MATERIALS SCIENCE AND ENGINEERING, M.S.

The Department of Materials Science and Engineering offers opportunities for graduate study leading to the master of science and the doctor of philosophy degrees in materials science and engineering. The department offers two distinct master of science programs. The named option program, Nanomaterials and Nanoengineering (http://guide.wisc.edu/graduate/materials-science-engineering/materials-science-engineering-ms/materials-science-engineering-nanomaterials-nanoengineering-ms), is an accelerated program that can be completed in one full year of study, and is designed for students wishing to pursue a career in industry or government. The traditional master of science program with no named option is designed for students wishing to conduct research during their program.

ABOUT MATERIALS SCIENCE AND ENGINEERING

Meeting many of the most critical challenges facing modern society requires advances in the materials that underpin new technologies. Examples include providing carbon-free and renewable energy, clean water, advanced medical treatments and devices, and sustainable materials manufacturing. New materials are also required for continued economic growth in areas as diverse as aerospace, computing, and sensors.

Materials scientists and engineers at UW–Madison work toward solutions to these problems via research in a wide variety of areas. Research areas include ceramics, computational material science; composites; corrosion; electrical, optical, magnetic materials; growth and synthesis; joining; materials for energy; metals; materials characterization and microscopy; nanomaterials; phase transformations; photonics; polymers and biomaterials; materials for nuclear energy; quantum computing; self-assembly; semiconductors; structural materials and mechanical properties; surfaces and interfaces; sustainability, thin films; and wear.

More broadly, the field of materials science and engineering is in the middle of a revolution in how we design and deploy new materials. The old way is by trial and error, which involves laboratory testing of hundreds or thousands of candidate materials, which is costly and can take decades to develop a new materials and deploy it in practical technologies. The emerging new method leverages advances in computational materials science; materials databases, data science, and machine learning; and high throughput materials synthesis and characterization to achieve true design of materials. The goal is to develop and deploy new materials much more quickly and much lower cost than ever before. Materials design is a major theme of materials research on campus, organized around the areas of materials design via atomically controlled thin film systems, modular design of nanomaterials, and integrated experimental and computational materials engineering. Materials design and these themes cut across the research and application areas list above.

Materials research extends across campus, well beyond the boundaries of the Department of Materials Science and Engineering, so graduate students in materials can pursue research with a large number of affiliate faculty. Faculty emphasize the cross-cutting, interdisciplinary nature of materials research, which is also reflected by the diverse undergraduate backgrounds of the student body, many of whom do not have undergraduate degrees in materials.

Materials research benefits from major campus facilities, including the Materials Science Center, the Wisconsin Microscopy and Characterization Center, Wisconsin Center for Applied Microelectronics, and the Soft Materials Laboratory. Research is supported by major centers, including the National Science Foundation Materials Research Science and Engineering Center and the Grainger Institute for Engineering.

Materials graduates from Wisconsin find long-term success in careers in private industry, national laboratories, and academia in the US and around the world.

ADMISSIONS

GRADUATE SCHOOL ADMISSIONS

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

<table>
<thead>
<tr>
<th>Requirements</th>
<th>Detail</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall Deadline</td>
<td>December 15</td>
</tr>
<tr>
<td>Spring Deadline</td>
<td>October 1</td>
</tr>
<tr>
<td>Summer Deadline</td>
<td>December 15</td>
</tr>
<tr>
<td>GRE (Graduate Record Examinations)</td>
<td>Required.</td>
</tr>
<tr>
<td>English Proficiency Test</td>
<td>Every applicant whose native language is not English or whose undergraduate instruction was not in English must provide an English proficiency test score and meet the Graduate School minimum requirements (<a href="https://grad.wisc.edu/apply/requirements/#english-proficiency">https://grad.wisc.edu/apply/requirements/#english-proficiency</a>).</td>
</tr>
<tr>
<td>Other Test(s) (e.g., GMAT, MCAT)</td>
<td>n/a</td>
</tr>
<tr>
<td>Letters of Recommendation Required</td>
<td>3</td>
</tr>
</tbody>
</table>

Applicants normally are expected to have a B.S. 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.

