements/>).

### FEE GRANTS

The Graduate School offers a limited number of application fee grants (waives all or part of the application fee) that are available in a few specific circumstances. Further information is available on the "Applying for a Fee Grant (<https://grad.wisc.edu/apply/fee-grant/>)" page.

### QUESTIONS

If you have questions about the application or admissions process, contact [msaegradadmission@engr.wisc.edu](mailto:msaegradadmission@engr.wisc.edu).

## FUNDING

### FUNDING

#### GRADUATE SCHOOL RESOURCES

Resources to help you afford graduate study might include assistantships, fellowships, traineeships, and financial aid. Further funding information (<https://grad.wisc.edu/funding/>) is available from the Graduate School. Be sure to check with your program for individual policies and restrictions related to funding.

#### PROGRAM RESOURCES

##### Financial Assistance

Please note that most funding is available for PhD students and there are limited resources for MS students.

Various types of financial assistance are available for entering graduate students, including research assistantships, teaching assistantships, fellowships, and special grants. Decisions regarding financial support are made on the basis of letters of recommendation, grades, GRE general test scores, and, for research assistantships, the matching of the interests

or experience of the applicant to the research programs of individual faculty members. December 15th is the deadline for receipt of fellowship applications. International students are generally not eligible for university fellowships. Applications for other types of support are accepted until mid-February.

### Research and Teaching Assistantships

Research assistantships (RAs) are available in any materials science area. These appointments are under the supervision of the major professor directing the research. Students interested in research assistantships in a particular area are encouraged to contact professors whose work is of special interest. The faculty's research interests are given in the Department of Materials Science and Engineering faculty section. An RA permits the most rapid progress toward a degree. Research assistantships in materials science graduate students are comparable to similar stipends from other institutions. Information about stipends can be obtained from the Associate Chair of Graduate Studies, [acgs@mse.wisc.edu](mailto:acgs@mse.wisc.edu) (<http://guide.wisc.edu/graduate/materials-science-engineering/materials-science-engineering-ms/acgs@mse.wisc.edu>).

Teaching assistantships involve teaching rather than research experience. They pay approximately the same as research assistantships. Teaching experience is especially desirable for students considering an academic career. The Department of Materials Science and Engineering supports a limited number of teaching assistantships, which are allocated after admissions.

### Fellowships

Herb Fellowships in Materials Science are given out each year. The Herb Fellowship is a one-year full-ride fellowship for incoming graduate students. It is intended to provide especially strong students extra flexibility and independence in formulating their graduate research program.

Fellowships supporting graduate education are also offered on a competitive basis by organizations such as the National Science Foundation (<http://www.nsf.gov/>), the Hertz Foundation (<http://www.hertzfndn.org/>), UW-Madison Graduate School (<http://www.wisc.edu/grad/>), the U.S. Department of Defense and a number of industries and foundations. Because some of these fellowships have fall application deadlines, early application is necessary. GRE scores for the General Test are required for fellowship applications.

### Other Funding Information

If you choose to attend UW-Madison and plan to pursue funding on your own, the following sites could be very helpful:

- Graduate School Funding Resources (<https://grad.wisc.edu/studentfunding/prospective/>)
- Graduate School Costs and Funding (<https://grad.wisc.edu/studentfunding/currentstudents/>)

## 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.

## NAMED OPTION 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	30 credits
Minimum Residence Credit Requirement	16 credits
Minimum Graduate Coursework Requirement	15 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: <a href="https://policy.wisc.edu/library/UW-1203">https://policy.wisc.edu/library/UW-1203</a> ( <a href="https://policy.wisc.edu/library/UW-1203/">https://policy.wisc.edu/library/UW-1203/</a> ).
Other Grade Requirements	n/a
Assessments and Examinations	Students 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 <a href="https://grad.wisc.edu/current-students/masters-guide/">https://grad.wisc.edu/current-students/masters-guide/</a> . 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.
Language Requirements	None.

