

# MATERIALS SCIENCE AND ENGINEERING: MATERIALS ENGINEERING, MS

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

## IS THIS PROGRAM RIGHT FOR YOU?

As a student in the UW–Madison accelerated master’s in materials engineering, you can choose from three focus areas. Taking the Nanomaterials and Nanoengineering path, you can develop a unique understanding of innovative applications such as nanomaterial synthesis, thin film deposition, polymeric materials, and crystallography. The Engineering Materials and Processes path offers in–depth knowledge of phase transformation, deformation, corrosion, and heat treatment, among others. The Semiconductor Materials and Manufacturing for Microelectronics path offers in–depth education on the microstructure, fabrication, and properties of electronic, optical, and magnetic materials and semiconductors. It aims to prepare students to make an impact in the semiconductor sector as it develops new materials and fabrication methods needed to create future generations of advanced computation, communications, quantum, and sensing devices. All focus areas include techniques for X-ray scattering, atomistic modeling, molecular dynamics, and more.

If you have questions, please contact Materials Science and Engineering Graduate Admissions at [msaegradadmission@engr.wisc.edu](mailto:msaegradadmission@engr.wisc.edu). Please see admission requirements on the Admissions tab.

## 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                    | The program does not admit in the spring. |
| 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 | 2  |

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
- English proficiency scores, if applicable
- Two letters of recommendation
- Statement of purpose
- 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.

Submit only the documents requested. Do not send documents to the Graduate School. All documents should be uploaded with your application.

Use the online application (<https://grad.wisc.edu/apply/>) to begin your application. If you have questions about the application or admissions process, e–mail [msaegradadmission@engr.wisc.edu](mailto:msaegradadmission@engr.wisc.edu).

## 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

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

Students enrolled in this program are not eligible to receive tuition remission from graduate assistantship appointments at this institution.

Financial assistance from the University or the Department is not available for the Master of Science named option program in Materials Engineering.

## 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/<br>Weekend | Online | Hybrid | Accelerated |
|--------------|---------------------|--------|--------|-------------|
| Yes          | No                  | No     | No     | Yes         |

#### 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     | 30 credits |
| Credit      |            |
| Requirement |            |

|             |            |
|-------------|------------|
| Minimum     | 16 credits |
| Residence   |            |
| Credit      |            |
| Requirement |            |

|             |  |
|-------------|--|
| Minimum     | 15 credits must be graduate-level coursework. Refer to the Graduate School: Minimum Graduate Coursework  |
| Graduate    | (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> ). |
| Coursework  |  |
| Requirement |  |

|             |  |
|-------------|--|
| Overall     | 3.00 GPA required.   |
| Graduate    | Refer to the Graduate School: Grade Point Average  |
| GPA         | (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> ). |
| Requirement |  |

|              |     |
|--------------|-----|
| Other Grade  | n/a |
| Requirements |     |

|                              |                                    |
|------------------------------|------------------------------------|
| Assessments and Examinations | No formal examination is required. |
|------------------------------|------------------------------------|

|              |       |
|--------------|-------|
| Language     | None. |
| Requirements |       |

### REQUIRED COURSES

| Code                                  | Title                                    | Credits   |
|---------------------------------------|--|-----------|
| <b>General Requirements</b>           |  |           |
| M S & E 900                           | Materials Research Seminar (2 semesters) | 2         |
| M S & E 350                           | Introduction to Materials Science        | 3         |
| or M S & E 550                        | Materials Fundamentals                   |           |
| M S & E 530                           | Thermodynamics of Solids                 | 3         |
| Courses within focus area (see below) |  | 22        |
| <b>Total Credits</b>                  |  | <b>30</b> |

Students choose one of the following pathways:

