Materials Science and Engineering Program at University of Cincinnati

Outline

Program and Regulations
Research Facilities
Faculty Research Activities
Prof. Donglu Shi
Program Chair

Department of Mechanical and Materials Engineering
College of Engineering and Applied Science, University of Cincinnati

August 16, 2018
<table>
<thead>
<tr>
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Graduate Program

- Annual research expenditures of ~$4M
- Around 75 graduate students including all full time and part time students
- 80% International, 20% domestic
- 20% female, 80% male
- 70% Ph.D., 25% M.S., 5% Non-thesis M.S.
- Almost all full time students get full UGS
- Approximately 15-20 graduate students get admission each year
- After graduation they find jobs in major manufacturing, R&D, as well as federal government and national laboratories, academia and research institutes
The Graduate Program in Materials Science and Engineering (MSE) is administered through the Dept. of Mechanical and Materials Engineering (MME), within the College of Engineering and Applied Science (CEAS). MSE at UC offers graduate degrees of MS and Ph.D with focuses on polymers, metallurgy, and ceramics, a truly cross-disciplinary field that underlies all engineering disciplines and leads the way for innovative advances in traditional as well as new areas of research in nano-science and soft materials.
Student Enrollment
Graduate Degrees Awarded
Graduate Program Regulations

- Regulations for graduate study in the MSE program are presented in the Graduate Student Handbook.
- The student is ultimately responsible for tracking their progress toward the degree and for meeting specific requirements and deadlines.
- Graduate Program Director and Graduate Studies Committee oversee enforcement of regulations.
Financial Aid

- University Graduate Scholarship (UGS): tuition only
- Graduate Assistant (GA/TA): UGS + stipend (typically $22,000 per year) from Department/College
- Research Assistant (RA): UGS + stipend (typically $22,000 per year) from research project
- Research Fellowship: UGS + stipend (typically >$25,000 per year) from agency/institution
Minimum Academic Performance

- The student must maintain a quality point average of at least 3.0 in courses at UC and within the MSE Program.
- Failure to maintain a 3.0 QPA will result in the student being placed on probation.
- If a student is on probation for two consecutive quarters or three non-consecutive quarters, further financial aid may be denied and the student dismissed from the program.
- No student with a QPA less than 3.0 will be recommended for graduation.
Core Courses – MS

Metals/Ceramics Option
• Advanced Thermodynamics (20-MTEN-7035)
• Mechanical Behavior of Materials (20-MTEN-6097)
• Kinetics of Materials Processing (20-MTEN-6020)
• Phase Transformations in Solids (20-MTEN-6071)

Polymers Option
• Advanced Thermodynamics (20-MTEN-7035)
• Fundamentals of Polymer Science (20-MTEN-7094)
• Physics of Polymer Properties (20-MTEN-6034)
• Polymer Analysis and Characterization (20-MTEN-7032C)
Core Courses – PhD

Metals/Ceramics Option
- Advanced Thermodynamics (20-MTEN-7035)
- Mechanical Behavior of Materials (20-MTEN-6097)
- Kinetics of Materials Processing (20-MTEN-6020)
- Phase Transformations in Solids (20-MTEN-6071)
- Diffraction Theory (20-MTEN-7048)
- Advanced Materials Techniques (20-MTEN-7010C)

Polymers Option
- Advanced Thermodynamics (20-MTEN-7035)
- Fundamentals of Polymer Science (20-MTEN-7094)
- Physics of Polymer Properties (20-MTEN-6034)
- Polymer Analysis and Characterization (20-MTEN-7032C)
- Diffraction Theory (20-MTEN-7048)
- Advanced Materials Techniques (20-MTEN-7010C)
MS Thesis

• Candidacy:
  • Enrollment in the graduate program makes the student a candidate for the degree of Master of Science.

• Time Limitations:
  • M.S. students are expected to complete the degree requirements within (6) semesters (2 years) after initial enrollment into the graduate program. Financial aid may be withheld after this time limit.
Credit Hours – MS Thesis

• A total of 30 credit hours
• 21 from courses, 9 from research
• Of the 21 course based credits: 12 credits from listed core courses, 9 credits from student’s choice within MSE or from another department (courses should be related to student’s research interest if from another department)
• All courses must be approved by your academic advisor. Courses taken outside the program should also be approved by the Graduate Studies Director
MS Thesis

• Thesis: No page requirement.
• A successful oral defense of the thesis before the student’s chosen committee is a degree requirement.
• Copies of the thesis must be submitted to the Thesis Committee members at least one week prior to the oral defense.
• The oral examination will start with a formal presentation (20-30 minutes) by the student, followed by questions from the members of the thesis committee and members of the audience.
• The entire examination may not exceed 2 hours.

Your Research Advisor should suggest and help coordinate with possible committee members
Credit Hours – PhD (Thesis)

Students with BS, Direct to PhD Program

- Total of at least 90 credit hours
- Minimum of 30 credit hours in courses, of which at least 24 credit hours must be in courses offered or approved by the MSE Program, with 15 of those in the relevant core courses. (Courses should be related to student’s research interest if from another department)
- Minimum of 60 credit hours in research
- All courses must be approved by your academic advisor
Credit Hours – PhD (Thesis)

Students with MS from UC in MSE or Other Depts or Other Universities

- Total of at least 60 credit hours
- Minimum of 30 credit hours in courses, of which at least 24 credit hours must be in courses offered or approved by the MSE Program, with 15 of those in the relevant core courses. (exceptions will be made if the student received a Masters from UC MSE. You can’t repeat courses)
- Minimum of 30 credit hours in research
- All courses must be approved in writing by your academic advisor
PhD (Thesis) Qualifying Exam

- A full-time student who started in this Program with a B.S. degree should make the first attempt at the qualifying examination no later than the 7th semester from the initial enrollment.

