MATERIALS SCIENCE AND ENGINEERING

The Materials Science and Engineering Program offers tracks of study in electronic, magnetic and photonics materials, soft materials, structural materials, materials for energy, biomaterials and computational materials science.

Materials science and engineering (MSE) is an interdisciplinary program aimed at providing rigorous education in materials science and engineering and the fundamental physics, engineering, chemistry and biology that underlie this discipline. Educational goals are achieved through both coursework and training in cross-disciplinary research supervised by one or more science and engineering faculty members.

The program offers six unique tracks of study:

- electronic, magnetic and photonics materials
- soft materials
- structural materials
- materials for energy
- biomaterials
- computational materials science

The MSE program is directed by Professor Robert McLeod of the Department of Electrical, Computer and Energy Engineering. For more information, see the Materials Science & Engineering Program (https://www.colorado.edu/mse/) website.

Master's Degree

- Materials Science and Engineering - Master of Science (MS) (catalog.colorado.edu/graduate/colleges-schools/engineering-applied-science/programs-study/materials-science-engineering/materials-science-engineering-master-science-ms/)

Doctoral Degree

- Materials Science and Engineering - Doctor of Philosophy (PhD) (catalog.colorado.edu/graduate/colleges-schools/engineering-applied-science/programs-study/materials-science-engineering/materials-science-engineering-doctor-philosophy-phd/)

Faculty

While many faculty teach both undergraduate and graduate students, some instruct students at the undergraduate level only. For more information, contact the faculty member's home department.

Anseth, Kristi S. (https://experts.colorado.edu/display/fisid_103471/) Distinguished Professor; PhD, University of Colorado Boulder

Betterton, Meredith D. (https://experts.colorado.edu/display/fisid_125396/) Associate Professor; PhD, Harvard University

Borden, Mark A. (https://experts.colorado.edu/display/fisid_148514/) Associate Professor; PhD, University of California, Davis

Bowman, Christopher N. (https://experts.colorado.edu/display/fisid_102043/) Distinguished Professor; PhD, Purdue University

Bryant, Stephanie J. (https://experts.colorado.edu/display/fisid_111810/) Professor; PhD, University of Colorado Boulder

Cao, Gang (https://experts.colorado.edu/display/fisid_157991/) Professor; PhD, Temple University

Cha, Jennifer N. (https://experts.colorado.edu/display/fisid_151746/) Professor; PhD, University of California, Santa Barbara

Clark, Noel A. (https://experts.colorado.edu/display/fisid_101947/) Professor; PhD, Massachusetts Institute of Technology

Dessau, Daniel S. (https://experts.colorado.edu/display/fisid_107532/) Professor; PhD, Stanford University

Ding, Yifu (https://experts.colorado.edu/display/fisid_146088/) Associate Professor; PhD, University of Akron

Dukovic, Gordana (https://experts.colorado.edu/display/fisid_147414/) Associate Professor; PhD, Columbia University

Ferguson, Virginia L. (https://experts.colorado.edu/display/fisid_110131/) Associate Professor; PhD, University of Colorado Boulder

George, Steven (https://experts.colorado.edu/display/fisid_103289/) Professor; PhD, University of California, Berkeley

Goodwin, Andrew Pratt (https://experts.colorado.edu/display/fisid_151595/) Associate Professor; PhD, University of California, Berkeley

Gopinath, Juliet T. (https://experts.colorado.edu/display/fisid_147075/) Associate Professor; PhD, Massachusetts Institute of Technology

Heinz, Hendrik (https://experts.colorado.edu/display/fisid_156488/) Associate Professor; PhD, ETH Zurich (Switzerland)

Holewinski, Adam P. (https://experts.colorado.edu/display/fisid_155859/) Assistant Professor; PhD, University of Michigan Ann Arbor

Huang, Shu-Wei (https://experts.colorado.edu/display/fisid_159847/) Assistant Professor; PhD, MIT, Cambridge

Hussein, Mahmoud I. (https://experts.colorado.edu/display/fisid_144300/) Professor; PhD, University of Michigan Ann Arbor

Keplinger, Christoph M. (https://experts.colorado.edu/display/fisid_156421/) Assistant Professor; PhD, Johannes Kepler Universität Linz (Austria)