## REQUIRED COURSES

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 course 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
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<b>Materials Core Courses</b>		<b>9</b>
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Students must complete at least 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 a 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>
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Students must complete at least 6 credits from the "Materials Elective Courses" list.

<b>Research</b>		<b>13</b>
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Students must complete 13 credits of the following course.

M S & E 790	Master's Research or Thesis
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<b>Total Credits</b>		<b>30</b>
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### 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

## POLICIES

### GRADUATE SCHOOL POLICIES

The Graduate School's Academic Policies and Procedures (<https://grad.wisc.edu/acadpolicy/>) provide essential information regarding general university policies. Program authority to set degree policies beyond the minimum required by the Graduate School lies with the degree program faculty. Policies set by the academic degree program can be found below.

### NAMED OPTION-SPECIFIC POLICIES

#### PRIOR COURSEWORK

##### Graduate Credits Earned at Other Institutions

Typically, no graduate work from other institutions may transfer in fulfillment of degree requirements. For questions about exceptions, contact the graduate coordinator.

##### Undergraduate Credits Earned at Other Institutions or UW-Madison

Typically, no credits from undergraduate coursework may transfer in fulfillment of degree requirements. For questions about exceptions, contact the graduate coordinator.

##### Credits Earned as a Professional Student at UW-Madison (Law, Medicine, Pharmacy, and Veterinary careers)

Typically, no credits earned as a professional student may transfer in fulfillment of degree requirements. For questions about exceptions, contact the graduate coordinator.

##### Credits Earned as a University Special Student at UW-Madison

Typically, no University Special student credits may transfer in fulfillment of degree requirements. For questions about exceptions, contact the graduate coordinator.

### PROBATION

Refer to the Graduate School: Probation (<https://policy.wisc.edu/library/UW-1217/>) policy.

The Materials Science and Engineering 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
  - a. Materials Science and Engineering 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
  - a. Research in the Materials Science and Engineering 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
  - a. Students and faculty are expected to contribute to a collegial professional research environment, practicing mutual respect for all students, faculty, and staff. The Materials Science and Engineering 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 MS Research program.
  - b. 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.
  - c. 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
  - a. 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
  - a. 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 Graduate On-Line Assessment & Achievement Learning System (GOAALS) survey or through direct communication with the Materials Science and Engineering Chair, the Materials Science and Engineering Associate Chair for Graduate Studies, or the College of Engineering Assistant Dean for Graduate Studies. The Materials Science and Engineering

department will include a discussion of these expectations as part of the required student orientation activities.

- b. 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.

## ADVISOR / COMMITTEE

Refer to the Graduate School: Advisor (<https://policy.wisc.edu/library/UW-1232/>) and Graduate School: Committees (Doctoral/Master's/MFA) (<https://policy.wisc.edu/library/UW-1201/>) policies.

Students without an advisor at the end of their first year enrolled are in danger of failing to make adequate progress towards their degree. Students can be suspended from the Graduate School if they do not have an advisor.

The master's thesis defense committee consists of three faculty: the student's advisor and two other faculty members from Materials Science and Engineering (primary or affiliated with Materials Science and Engineering). Committee members must represent at least two different tenure homes. All members of the committee must be physically or virtually present for the exam.

## CREDITS PER TERM ALLOWED

15 credits

## TIME LIMITS

The master's degree is typically completed within three years.

Refer to the Graduate School: Time Limits (<https://policy.wisc.edu/library/UW-1221/>) policy.

