MATERIALS SCIENCE AND ENGINEERING, PHD

Degree: Doctor of Philosophy (PhD)
Field of Study: Materials Science and Engineering

Program Overview

The Department of Materials Science and Engineering offers programs leading to the degree of Doctor of Philosophy. The Doctor of Philosophy is one of the highest academic degrees conferred by Case Western Reserve University. The underlying PhD program combines acquiring a great breadth of knowledge and understanding with building in-depth knowledge and skills in a chosen cutting-edge field of active materials research. Doctoral students develop skills to realize their own, original, curiosity-driven scientific research. As they research a specific topic in depth, doctoral students experience an intellectual transformation that enables them to succeed universally in challenging professional tasks, positioning them for the most ambitious leadership careers in academia, national laboratories, industrial research, etc.

Candidates for a PhD degree in Materials Science and Engineering perform coursework and research that leads to a dissertation. The coursework must include the Materials Science and Engineering *Core* and fulfill a Breadth Requirement and a Basic Science Requirement. In addition, candidates must pass a General Exam and a Thesis Defense. The General Exam consists of two parts, taken in two subsequent semesters: (i) Comprehensive Exam ("PhD-Qualifying Exam"). (ii) Thesis Proposal Evaluation.

Advanced Standing

Students entering the PhD program with an MS degree in a materials-related field are considered to be in advanced standing. For these students, the minimum course requirement is 6 courses (18 credit hours). The Breadth Requirement and the Basic-Science Requirement may require taking further courses.

Exams

Comprehensive Exam

The Comprehensive Exam of the PhD program consists of two parts:

a. The "General Exam," also known as "PhD-Qualifying Exam," a written general exam.
b. The "PhD Proposal Evaluation" includes a written thesis proposal, an oral presentation, and an examination by the thesis committee that may address the thesis proposal, the presentation, and general knowledge.

The General Exam (PhD-Qualifying Exam) has multi-part questions that cover the following four areas:

- EMSE 503
- EMSE 504
- EMSE 505
- A Synthesis Area, which combines concepts from the first three areas as they apply to performance of materials.

Students who achieve a score of 70% or above on three of the completed questions and an overall average of 75% or above will pass outright. Students who do not achieve this on their first attempt of the written exam will have one more opportunity to take the General Exam the next time the department offers it.

To register for taking the General Exam, students need a cumulative GPA of 3.0 or higher for courses taken at Case Western Reserve University is required. The exam will be offered once per year, typically in June. The time limits within which students must take the General Exam are as follows:

- Full-time students entering with an MS degree: within one year.
- Full-time students entering with a BS degree: within two years of entering the PhD program.
- Part-time students: prior to accumulating 10 or more credit hours.

Dissertation Advisory Committee

After passing the General Exam and before the Thesis Proposal Evaluation, the student needs to establish a Dissertation Advisory Committee. It must consist of at least three faculty members from the department and one non-departmental member. The committee members should be chosen in consultation with the advisor.

Thesis Proposal Evaluation

The Thesis Proposal Evaluation must occur in the semester immediately following the successful completion of the General Exam (unless a petition, supported by the research advisor, is approved by the Graduate Studies Committee of the Department of Materials Science and Engineering). The Thesis Proposal Evaluation tests the more specific knowledge of the PhD candidate concerning the science underlying the proposed research and the candidate's intellectual maturity. It includes a written document in which the candidate proposes a doctoral research project, an oral presentation on this project, and an examination by the thesis committee addressing the written document, the presentation, general knowledge of materials science and engineering, and special knowledge the candidate acquired e.g. in advanced courses taken in support of their research program. The written document and the oral presentation should include an analysis of a research problem, the results of a corresponding literature search, suggested research procedures, and major results and scientific advances to be expected. The written document must be submitted to the student's Dissertation Advisory Committee for examination at least one week prior to the oral evaluation. The written document as well as the presentation and committee examination of the Thesis Proposal Evaluation will be graded P/N (pass/no pass).

PhD Candidacy

Upon passing both the Comprehensive Exam and the Thesis Proposal Evaluation, a student will advance to PhD Candidacy.

Dissertation and Defense

Upon successful completion of all requirements, a PhD candidate must submit a written dissertation as evidence for their ability to conduct original scientific research. No later than 10 days before the defense, the candidate must provide a copy of the completed dissertation to each member of the Dissertation Advisory Committee. The defense consists of a (public) presentation and a (non-public) oral exam by the members of the student's Dissertation Advisory Committee.

PhD Policies

For PhD policies and procedures, please review the School of Graduate Studies section of the General Bulletin.

Program Requirements

Entering the Program

Immediately upon entering the department, the PhD candidate normally will:

- Fill out and submit the first part of the Academic Program and the Supplementary Form.
- Register for 2 courses during the first semester and EMSE 499.
- Register for EMSE 701 (usually 3 credit hours) during the first semester. Note that registration for EMSE 701 is not permitted before the Academic Program form is turned in.

As specified in the University General Bulletin section of the School of Graduate Studies: "In order to meet the requirements for the doctorate, a student must pass satisfactorily a general examination (or a series of examinations covering different fields) specified and administered by the student's department or supervising committee."

PhD Program of Study – Course and GPA Requirements

The student's Academic Program is a list of the courses the student will take to fulfill the PhD requirements, will be discussed and updated as needed at the time of the Thesis Proposal Evaluation.

A PhD student must take a minimum of 18 credit hours of EMSE 701 and must continue registration each subsequent regular semester (Fall and Spring) until the dissertation is complete, unless granted a leave of absence.

The time limit for the PhD program is 5 years for full-time students, starting with the first semester of EMSE 701 registration.

The minimum course requirement is 12 courses (36 credit hours) beyond the BS level, of which at least six courses (18 credit hours) must be taken at Case Western Reserve University. Of these 12 courses, four courses must satisfy the Breadth Requirement and 2 courses must satisfy the Basic Science Requirement for the department as outlined below.

In the case of a student entering with an MS degree from another discipline, additional courses may be required at the discretion of the student's academic advisor.

Graduation requires a GPA of at least 3.0. Students with a cumulative GPA below 3.0 will be placed on academic probation.

A required part of the PPOS for all PhD students in the Materials Science and Engineering *Core*. It consists of the following sequence of courses:

- EMSE 503
- EMSE 504
- EMSE 505

Transfer credit for comparable graduate courses taken at another institution will be allowed on a case-by-case basis. Students may find it helpful to complete the Materials Science and Engineering Core sequence prior to taking the PhD comprehensive exam.

Breadth Requirement

The Breadth Requirement can be fulfilled by taking a total of four courses (12 credit hours) within the Case School of Engineering (including Materials Science and Engineering), selected in consultation with the student's advisor.

Basic-Science Requirement

The Basic-Science Requirement consists of taking two corresponding courses (6 credit hours). These can be courses at the 400- or 500-level with course designation PHYS, CHEM, BIOL, MATH, STAT, or DSCI and/or certain engineering curricula approved by the Graduate Studies Committee of the Department of Materials Science and Engineering. Engineering courses used to meet this requirement must be approved prior to enrolling in the course. The deadline is the conclusion of add/drop in any given semester. Students making such a request are required to submit a petition to the Graduate Studies Committee that justifies the role of the stipulated course as basic (rather than applied) science. Such petitions are expected to be brief. Courses that are not approved as meeting the Basic-Science Requirement may still be applicable to the Breadth Requirement.