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_155421/) 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
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

Pellegriino, 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 Adjoint; 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)

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

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 5919 (1-5) Special Topics in MSE
Offers an opportunity for special topics in MSE. Subject arrangement to
fit the needs of the program.
Repeatable: Repeatable for up to 10.00 total credit hours. Allows multiple
enrollment in term.
Requisites: Restricted to graduate students 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.