#### Nanomaterials and Nanoengineering<sup>1</sup>

| Code                    | Title  | Credits |
|-------------------------|--|---------|
| <b>Required course:</b> |  |         |
| M S & E 553             | Nanomaterials & Nanotechnology   | 3       |
| <b>Electives:</b>       |  |         |
| M S & E 401             | Special Topics in Materials Science and Engineering (Energy Storage Materials)           | 3       |
| M S & E 401             | Special Topics in Materials Science and Engineering (Inorganic Organic Hybrid Materials) | 3       |
| M S & E/CHEM 421        | Polymeric Materials  | 3       |
| M S & E 434             | Introduction to Thin-Film Deposition Processes   | 3       |
| M S & E 448             | Crystallography and X-Ray Diffraction  | 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 521             | Advanced Polymeric Materials   | 3       |
| M S & E 551             | Structure of Materials   | 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 752 | Advanced Materials Science: Phase Transformations                      | 3   |
| M S & E 760 | Molecular Modeling of Materials  | 3   |
| M S & E 699 | Independent Study <sup>2</sup>   | 1-4 |
| M S & E 803 | Special Topics in Materials Science (with advisor approval)            | 1-3 |

### Engineering Materials and Processes<sup>1</sup>

| Code                           | Title  | Credits |
|--------------------------------|--|---------|
| <b>Required Course:</b>        |  |         |
| M S & E 752                    | Advanced Materials Science: Phase Transformations                      | 3       |
| <b>Electives:</b>              |  |         |
| M S & E/N E 433                | Principles of Corrosion  | 3       |
| M S & E 441                    | Deformation of Solids  | 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 551                    | Structure of Materials   | 3       |
| M S & E 560                    | Fundamentals of Atomistic Modeling                                     | 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 699                    | Independent Study <sup>2</sup>   | 1-4     |
| M S & E 748                    | Structural Analysis of Materials                                       | 3       |
| M S & E 760                    | Molecular Modeling of Materials  | 3       |
| E P D 605                      | Fundamentals of Technical Project Management                           | 1       |
| E P D 701                      | Writing for Professionals  | 1       |
| E P D 702                      | Professional Presentations   | 1       |
| E P D 704                      | Organizational Communication and Problem Solving                       | 1       |
| E P D 706                      | Change Management  | 1       |
| E P D 708                      | Creating Breakthrough Innovations                                      | 1       |
| E P D 712                      | Ethics for Professionals   | 1       |
| E P D/GEN BUS/<br>MARKETNG 782 | Marketing for Non-Marketing Professionals                              | 1       |
| E P D/GEN BUS/<br>M H R 783    | Leading Teams  | 1       |
| or E P D 606                   | Leading and Managing Technical Teams                                   |         |

### Semiconductor Materials and Manufacturing for Microelectronics<sup>1</sup>

| Code                     | Title  | Credits |
|--------------------------|--|---------|
| <b>Required courses:</b> |  |         |
| M S & E 434              | Introduction to Thin-Film Deposition Processes | 3       |

|             |                              |   |
|-------------|------------------------------|---|
| M S & E 570 | Properties of Solid Surfaces | 3 |
|-------------|------------------------------|---|

At least one course from the following three:<sup>3</sup>

|             |   |  |
|-------------|---|--|
| M S & E 456 | Electronic, Optical, and Magnetic Properties of Materials |  |
| M S & E 756 | Structure and Properties of Advanced Electronic Materials |  |
| M S & E 760 | Molecular Modeling of Materials                           |  |

#### Electives:

|             |   |     |
|-------------|---|-----|
| M S & E 401 | Special Topics in Materials Science and Engineering (Quantum Materials) | 3   |
| M S & E 448 | Crystallography and X-Ray Diffraction                                   | 3   |
| M S & E 456 | Electronic, Optical, and Magnetic Properties of Materials <sup>3</sup>  | 3   |
| M S & E 551 | Structure of Materials  | 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 756 | Structure and Properties of Advanced Electronic Materials <sup>3</sup>  | 3   |
| M S & E 760 | Molecular Modeling of Materials <sup>3</sup>                            | 3   |
| M S & E 699 | Independent Study <sup>2</sup>  | 1-4 |
| E C E 549   | Integrated Circuit Fabrication Laboratory                               | 4   |