IMPORTANT APPLICATION INFORMATION

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. Graduate Record Examinations (http://www.ets.org/gre) scores on the General Test are required. Admission is highly selective. Most admitted students have an undergraduate GPA above 3.5. Mean GRE scores in the most recent admission cycle were quantitative: 166, verbal: 163, and analytical writing: 3.5. However, full consideration will be given to all students
meeting the UW–Madison graduate school requirements. Please use institution code: 1846; no department code is necessary. Foreign students must submit satisfactory results on the TOEFL (http://www.ets.org/toefl) or another acceptable English Language Test. Please use institution code: 1846; no department code is necessary. Information about these exams can be obtained from the Educational Testing Service, Princeton, New Jersey 08540 or Berkeley, California 94704.

Please use the online application (https://apply.grad.wisc.edu/Account/Login?ReturnUrl=%2F) to begin your application. To be considered for fellowships, all application materials are due by January 1. If you have questions about the application or admissions process, please do not hesitate to email msaegradadmission@engr.wisc.edu.

The graduate school offers a limited number of application fee grants (waivers of all or part of the application fee) that are available in a few specific circumstances. Further information is available here. (https://grad.wisc.edu/admissions/feegrants)

#Submit only the documents requested.

NOTE: PLEASE DO NOT SEND DOCUMENTS TO THE GRADUATE SCHOOL. ALL DOCUMENTS SHOULD BE UPLOADED WITH YOUR APPLICATION.

APPLICATION DEADLINES:
Spring semester: October 1
Fall semester: December 15

QUESTIONS?
Check out the Admissions FAQ or contact us at msaegradadmission@engr.wisc.edu.

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 processes related to funding.

PROGRAM RESOURCES

FINANCIAL ASSISTANCE
Please note that most funding is available for Ph.D. students and there is limited resources for M.S. students. International students must prove one year of funding before requesting assistance. Financial assistance is not available for students enrolled in the named option. M.S. in Nanomaterials and Nanoengineering (http://guide.wisc.edu/graduate/materials-science-engineering/materials-science-engineering-ms/materials-science-engineering-nanomaterials-nanoengineering-ms).

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. January 1 is the deadline for receipt of fellowship applications.

Foreign 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 director of graduate studies, dgs@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. Applications for teaching assistantship positions for the 2018–2019 academic year are available here (https://docs.google.com/document/d/1-L8U7xhNQ9i-FOJbk0gJA67H8tZzC09qRytILDeGZ_lo/edit).

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.hertzfdn.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)
• Tuition & Fees (https://registrar.wisc.edu/tuition_and_fees.htm)

REQUIREMENTS

MINIMUM GRADUATE SCHOOL REQUIREMENTS
Review the Graduate School minimum academic progress and degree requirements (http://guide.wisc.edu/graduate/
Major Requirements

Mode of Instruction Definitions

**Evening/Weekend**: These programs are offered in an evening and/or weekend format to accommodate working schedules. Enjoy the advantages of on-campus courses and personal connections, while keeping your day job. For more information about the meeting schedule of a specific program, contact the program.

**Online**: These programs are offered primarily online. Many available online programs can be completed almost entirely online with all online programs offering at least 50 percent or more of the program work online. Some online programs have an on-campus component that is often designed to accommodate working schedules. Take advantage of the convenience of online learning while participating in a rich, interactive learning environment. For more information about the online nature of a specific program, contact the program.

**Hybrid**: These programs have innovative curricula that combine on-campus and online formats. Most hybrid programs are completed on-campus with a partial or completely online semester. For more information about the hybrid schedule of a specific program, contact the program.

**Accelerated**: These on-campus programs are offered in an accelerated format that allows you to complete your program in a condensed time-frame. Enjoy the advantages of on-campus courses with minimal disruption to your career. For more information about the accelerated nature of a specific program, contact the program.

