

# MATERIALS SCIENCE AND ENGINEERING (ENMA)

Graduate Degree Program  
College: Engineering

## Abstract

Materials Science and Engineering is an interdisciplinary program. Students from engineering and science disciplines receive a solid foundation in the physics and chemistry of materials, thermodynamics and structure of materials, as well as the latest technological aspects of materials in today's manufacturing environment. Faculty research areas are mainly concentrated in the development of novel materials for today's electronics, energy, biomedical and high tech industries. These materials may be bulk or thin film format and range from ceramics, semiconductors, metals, polymer and biomaterials. Departmental faculty members are major participants in the University of Maryland Materials Research Science and Engineering Center (<http://mrsec.umd.edu/>), the Maryland NanoCenter (<https://www.nanocenter.umd.edu/>) and the University of Maryland Energy Research Center (<http://www.umerc.umd.edu/>). For an overview of the Materials Science and Engineering Department, please visit Materials Science and Engineering at the University of Maryland (<http://www.mse.umd.edu/>).

## Financial Assistance

Financial assistance in the form of teaching and research assistantships and sponsored fellowships are available to qualified students. Requests for financial assistance will be considered for Fall admission only.

## Contact

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**Website:** <http://www.mse.umd.edu>

**Courses:** ENMA (<https://umd-curr.courseleaf.com/graduate/courses/enma/>)

## ADMISSIONS

### General Requirements

- Statement of Purpose
- Transcript(s)
- TOEFL/IELTS/PTE (international graduate students (<https://gradschool.umd.edu/admissions/english-language-proficiency-requirements/>))

### Program-Specific Requirements

- Letters of Recommendation (3)
- Graduate Record Examination (GRE) - optional
- CV/Resume

The Department offers graduate study leading to the Master of Science (thesis or non-thesis options) and Doctor of Philosophy degrees. In addition, students enrolled in the Professional Master of Engineering program may choose Materials Science and Engineering as a program option. Graduate study is open to qualified students holding a bachelor's degree from accredited programs in any of the engineering and science areas. For detailed admissions and program information, please visit Materials Science and Engineering Graduate Programs (<http://www.mse.umd.edu/graduate/admissions/>)

### Application Deadlines

Type of Applicant	Fall Deadline	Spring Deadline
<b>Domestic Applicants</b>		
US Citizens and Permanent Residents	January 4, 2024	October 12, 2023
<b>International Applicants</b>		
F (student) or J (exchange visitor) visas; A, E, G, H, I and L visas and immigrants	January 4, 2024	September 29, 2023

### RESOURCES AND LINKS:

**Program Website:** <http://www.mse.umd.edu>

**Application Process:** [gradschool.umd.edu/admissions/application-process/step-step-guide-applying](https://gradschool.umd.edu/admissions/application-process/step-step-guide-applying) (<https://gradschool.umd.edu/admissions/application-process/step-step-guide-applying/>)

## REQUIREMENTS

- Materials Science and Engineering, Doctor of Philosophy (Ph.D.) (<https://academiccatalog.umd.edu/graduate/programs/materials-science-engineering-enma/materials-science-engineering-phd/>)
- Materials Science and Engineering, Master of Science (M.S.) (<https://academiccatalog.umd.edu/graduate/programs/materials-science-engineering-enma/materials-science-engineering-ms/>)

## FACILITIES AND SPECIAL RESOURCES

Special equipment includes scanning and transmission electron microscopes; X-ray diffraction devices; image analysis and mechanical testing facilities; crystal growing, thin film deposition and analysis equipment; HPLC, GC, IR and other sample preparation and analytical apparatus.

The Laboratory for Advanced Materials Processing (LAMP) in JM Patterson 2225 includes a class 1000 clean room for various kinds of thin film processing, particularly things difficult to accomplish in the NanoCenter's new FabLab clean room in the Kim Building. LAMP also features custom-designed ultraclean chemical vapor deposition (CVD) and atomic layer deposition (ALD) equipment as the basis for research in nano applications and manufacturing process prototyping, particularly with real-time chemical sensing for metrology and process control.

A custom wafer-scanning electrical characterization facility enables resistance and capacitance mapping.

The Nano-Bio Systems Laboratory (NBSL) in JM Patterson 2229 adjoins LAMP and provides capability for biotech research, specifically in biomaterials processing and biomicrosystems development. It includes a Zeiss 310 laser confocal/fluorescence microscope, microfluidic chip testing for biomolecular reaction and cellular response experiments, biomaterials deposition, a Zyvex L200 nanomanipulator system for life science studies, and mass spectrometry and ICP optical emission equipment.

The W. M. Keck Laboratory for Combinatorial Nanosynthesis and Multiscale Characterization in 1141 Kim Building houses several thin film deposition chambers for rapid exploration of novel functional materials. The combinatorial approach allows simultaneous investigation of large numbers of different samples. The combinatorial laser molecular beam epitaxy is used to perform atomic layer controlled combinatorial synthesis of functional materials. Atomically controlled growth of unitcells are monitored in-situ using electron diffraction.

The Advanced Imaging and Microscopy Laboratory (AIM), located in 1237 Jeong H. Kim Building, houses the most electron powerful microscopes within any university in the Washington, DC metro area. The facility has a Field-emission Transmission Electron Microscope (TEM) with 1.4 angstrom resolution and can generate chemical-composition maps of materials using Energy-Dispersive X-Ray Spectroscopy (EDS) or Electron Energy-Loss Spectroscopy (EELS). Also housed in the lab are a thermionic TEM with 2.0 angstrom resolution (capable of in-situ electrical measurements and in-situ observations between -183 C and 1000C) and an electron microprobe with five Wavelength-Dispersion X-Ray Spectrometers (WDS).

Equipment available at other facilities include a Lakeshore vibrating scanning magnetometer and a scanning Auger spectrometer.

For additional information about the department's research facilities, please visit the following webpage: Materials Science and Engineering Research (<http://www.mse.umd.edu/research/>).