

MATERIALS SCIENCE AND ENGINEERING, MINOR

Requirements for a minor may be completed at any campus location offering the specified courses for the minor. Students may not change from a campus that offers their major to a campus that does not offer their major for the purpose of completing a minor.

Spring 2025 Curricular Update: The program description, entrance requirements, and program requirements detailed on this page are effective beginning Spring 2025. To learn more about what approved curricular changes take effect in Spring 2025, please visit the Changes to the UG Bulletin page (<https://bulletins.psu.edu/undergraduate/general-information/using-this-bulletin/#changementotheugbulletintext>). To view the requirements in effect for Fall 2024, please visit the 2025-25 Undergraduate Bulletin PDF (<https://bulletins.psu.edu/pdf/undergraduate.pdf>).

Program Description

The minor in Materials Science and Engineering prepares students to understand the materials properties, materials processing techniques, characterization methods, and selection criteria in implementing engineering solutions. The materials selection and use for cutting edge technology requires precise and definite knowledge of choice of materials, processing route, and material response in service conditions. A wide variety of industries such as aerospace, automotive, energy, biomedical, chemical, industrial, and electrical to name a few, have a demand for engineers with a strong background in materials engineering.

The materials minor includes an introductory course on materials science to provide a foundation on properties and processing of materials, materials thermodynamics and kinetics, and characterization of mechanical, microstructural and electrical properties of materials. Students then have the freedom and flexibility to enhance their knowledge on the processing, structure, and properties of materials such as metals, ceramics, polymers, electronics, biomaterials, composites, nanomaterials, and materials for energy. The minor can easily complement most engineering, chemistry, and physics studies.

This minor is intended for students in other engineering or science majors who have the necessary foundational knowledge in math, physics, and chemistry [even if the courses taken are not exactly the same as the listed prerequisites for MATSE courses (i.e., MATH 250 and MATH 252 vs. MATH 251, CHEM 210 vs. CHEM 202, etc.)]. Therefore, we recommend students reach out to the MATSE department or the faculty member teaching a specific MATSE course if they have questions about meeting prerequisites.

What is Materials Science and Engineering?

Materials are ubiquitous. Materials play a role in every industry and facet of life. Materials science and engineering is an interdisciplinary study of the properties of matter and the exploration for new and creative uses of ceramics, metals, polymers and composites. Materials scientists and engineers study the entire life cycle of materials (production, synthesis and processing, manufacturing, use, recycling and reclamation) by employing science to solve engineering problems. This engineering discipline is unique in that our studies begin with understanding materials at the atomic scale, allowing for prediction and measurement of material properties, and creation of materials by design. What do you

want to do with your career? Make alternative energy more economical? Improve human health, cure cancer? Provide clean drinking water to the world? Make transportation more efficient and environmentally friendly? Make everyday materials more sustainable? All these outcomes and more are possible by studying materials.

You Might Like This Program If...

- You enjoy problem-solving, math, and the physical sciences.
- You like understanding why materials react the way they do to various stimuli.
- You are interested in creating tools and materials for the aerospace, automotive, energy, biomedical, or electronics industries.

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Program Requirements

| Requirement | Credits |
|----------------------------|---------|
| Requirements for the Minor | 18 |

The minor in Materials Science and Engineering requires the completion of a total of 18 credits in materials related and other supporting courses. With the approval of the student's program chair, some of these courses may also be used to satisfy the requirements for the student's major bachelor's degree.

Requirements for the Minor

A grade of C or better is required for all courses in the minor, as specified by Senate Policy 59-10 (<https://senate.psu.edu/students/policies-and-rules-for-undergraduate-students/59-00-minors-and-certificates/>). In addition, at least six credits of the minor must be unique from the prescribed courses required by a student's major(s).

| Code | Title | Credits |
|--|--|---------|
| Additional Courses | | |
| <i>Additional Courses: Require a grade of C or better</i> | | |
| Select one of the following: | | 3 |
| ESC 414M | Elements of Material Engineering | |
| MATSE 201 | Introduction to Materials Science | |
| MATSE 259 | Properties and Processing of Engineering Materials | |
| Select 3-9 credits from the following MATSE Core Courses: | | 3-9 |
| MATSE 400 | Crystal Chemistry | |
| MATSE 401 | Thermodynamics of Materials | |
| MATSE 402 | Materials Process Kinetics | |
| MATSE 413 | Solid-State Materials | |
| MATSE 419 | Computational Materials Science and Engineering | |
| MATSE 430 | Materials Characterization | |
| MATSE 436 | Mechanical Properties of Materials | |
| Select 6-12 credits from the following MATSE Supporting Courses: | | 6-12 |
| MATSE 403 | Biomedical Materials | |
| MATSE 404 | Surfaces and the Biological Response to Materials | |