Curricular Requirements

<table>
<thead>
<tr>
<th>Requirements</th>
<th>Detail</th>
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<tbody>
<tr>
<td>Minimum Credit Requirement</td>
<td>30 credits</td>
</tr>
<tr>
<td>Minimum Residence Credit Requirement</td>
<td>16 credits</td>
</tr>
<tr>
<td>Minimum Graduate Coursework Requirement</td>
<td>Half of degree coursework (15 credits out of 30 total credits) must be completed on-campus level coursework; courses with the Graduate Level Coursework attribute are identified and searchable in the university’s Course Guide (<a href="https://registrar.wisc.edu/course-guide/">https://registrar.wisc.edu/course-guide/</a>).</td>
</tr>
<tr>
<td>Overall Graduate GPA Requirement</td>
<td>3.00 GPA required</td>
</tr>
<tr>
<td>Other Grade Requirements</td>
<td>The Graduate School requires an average grade of B or better in all coursework (300 or above, not including research credits) taken as a graduate student unless conditions for probationary status require higher grades. Grades of Incomplete are considered to be unsatisfactory if they are not removed during the next enrolled semester.</td>
</tr>
</tbody>
</table>

Assessments and Examinations

Students must prepare a Master’s thesis, present it in a public seminar, and defend it in closed examination by their Master’s committee. The format and procedures must conform to the Graduate School rules for a Master’s thesis, currently found at http://grad.wisc.edu/currentstudents/mastersthesis.

Required Courses

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>M S &amp; E 900</td>
<td>Materials Research Seminar ¹</td>
<td>1</td>
</tr>
<tr>
<td>M S &amp; E 530</td>
<td>Thermodynamics of Solids ²</td>
<td>3</td>
</tr>
<tr>
<td>M S &amp; E 551</td>
<td>Structure of Materials ²</td>
<td>3</td>
</tr>
<tr>
<td>M S &amp; E 521</td>
<td>Advanced Polymeric Materials ²</td>
<td>3</td>
</tr>
<tr>
<td>E P / E M A 547</td>
<td>Engineering Analysis ²</td>
<td>3</td>
</tr>
<tr>
<td>CBE 660</td>
<td>Intermediate Problems in Chemical Engineering ²</td>
<td>3</td>
</tr>
<tr>
<td>MATH 703</td>
<td>Methods of Applied Mathematics ¹</td>
<td>3</td>
</tr>
<tr>
<td>MATH 704</td>
<td>Methods of Applied Mathematics-2</td>
<td>3</td>
</tr>
<tr>
<td>PHYSICS 721</td>
<td>Theoretical Physics-Electrodynamics ²</td>
<td>3</td>
</tr>
<tr>
<td>M S &amp; E 752</td>
<td>Advanced Materials Science: Phase Transformations ²</td>
<td>3</td>
</tr>
<tr>
<td>Select two materials electives ³</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M S &amp; E 790</td>
<td>Master’s Research or Thesis ⁴</td>
<td>13</td>
</tr>
</tbody>
</table>

¹ Take two semesters.
² Take three materials core course, chosen from these options.
³ Electives are to be selected from the list below.
⁴ MS&E graduate students are required to take at least 13 credits of research study.

Elective Courses

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>M S &amp; E 401</td>
<td>Special Topics in Materials Science and Engineering</td>
<td>1-3</td>
</tr>
<tr>
<td>M S &amp; E/CHM 421</td>
<td>Polymeric Materials</td>
<td>3</td>
</tr>
<tr>
<td>M S &amp; E/N E 423</td>
<td>Nuclear Engineering Materials</td>
<td>3</td>
</tr>
<tr>
<td>M S &amp; E/N E 433</td>
<td>Principles of Corrosion</td>
<td>3</td>
</tr>
<tr>
<td>M S &amp; E 434</td>
<td>Introduction to Thin-Film Deposition Processes</td>
<td>3</td>
</tr>
<tr>
<td>M S &amp; E 441</td>
<td>Deformation of Solids</td>
<td>3</td>
</tr>
<tr>
<td>M S &amp; E 448</td>
<td>Crystallography and X-Ray Diffraction</td>
<td>3</td>
</tr>
<tr>
<td>M S &amp; E 451</td>
<td>Introduction to Ceramic Materials</td>
<td>3</td>
</tr>
<tr>
<td>M S &amp; E 456</td>
<td>Electronic, Optical, and Magnetic Properties of Materials</td>
<td>3</td>
</tr>
<tr>
<td>M S &amp; E 461</td>
<td>Advanced Metal Casting</td>
<td>3</td>
</tr>
<tr>
<td>M S &amp; E/M E 462</td>
<td>Welding Metallurgy</td>
<td>3</td>
</tr>
</tbody>
</table>
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. In addition, only one mathematics course may be counted as a materials core or materials elective course. Students or faculty may request that a course be added to the list by submitting a letter to the department graduate secretary including the course syllabus and explaining why the course is a materials-centric course.