Lee, Minhyea (https://experts.colorado.edu/display/fisid_145209/) Assistant Professor; PhD, University of Chicago

Lee, Sehee (https://experts.colorado.edu/display/fisid_144739/) Professor; PhD, Seoul National University (South Korea)

MacLennan, Joseph E. (https://experts.colorado.edu/display/fisid_104854/) Professor
Materials Science and Engineering

Maute, Kurt (https://experts.colorado.edu/display/fisid_113875/)
Professor; PhD, University of Stuttgart (Germany)

McGehee, Michael D. (https://experts.colorado.edu/display/fisid_163453/)
Professor; PhD, University of California, Santa Barbara

McLeod, Robert R. (https://experts.colorado.edu/display/fisid_107547/)
Professor; PhD, University of Colorado Boulder

Medlin, James William (https://experts.colorado.edu/display/fisid_122699/)
Professor; PhD, University of Delaware

Mickelson, Alan R. (https://experts.colorado.edu/display/fisid_100286/)
Associate Professor; PhD, California Institute of Technology

Moddel, Garret (https://experts.colorado.edu/display/fisid_105440/)
Professor; PhD, Harvard University

Murnane, Margaret (https://experts.colorado.edu/display/fisid_115333/)
Distinguished Professor; PhD, University of California, Berkeley

Murray, Todd W. (https://experts.colorado.edu/display/fisid_146549/)
Professor; PhD, Johns Hopkins University

Musgrave, Charles Bruce (https://experts.colorado.edu/display/fisid_144977/)
Professor; PhD, California Institute of Technology

Nagpal, Prashant (https://experts.colorado.edu/display/fisid_151726/)
Assistant Professor; PhD, University of Minnesota

Nair, Devatha P.
Assistant Professor; PhD, University of Colorado Boulder

Neogi, Sanghamitra (https://experts.colorado.edu/display/fisid_156773/)
Assistant Professor; PhD, Pennsylvania State University

Park, Won (https://experts.colorado.edu/display/fisid_122676/)
Professor; PhD, Georgia Institute of Technology

Pellegrino, John (https://experts.colorado.edu/display/fisid_130902/)
Research Professor; PhD, University of Colorado Boulder

Perkins, Thomas T. (https://experts.colorado.edu/display/fisid_124578/)
Associate Professor Adjunct; PhD, Stanford University

Raj, Rishi (https://experts.colorado.edu/display/fisid_108413/)
Professor; PhD, Harvard University

Regueiro, Richard A. (https://experts.colorado.edu/display/fisid_134705/)
Associate Professor; PhD, Stanford University

Reznik, Dmitry (https://experts.colorado.edu/display/fisid_147659/)
Associate Professor; PhD, University of Illinois at Urbana–Champaign

Rogers, Charles (https://experts.colorado.edu/display/fisid_101331/)
Professor; PhD, Cornell University

Rumbles, Garry (https://experts.colorado.edu/display/fisid_147479/)
Professor Adjoint; PhD, University of London (England)

Smalyukh, Ivan (https://experts.colorado.edu/display/fisid_144757/)
Professor; PhD, Kent State University

Song, Jeong-Hoon (https://experts.colorado.edu/display/fisid_154468/)
Assistant Professor; PhD, Northwestern University

Srubar, Wil V. III (https://experts.colorado.edu/display/fisid_153058/)
Assistant Professor; PhD, Stanford University

Stansbury, Jeffrey W.
Associate Dean; PhD, University of Maryland

Stoldt, Conrad R. (https://experts.colorado.edu/display/fisid_126290/)
Professor; PhD, Iowa State University

Tan, Wei (https://experts.colorado.edu/display/fisid_141464/)
Associate Professor; PhD, University of Illinois at Chicago

van de Lagemaat, Jao (https://experts.colorado.edu/display/fisid_148357/)
Assistant Professor

Vernerey, Franck J. (https://experts.colorado.edu/display/fisid_144760/)
Associate Professor; PhD, Northwestern University

Walba, David M. (https://experts.colorado.edu/display/fisid_105830/)
Professor; PhD, California Institute of Technology