### Computation and Artificial Intelligence in Materials Engineering<sup>1</sup>

| Code   | Title  | Credits |
|--|--|---------|
| <b>Required courses:</b>                                 |  |         |
| M S & E 803  | Special Topics in Materials Science (Data Science in Materials)              | 3       |
| M S & E 660  | Mesoscale Modeling of Materials  | 3       |
| At least one course from the following two: <sup>3</sup> |  |         |
| M S & E 460  | Introduction to Computational Materials Science and Engineering              |         |
| M S & E 760  | Molecular Modeling of Materials  |         |
| <b>Electives:</b>  |  |         |
| M S & E 401  | Special Topics in Materials Science and Engineering (Modern Alloy Design)    | 3       |
| M S & E 401  | Special Topics in Materials Science and Engineering (Quantum 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 <sup>3</sup> | 3       |
| M S & E 553  | Nanomaterials & Nanotechnology   | 3       |
| M S & E 699  | Independent Study <sup>2</sup>   | 1-4     |
| M S & E 756  | Structure and Properties of Advanced Electronic Materials                    | 3       |
| M S & E 760  | Molecular Modeling of Materials <sup>3</sup>                                 | 3       |

|                                      |   |   |
|--------------------------------------|---|---|
| COMP SCI/E C E/<br>E M A/E P/M E 759 | High Performance Computing for<br>Applications in Engineering | 3 |
|--------------------------------------|---|---|

## Footnotes

- <sup>1</sup> These pathways are internal to the program and represent different curricular paths a student can follow to earn this degree. Pathway names do not appear in the Graduate School admissions application, and they will not appear on the transcript.
- <sup>2</sup> Students in this program may apply a maximum of 4 credits of M S & E 699 Independent Study to the degree, with advisor approval.
- <sup>3</sup> The same course may not satisfy more than one requirement. For example, if M S & E 456 Electronic, Optical, and Magnetic Properties of Materials is taken as a required course, it cannot also be used as an elective course.

## Other Policy

Students in this program may not take courses outside the prescribed curriculum without faculty advisor and program director approval. Students in this program cannot enroll concurrently in other undergraduate or graduate degree programs.

## 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 for graduate program requirements.

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

Typically, no credits from undergraduate coursework may transfer for graduate program requirements. However, with program approval, students who received a Materials Science and Engineering BS at UW-Madison may transfer up to 7 credits from the Department of Materials Science and Engineering coursework numbered 300 or above toward the minimum credit requirement. Coursework numbered 700 or above may satisfy the minimum graduate coursework (50%) requirement. No credits can be counted toward the minimum graduate residence credit requirement.

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

Refer to the Graduate School: Transfer Credits for Prior Coursework (<https://policy.wisc.edu/library/UW-1216/>) policy.

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

Typically, no UW-Madison University Special student credits may transfer for graduate program requirements. For questions about exceptions, contact the graduate coordinator.

### PROBATION

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

### 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.

### CREDITS PER TERM ALLOWED

15 credits; Suggested course credit allocation:

- Summer session: 4 credits
- Fall semester: 13 credits
- Spring semester: 13 credits

### TIME LIMITS

The Master of Science in Materials Science and Engineering: Materials Engineering, which is a named option program within the Department of Materials Science and Engineering, can be completed within 12 months and must be completed within 16 months.

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://factstaff.provost.wisc.edu/>)
- 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://employee disabilities.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 Student Assistance and Support (OSAS) (<https://osas.wisc.edu/>) (for all students to seek grievance assistance and support)
- 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

Students are strongly discouraged to pursue positions as Project Assistants, Teaching Assistants or Research Assistants during their time in this program, as the rigor and accelerated nature of this program may not accommodate those work time commitments. Students in this program will not receive the tuition remission that is typically part of the compensation package for a graduate assistantship.

## 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

Jiamian Hu, Jason Kawasaki and Yuan Ping

### ASSISTANT PROFESSORS

Dawei Feng, 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/>).