Ph.D. in Materials Science

Participating Departments:

Chemistry and Biochemistry, Physics, Chemical and Biological Engineering, Mechanical and Industrial Engineering, and Electrical and Computing Engineering.

Information Contact

Overview

Montana State University and Montana Technological Institute (MTech) participate in the collaborative Ph.D. Materials Science program. At both institutions, faculty, research, and curriculum courses span across multiple departments. The curriculum, in broad strokes, integrates the science and engineering applications of materials that impact energy, health, industry, and the environment. Faculty from both institutions teach the courses each semester either in person or via a virtual platform.

Admission

Admission decisions are holistically determined by review of applicant's transcripts, personal statement, letters of recommendation, research experience, and strength of undergraduate background. There are no spring admissions.

The following criteria should be used as a guide to help you as you apply.

- Undergraduate GPA must be 3.0 or above on a 4.0-point scale.
- GRE scores are NOT required.
- All international students must show English proficiency. You can submit the IELTS or the iBT form of the TOEFL exam and provide a report. A TOEFL total score of 90 is required with a minimum speaking score of 26 to qualify for admission to our programs and for a teaching assistantship. A total minimum score of 7.0 is required on the IELTS exam and a speaking component score of 8.0 to qualify for a teaching assistantship. Duolingo test scores are accepted (130-135). Some exceptions apply for students from different countries (see Graduate School website.)
- Your personal statement should include your short-term academic goals and long-term professional goals and why the PhD program is a good fit for you. Include in your statement, any research experience either as an undergraduate or in your working career and the names of 3 professors in the Materials Science program you would like to conduct research with and why.
- You do not need to contact faculty to apply or be accepted into the program.
- You do not need to hold an MS degree to apply to our PhD programs.
- Review of applications begins in early January and continues until our class is full. Priority is given to early applicants.
- Applicants will be notified about acceptance and financial awards no later than April 1st. Completed applications should be in our office by January 15th. Applications received after January 15th are still eligible for acceptance if space is available, however, no waivers will be provided.
- If accepted into the PhD program, support in the first academic year (Fall + Spring) for a PhD student will be in the form of a Graduate Teaching Assistantship (GTA) and a tuition waiver. Later support will be determined with your research advisor as a GTA or Graduate Research Assistant.

Degree Requirements and Curriculum

The MatSci Ph.D. curriculum is designed to be flexible, but still provide students with an exceptionally strong and broad understanding of the theory, experimental techniques, current challenges, and societal/economic impacts of materials science and engineering. All students in the program —regardless of specialty—will understand how classes of materials derive their properties from the atomic to the macroscopic level and be familiar with the growing set of materials fabrication, assembly, processing, and characterization tools and techniques. Furthermore, students will be aware of and committed to the professional and ethical standards of the field. Students are also expected to become aware of the economic, societal, and other broader impacts of materials and materials research. Through their dissertation research, students will demonstrate that they can conceive, plan, design, conduct, analyze, defend, publish, and communicate original and creative research that advances understanding in an area important to MatSci.

The MatSci Ph.D. will require a minimum of 60 semester credits beyond the bachelor's degree. Of the 60 credits, at least 18 credits must be obtained for dissertation research, and at least 32 credits must be earned for coursework.

In addition to the core curriculum, each student must earn at least 12 credits of electives within or related to the chosen specialty. Typically, this coursework would be completed by the end of the student's second year. Additional elective courses intended to provide a student with specialized expertise and/or skills relevant to their dissertation research may be recommended by the individual student's advisor and committee.

Other Requirements

Other requirements include the qualifying exam, the candidacy exam, the dissertation, participation in the program's annual summer symposium, annual meetings with a student's advisory committee, and an optional internship.

Core Courses

- MTSI 501 Material Structure and Bonding
- MTSI 502 Adv Materials Science II
- MTSI 511 Thermodynamics of Materials
- MTSI 512 Kinetics Phase Transformations
- MTSI 551 Adv Materials Characterization/ MTSI 552 Adv Material Character II
- MTSI 594 Seminar
- MTSI 690 DISSERTATION RESEARCH

ELECTIVES

- MTSC 580 SPECIAL TOPICS
- MTSC 589 COLLABORATIVE PROJECT

Other Electives

Elective courses will be available, allowing students to deepen their understanding and research skills in the program's focus areas:

1. biomaterials;
2. materials for energy storage, conversion, and conservation;

3. electronic, magnetic, and photonic materials; and
4. materials synthesis, processing, and fabrication.

Some electives will be developed specifically for the MatSci Ph.D. program, others would be graduate courses from other related graduate programs at the three campuses. Courses in mathematics, statistics, and numerical modeling would be recommended for students with special interests in theory and simulation.