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| MATSE 409 | Nuclear Materials |
| MATSE 410 | Phase Relations in Materials Systems |
| MATSE 411 | Processing of Ceramics |
| MATSE 412 | Thermal Properties of Materials |
| MATSE 415 | Introduction to Glass Science |
| MATSE 417 | Electrical and Magnetic Properties |
| MATSE 421 | Corrosion Engineering |
| MATSE 425 | Processing of Metals |
| MATSE 426 | Aqueous Processing |
| MATSE 427 | Microstructure Design of Structural Materials |
| MATSE 429 | Non-Ferrous Structural Metals |
| MATSE 435 | Optical Properties of Materials |
| MATSE 440 | Nondestructive Evaluation of Flaws |
| MATSE 441 | Polymeric Materials I |
| MATSE 445 | Thermodynamics, Microstructure, and Characterization of Polymers |
| MATSE 446 | Mechanical and Electrical Properties of Polymers and Composites |
| MATSE 447 | Rheology and Processing of Polymers |
| MATSE 449 | Fundamentals of Composite Materials Science and Engineering |
| MATSE 450 | Synthesis and Processing of Electronic and Photonic Materials |
| MATSE 455 | Properties and Characterization of Electronic and Photonic Materials |
| MATSE 497 | Special Topics |

Supporting Courses and Related Areas

Supporting Courses and Related Areas: Require a grade of C or better

Select 0-6 credits from the following: 0-6

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| BME 408 | Solid Mechanics of Biological Materials |
| BME 443 | Biomedical Materials |
| BME 444 | Surfaces and the Biological Response to Materials |
| BME 446 | Polymers in Biomedical Engineering |
| CHE 320 | Phase and Chemical Equilibria |
| CHE 430 | Chemical Reaction Engineering |
| CHE 443 | Introduction to Polymer Science |
| CHEM 410 | Inorganic Chemistry |
| CHEM 480 | Chemistry and Properties of Polymers |
| ESC 417 | Electrical and Magnetic Properties |
| ESC 419 | Electronic Properties and Applications of Materials |
| ESC 450 | Synthesis and Processing of Electronic and Photonic Materials |
| ESC 475 | Particulate Materials Processing |
| EE 340 | Introduction to Nanoelectronics |
| EE 441 | Semiconductor Integrated Circuit Technology |
| EE 442 | Solid State Devices |
| EGEE 304 | Heat and Mass Transfer |
| EGEE 420 | Hydrogen and Fuel Cells |
| EGEE 441 | Electrochemical Engineering Fundamentals |
| EGEE 442 | Electrochemical Methods |
| EGEE 455 | Materials for Energy Applications |
| EME 301 | Thermodynamics in Energy and Mineral Engineering |

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|----------|---|
| EME 303 | Fluid Mechanics in Energy and Mineral Engineering |
| EME 407 | Electrochemical Energy Storage |
| IE 311 | Principles of Solidification Processing |
| IE 312 | Product Design and Manufacturing Processes |
| IE 428 | Metal Casting |
| ME 403 | Polymer Electrolyte Fuel Cell Engines |
| ME 404 | Gas Turbines |
| PHYS 412 | Solid State Physics I |

Additional 300- or 400-level courses within a science or engineering major and with a materials focus may be approved at the discretion of the Materials Science and Engineering department.

Academic Advising

The objectives of the university's academic advising program are to help advisees identify and achieve their academic goals, to promote their intellectual discovery, and to encourage students to take advantage of both in-and out-of class educational opportunities in order that they become self-directed learners and decision makers.

Both advisers and advisees share responsibility for making the advising relationship succeed. By encouraging their advisees to become engaged in their education, to meet their educational goals, and to develop the habit of learning, advisers assume a significant educational role. The advisee's unit of enrollment will provide each advisee with a primary academic adviser, the information needed to plan the chosen program of study, and referrals to other specialized resources.

READ SENATE POLICY 32-00: ADVISING POLICY (<https://senate.psu.edu/students/policies-and-rules-for-undergraduate-students/32-00-advising-policy/>)

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