- A student who started with an M.S. degree should make the first attempt no later than the 4th semester from the initial enrollment.

- Students may attempt the Qualifying Exam twice.
- Qualifying Exam consists of two parts:
  - 1) Written Exam
  - 2) Oral Exam
PhD Qualifying Written Exam

• The Graduate Director will send an email before the start of each semester to the PhD student. Respond if you want to take the exam in that semester.

• Written part consists of (4) sections, 100 points per section.

Metals/Ceramics
1. Thermodynamics
2. Physical Metallurgy
3. Mechanical Metallurgy
4. Ceramic Engineering

Polymers Science
1. Thermodynamics
2. Polymer Physics and Properties
3. Polymer Characterization
4. Polymer Synthesis and Chemistry

• A 60 % average overall is required to pass the written part
PhD Qualifying Oral Exam

- Occurs after you pass the written exam
- The Oral Part is graded as a Pass/Fail as determined by the Oral Exam Committee (the Oral Exam Committee is composed of the student’s research advisor and at least two other primary MSE faculty). Notify your research advisor and the Graduate Chair BEFORE the semester starts in which you are planning to take the qualifier.
- The Oral Exam Committee is chaired and organized by the student’s dissertation advisor.
- The student submits a written report, called: Research Proposal based on his/her proposed research topic with a 15-page limit, excluding references. The Research Proposal consists 4 parts: Introduction, Literature Review, Background/Motivation, and Proposed Research.
PhD Qualifying Oral Exam

• The Oral Part is limited to 2 hours maximum. The formal presentation of the Research Proposal during the Oral Part is limited to the first 40 minutes (uninterrupted, except for brief clarifications) of the examination.

• The use of viewgraphs, power point or other visual aids, is recommended. These should be of high quality.

• The remaining time is reserved for Oral Exam Committee members to ask questions related to the literature review and critique the student’s experimental plan outlined in the proposed research, initial experimental results and analysis (if included)
Current MSE Faculty

- The Materials Program at UC is supported by 9 Primary MSE and 8 Secondary faculty members.
- These faculty members cover a wide range of topical fields in polymers, metallurgy, ceramics, and nanomaterials.
- They also lead frontier research in nanoscience, energy devices, polymer synthesis and characterization, nanocomposites, ceramic composites, surface engineering, electronic materials, biomaterials, and nano biomedicine.
New Faculty

Ashley Paz y Puente
Assistant Professor, MSE

Research Interests: Physical metallurgy, phase transformations, diffusion reactions and kinetics, intermetallics, shape memory alloys, additive manufacturing, X-ray tomography

Matthew Steiner
Assistant Professor, MSE

Research Interests: Phase transformations, metallurgy, chemical ordering; strain-effects on phase equilibria, thin film deposition, magnetic materials, crystallographic texture evolution, laser-material interactions
- **The Laboratory for Nanobiomedicine** (Donglu Shi)
  The Laboratory for Nanobiomedicine develops nanotechnologies that can address some of the critical issues in medical diagnosis and treatment.

- **Novel Devices Laboratory** (Jason Heikenfeld)
  NDL performs highly multidisciplinary research, primarily in electrofluidics and biosensors, spanning fundamental science to more applied work through industrial partnerships.

- **The Nanoelectronics Laboratory** (Andrew Steckl)
  The lab is dedicated to optical and materials characterization, focused ion beam processing and atomic force microscopy.

- **The Center for Macromolecular Topology** (Greg Beaucage)
  The Center for Macromolecular Topology addresses the need in the polymer industry to synthetically control, characterize, model and simulate
Research Concentrations in MSE

**Adhesion, Thin Films & Coatings**
Jude Iroh, Donglu Shi, Je-Hyeong Bahk

**Polymer Physics, Synthesis, Structure, Properties, Characterization, Modeling**
Greg Beaucag, Jude Iroh, Neil Ayers

**Advanced Alloys**
Vijay Vasudevan, Donglu Shi, Ashley Paz Y Puente, Mathew Steiner

**Functional Ceramics**
Donglu Shi, Je-Hyeong Bahk, Junhang Dong, Heikenfeld

**Composite Materials**
Jim Boerio, Jude Iroh, Greg Beaucage

**Biomedical Materials**
Mark Schulz, Vesco Shanov, Donglu Shi, Chia-Chi Ho

**Energy Materials & Systems**
Vesco Shanov, Mark Schulz, Donglu Shi, Je-Hyeong Bahk

**Nanoscale Materials & Nanotechnology**
Vesco Shanov, Mark Schulz, Donglu Shi
NSF-sponsored RA positions for atomistic simulations about graphene friction are available. If you are interested, please contact Dr. Woo Kyun Kim at kimwu@ucmail.uc.edu.