**NAMED OPTIONS (SUB-MAJORS)**

A named option is a formally documented sub-major within an academic major program. Named options appear on the transcript with degree conferral.

**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.

**MAJOR-SPECIFIC POLICIES**

**GRADUATE PROGRAM HANDBOOK**

The Graduate Program Handbook (https://www.engr.wisc.edu/app/uploads/2016/01/MSE-Graduate-Curriculum-adopted-01_26_16-corrected-7-12-17.pdf) is the repository for all of the program's policies and requirements.

**PRIOR COURSEWORK**

**Graduate Work from Other Institutions**

With program approval, students are allowed to count graduate coursework from other institutions toward the minimum graduate degree credit requirement and the minimum graduate coursework (50%) requirement. No credits from other institutions can be counted toward the minimum graduate residence credit requirement. For additional requirements, consult the program.

**UW–Madison Undergraduate**

Typically, no credits from undergraduate coursework may be counted toward graduate program requirements. However, with program approval, students are allowed to count up to 7 credits numbered 300 or above toward the minimum graduate degree credit requirement when 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.

**UW–Madison University Special**

Typically, no UW–Madison University Special student credits may be counted toward graduate program requirements. However, with program approval, students are allowed to
count up to 15 credits of coursework numbered 300 or above taken as a UW–Madison Special student toward the minimum graduate residence credit requirement, and the minimum graduate degree credit requirement; if that coursework is numbered 700 or above it may satisfy the minimum graduate coursework (50%) requirement.

PROBATION
The Graduate School regularly reviews the record of any student who earned grades of BC, C, D, F, or Incomplete in a graduate course (300 or above), or grade of U in research credits. This review could result in academic probation with a hold on future enrollment or in being suspended from the Graduate School.

ADVISOR / COMMITTEE
Every graduate student is required to have an advisor. An advisor is a faculty member, or sometimes a committee, from the major department responsible for providing advice regarding graduate studies. An advisor generally serves as the thesis advisor. In many cases, an advisor is assigned to incoming students. To ensure that students are making satisfactory progress toward a degree, the Graduate School expects them to meet with their advisor on a regular basis.

Students without a researcher 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.

CREDITS PER TERM ALLOWED
15 credits

TIME CONSTRAINTS
The Master’s degree is typically completed within three years.

Master’s degree students who have been absent for five or more consecutive years lose all credits that they have earned before their absence. Individual programs may count the coursework students completed prior to their absence for meeting program requirements; that coursework may not count toward Graduate School credit requirements.

OTHER
n/a

LEARNING OUTCOMES
1. Demonstrate a strong understanding of mathematical, scientific, and engineering principles in the field.
2. Demonstrate an ability to formulate, analyze, and solve advanced engineering problems.
3. Demonstrate creative, independent problem solving skills.
4. Apply the latest scientific and technological advancements, advanced techniques, and modern engineering tools to these problems.
5. Recognize and apply principles of ethical and professional conduct.

PEOPLE

FACULTY:
Professors:
Mike Arnold, Sue Babcock, Chang-Beom Eom, Paul Evans, Padma Gopalan, Sindo Kou, Rod Lakes, Dane Morgan, John Perepezko, lan Robertson, Don Stone, Izabela Szlufarska, Paul Voyles, and Xudong Wang.

Assistant Professors:
Dawei Feng, Jason Kawasaki and Jamian Hu.

AFFILIATE FACULTY:

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.

PROGRAM RESOURCES
Find information about professional development from the College of Engineering at the following webpage: https://epd.wisc.edu/.