## GRIEVANCES AND APPEALS

These resources may be helpful in addressing your concerns:

- Bias or Hate Reporting (<https://doso.students.wisc.edu/bias-or-hate-reporting/>)
- Graduate Assistantship Policies and Procedures (<https://hr.wisc.edu/policies/gapp/#grievance-procedure>)
- Hostile and Intimidating Behavior Policies and Procedures (<https://hr.wisc.edu/hib/>)
  - Office of the Provost for Faculty and Staff Affairs (<https://facstaff.provost.wisc.edu/>)
- Dean of Students Office (<https://doso.students.wisc.edu/>) (for all students to seek grievance assistance and support)
- Employee Assistance (<http://www.eao.wisc.edu/>) (for personal counseling and workplace consultation around communication and conflict involving graduate assistants and other employees, post-doctoral students, faculty and staff)
- Employee Disability Resource Office (<https://employeeabilities.wisc.edu/>) (for qualified employees or applicants with disabilities to have equal employment opportunities)
- Graduate School (<https://grad.wisc.edu/>) (for informal advice at any level of review and for official appeals of program/departmental or school/college grievance decisions)
- Office of Compliance (<https://compliance.wisc.edu/>) (for class harassment and discrimination, including sexual harassment and sexual violence)
- Office of Student Conduct and Community Standards (<https://conduct.students.wisc.edu/>) (for conflicts involving students)

- Ombuds Office for Faculty and Staff (<http://www.ombuds.wisc.edu/>) (for employed graduate students and post-docs, as well as faculty and staff)
- Title IX (<https://compliance.wisc.edu/titleix/>) (for concerns about discrimination)

## MS&E Grievance Procedures

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 submit a formal grievance to the department. 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.

To pursue a formal grievance, the student should submit a letter describing the issue in detail to the department Associate Chair of Graduate Studies within 60 days of the precipitating incident. (Should the grievance involve the Director of Graduate Studies, the letter should be submitted to the department Chair.) The Director (or Chair) will convene a committee of not fewer than three department faculty. The committee will obtain a written response from the person or persons who are the subject of the complaint. The committee will then decide a course of action in response to the grievance. The response from the subject of the complaint and the committee course of action will be communicated in writing to the student within 15 working days of submission of the grievance. The course of action will be implemented no later than 10 working days of the communication.

If the departmental procedure does not resolve the grievance, the student may appeal to the College of Engineering or the Graduate School. The College grievance procedures are currently available at <https://engineering.wisc.edu/report-an-incident/academic-grievances-and-complaints/>, (<http://www.engr.wisc.edu/current/current-students-how-to-file-a-grievance.html>) and the Graduate School procedures are available at <http://grad.wisc.edu/acadpolicy/>. (<http://grad.wisc.edu/acadpolicy/>)

The Assistant Dean for Graduate Affairs ([engr-dean-graduateaffairs@engr.wisc.edu](mailto:engr-dean-graduateaffairs@engr.wisc.edu)) provides overall leadership for graduate education in the College of Engineering (CoE), and is a point of contact for graduate students who have concerns about education, mentoring, research, or other difficulties.

## OTHER

### Materials Elective Course Request

Students or faculty may request a course be added to the "Materials Elective Courses" list by submitting a letter to the graduate coordinator. The request must include the course syllabus and explain why the course is a materials-centric course.

## PROFESSIONAL DEVELOPMENT

### PROFESSIONAL DEVELOPMENT GRADUATE SCHOOL RESOURCES

Take advantage of the Graduate School's professional development resources (<https://grad.wisc.edu/pd/>) to build skills, thrive academically, and launch your career.

## PEOPLE

### PEOPLE

#### PROFESSORS

Michael Arnold, Chang-Beom Eom, Paul Evans, Padma Gopalan, Sindo Kou, Dane Morgan, John Perepezko, Kumar Sridharan, Donald Stone, Izabela Szlufarska, Dan Thoma, Paul Voyles, and Xudong Wang

#### ASSOCIATE PROFESSORS

Jason Kawasaki and Yuan Ping

#### ASSISTANT PROFESSORS

Dawei Feng, Jiamian Hu, Sebastian Kube, Fang Liu, Hyunseok Oh, Daniel Rhodes, and Jun Xiao

#### ASSISTANT TEACHING PROFESSORS

Franklin Hobbs

See also Materials Science and Engineering Faculty Directory (<https://directory.engr.wisc.edu/mse/faculty/>).