SCHOOL OF ADVANCED MATERIALS DISCOVERY (SAMD)

1350 Center Avenue, Anatomy-Zoology Building
(970) 491-4879
Find us online at the SAMD (https://www.research.colostate.edu/samd/) website.

Director: Dr. Travis Bailey
Associate Director: Dr. Chris Weinberger

The overall objective of the School of Advanced Materials Discovery (SAMD) program is to develop students to be science and engineering professionals who use their multidisciplinary problem solving skills to address global challenges in the field of materials science and engineering (MSE).

The development of advanced materials, including their synthesis, characterization, and application in novel devices, occupies a central role in 21st century science, technology, and business. Materials research is, by its very nature, an extraordinarily inter- and multi-disciplinary endeavor, involving expertise in chemistry, physics, and engineering at the core, but also utilizing concepts from various other scientific disciplines as well as business and sociology, as materials research is often very focused on creating a product for the marketplace more efficiently and effectively. Indeed, work in this area is concerned with the structure, property, and function of materials. Thus, we educate future materials scientists and engineers to understand how different combinations of molecules can result in different thermal, mechanical, electrical, optical, and magnetic properties; to measure those properties at the atomic, electronic, surface, and bulk level; and to manufacture usable devices from the resulting materials. It is imperative that the next generation of materials scientists and engineers be explicitly educated in an interdisciplinary manner. The degree program contains elements that address materials technology transfer, materials manufacturing, responsible conduct of research, and other professional development skills necessary for success in the materials community.

Graduate

Master's Programs


Ph.D.

- Ph.D. in Materials Science and Engineering (http://catalog.colostate.edu/general-catalog/university-wide-programs/interdisciplinary-studies/school-advanced-materials-discovery/materials-science-engineering-phd/)

Courses

MSE 465 Sustainable Strategies for E-Waste Management Credits: 3 (3-0-0)
Also Offered As: GES 465.
Course Description: Trans-disciplinary overview of the electronics industry, with an emphasis on sources and impacts of e-waste on human & natural systems. Systems approaches to mitigating environmental and social impacts of electronics—from product design, materials and manufacture to use, re-use, recycle and disposal. Apply learnings in trans-disciplinary project teams to evaluate opportunities for improving the sustainability of the industry and its products.
Prerequisite: None.
Registration Information: Online. Credit allowed for only one of the following: GES 465, GES 481A1, MSE 465, or MSE 481A1.
Term Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: No.

MSE 501 Materials Technology Transfer Credit: 1 (1-0-0)
Course Description: The pathways toward commercialization of materials from research. Case studies, technology readiness levels, proposal writing, entrepreneurship, and intellectual property practices.
Prerequisite: MATH 431.
Registration Information: Senior standing.
Term Offered: Fall.
Grade Mode: S/U Sat/Unsat Only.
Special Course Fee: No.

MSE 502A Materials Science & Engineering Methods: Materials Structure and Scattering Credit: 1 (1-0-0)
Course Description: Introduction to the atomic level arrangements of materials, defects related to these structures, and X-ray Diffraction, X-ray scattering, and electron diffraction methods.
Prerequisite: MATH 345 and MECH 331.
Registration Information: Senior standing.
Term Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: No.

MSE 502B Materials Science & Engineering Methods: Computational Materials Methods Credit: 1 (1-0-0)
Course Description: Introduction to mathematical and computational methods that are used to model materials: Simulation/Modeling, Monte-Carlo, Monte-Carlo Potts, Density Functional Theory, and other approaches.
Prerequisite: (MATH 340 or MATH 345) and (MECH 331).
Registration Information: Senior standing.
Term Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: No.

MSE 502C Materials Science & Engineering Methods: Materials Microscopy Credit: 1 (1-0-0)
Course Description: Introduction to modern microscopy techniques for materials research using optical microscopy, Interferometry and confocal techniques, scanning electron, microscopy transmission electron microscopy, and scanning probe microscopy.
Prerequisite: (CHEM 431 or MECH 331) and (MATH 340 or MATH 345).
Registration Information: Senior standing.
Term Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: No.
### MSE 502D Materials Science & Engineering Methods: Materials Spectroscopy
**Credit:** 1 (1-0-0)

**Course Description:** The investigation and measurement of spectra produced when matter interacts with or emits electromagnetic radiation, including an introduction to X-ray photoelectron spectroscopy, electron energy loss spectroscopy, Raman and infrared, and energy dispersive spectroscopy for materials research.

**Prerequisite:** (MATH 340 or MATH 345) and (MECH 331).

**Registration Information:** Senior standing.

**Term Offered:** Spring.

**Grade Mode:** Traditional.

**Special Course Fee:** No.

### MSE 502E Materials Science & Engineering Methods: Bulk Properties and Performance
**Credit:** 1 (1-0-0)

**Course Description:** Physical properties of materials and how they relate to the functionalization of materials, including their use in electronic, magnetic, optical, and other functional devices.