Weimer, Alan W. (https://experts.colorado.edu/display/fisid_109152/)
Professor; PhD, University of Colorado Boulder

White, Timothy J. (https://experts.colorado.edu/display/fisid_163899/)
Professor; PhD, University of Iowa

Whiting, Gregory L. (https://experts.colorado.edu/display/fisid_159727/)
Associate Professor; PhD, University of Cambridge (England)

Xi, Yunping (https://experts.colorado.edu/display/fisid_110518/)
Professor; PhD, Northwestern University

Xiao, Jianliang (https://experts.colorado.edu/display/fisid_149777/)
Assistant Professor; PhD, Northwestern University

Yang, Ronggui (https://experts.colorado.edu/display/fisid_142640/)
Professor; PhD, Massachusetts Institute of Technology

Yin, Xiaobo (https://experts.colorado.edu/display/fisid_153484/)
Associate Professor; PhD, Stanford University

Yu, Liping
Assistant Research Professor

Zhang, Wei (https://experts.colorado.edu/display/fisid_146429/)
Professor; PhD, University of Illinois at Urbana–Champaign

Zunger, Alexander (https://experts.colorado.edu/display/fisid_149868/)
Research Professor; PhD, Tel Aviv Univ (Israel)

Courses

MSEN 5000 (1-3) Fundamentals of Materials Science and Engineering
Discusses fundamental topics in materials science and engineering.
**Requisites:** Restricted to graduate students only.
**Grading Basis:** Letter Grade
MSEN 5064 (3) Soft Machines
Introduces soft machines as a new paradigm of engineering that starts to impact healthcare, consumer electronics, renewable energy and collaborative robotics. Prepares students to participate in research on soft machines by starting with fundamentals of soft materials and by covering soft robotics, stretchable electronics, energy harvesting and functional polymers. Includes guest lectures, a literature review and a hands-on lab project.
Equivalent - Duplicate Degree Credit Not Granted: MCEN 4046 and MCEN 5046
Requisites: Restricted to students with 87-180 credits (Senior, Fifth Year Senior) Mechanical (MCEN) majors or College of Engineering graduate students only.
Grading Basis: Letter Grade

MSEN 5370 (3) Materials Thermodynamics
Reviews thermodynamics fundamentals and applies them to understand the chemical, thermal and mechanical behavior of materials. Examines equations of state, solution theory, equilibrium diagrams and phase changes.
Requisites: Restricted to graduate students only.
Grading Basis: Letter Grade

MSEN 5430 (3) Transmission Electron Microscopy in Materials Science & Engineering
This course provides a comprehensive introduction to transmission electron microscopy (TEM) as a powerful characterization tool in materials science. It is aimed at beginners and intermediate users of TEM and covers both the theoretical and practical aspects of advanced electron microscopy techniques. By taking this course, students will be able to interpret and analyze TEM data and understand electron microscopy publications. Students will learn the necessary theoretical basis for taking practical training on modern aberration-corrected TEMs. Previously offered as a special topics course. Recommended Prerequisite: Experience on electron microscopy is recommended but not necessary.
Requisites: Restricted to students with 87-180 credits (Senior, 5th Yr Senior) or graduate students only.
Grading Basis: Letter Grade

MSEN 5470 (3) Materials Composition and Structure
The synthesis, organization, and processing of materials can enable functional performance. Curriculum will overview the synthesis and design of functional organic and inorganic materials. A particular emphasis will be placed on structure-performance correlations between chemistry and materials organization. Topical foci will include polymers, biomaterials, and materials for energy.

MSEN 5840 (1-6) Independent Study
Offers an opportunity for students to do independent work. Subject arranged to fit the needs of the student.
Repeatable: Repeatable for up to 30.00 total credit hours.
Requisites: Restricted to MS and PhD students in the Materials Science and Engineering program (MTEN) only.

MSEN 6950 (1-6) Master's Thesis
Repeatable: Repeatable for up to 6.00 total credit hours.
Requisites: Restricted to MS students in the Materials Science and Engineering program (MTEN) only.

MSEN 8990 (1-10) Doctoral Dissertation
Repeatable: Repeatable for up to 30.00 total credit hours.
Requisites: Restricted to PhD students in the Materials Science and Engineering program (MTEN) only.