**Prerequisite:** (MATH 340 or MATH 345) and (MECH 331).

**Registration Information:** Senior standing.

**Term Offered:** Spring.

**Grade Mode:** Traditional.

**Special Course Fee:** No.

### MSE 502F Materials Science & Engineering Methods: Experimental Methods for Materials Research
**Credit:** 1 (1-0-0)

**Course Description:** Modern experimental design methods and techniques for materials research. Topics include vacuum systems, cryogenic experimentation, temperature characterization, data acquisition and digitization, device and circuitry design in the context of materials research.

**Prerequisite:** (MATH 340 or MATH 345) and (MECH 331).

**Registration Information:** Senior standing.

**Term Offered:** Spring.

**Grade Mode:** Traditional.

**Special Course Fee:** No.

### MSE 503 Mechanical Behavior of Materials
**Credits:** 3 (3-0-0)

**Course Description:** The mechanical behavior of metals, polymeric, ceramic, and composite materials in mechanical designs considering multiple factors such as structure, processing, and physical properties. Practical and specific performance analyses of structural materials are examined.

**Prerequisite:** (MSE 501 or MSE 502A or MECH 331) and (MATH 340 or MATH 345).

**Registration Information:** Senior standing. Sections may be offered: Online.

**Term Offered:** Fall.

**Grade Mode:** Traditional.

**Special Course Fee:** No.

### MSE 504 Thermodynamics of Materials
**Credits:** 3 (3-0-0)

**Course Description:** The determination of whether and the means by which a given reaction can occur. Macroscopic and microscopic solid-state thermodynamics with experimental methodologies for characterizing them, with a focus on thermodynamic and statistical mechanical aspects of material structure-property relationships.

**Prerequisite:** (CBE 210 or CHEM 476 or MECH 331 or PH 361) and (MATH 340 or MATH 345).

**Registration Information:** Senior standing.

**Term Offered:** Fall.

**Grade Mode:** Traditional.

**Special Course Fee:** No.

### MSE 505 Kinetics of Materials
**Credits:** 3 (3-0-0)

**Course Description:** The determination of whether and the means by which a given reaction can occur. Macroscopic and microscopic solid-state kinetics with experimental methodologies for characterizing them, with a focus on the kinetic aspects of material structure-property relationships.

**Prerequisite:** MSE 504.

**Registration Information:** Senior standing.

**Term Offered:** Spring.

**Grade Mode:** Traditional.

**Special Course Fee:** No.

### MSE 631 Defects in Crystals
**Credits:** 3 (3-0-0)

**Also Offered As:** MECH 631.

**Course Description:** Mechanics, thermodynamics and kinetics of defects in crystalline solids including point defects, dislocations, and grain boundaries.

**Prerequisite:** None.

**Restriction:** Must be a: Graduate, Professional.

**Registration Information:** Sections may be offered: Online. Credit allowed for only one of the following: MECH 631, MSE 631, or MECH 681A2.

**Term Offered:** Spring.

**Grade Mode:** Traditional.

**Special Course Fee:** No.

### MSE 651 Special Topics in Materials Science
**Credits:** 3 (0-0-3)

**Course Description:** New or emerging topics in materials science and engineering.

**Prerequisite:** MECH 331.

**Restriction:** Must be a: Graduate, Professional.

**Grade Mode:** Traditional.

**Special Course Fee:** No.

### MSE 695 Independent Study
**Credits:** Var[1-5] (0-0-0)

**Course Description:** Independent study of special topics in materials science and engineering.

**Prerequisite:** None.

**Restriction:** Must be a: Graduate, Professional.

**Registration Information:** Written consent of advisor.

**Terms Offered:** Fall, Spring, Summer.

**Grade Mode:** Instructor Option.

**Special Course Fee:** No.

### MSE 699 Thesis
**Credits:** Var[1-6] (0-0-0)

**Course Description:** Thesis in materials science and engineering.

**Prerequisite:** None.

**Restriction:** Must be a: Graduate, Professional.

**Registration Information:** Written consent of advisor.

**Terms Offered:** Fall, Spring, Summer.

**Grade Mode:** Instructor Option.

**Special Course Fee:** No.

### MSE 784 Supervised College Teaching
**Credits:** Var[1-5] (0-0-0)

**Course Description:** Supervised college teaching in materials science and engineering.

**Prerequisite:** None.

**Restriction:** Must be a: Graduate, Professional.

**Registration Information:** Written consent of advisor.

**Terms Offered:** Fall, Spring, Summer.

**Grade Mode:** Instructor Option.

**Special Course Fee:** No.
MSE 793  Professional Development Seminar  Credit: 1 (0-0-1)
Course Description: Professional skills for careers in materials science and opportunities for students to see materials innovation and discovery up-close.
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Registration Information: Required field trips. Restricted to students in MSE graduate programs or by consent of instructor.
Terms Offered: Fall, Spring.
Grade Mode: Instructor Option.
Special Course Fee: No.

MSE 795  Independent Study  Credits: Var[1-5] (0-0-0)
Course Description: Advanced independent study of special topics in materials science and engineering.
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Registration Information: Written consent of advisor.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Instructor Option.
Special Course Fee: No.

MSE 799  Dissertation  Credits: Var[1-12] (0-0-0)
Course Description: Dissertation in materials science and engineering.
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Registration Information: Written consent of advisor.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Instructor Option.
Special Course Fee: No.