MATERIALS SCIENCE (MS)

Degrees Offered: Ph.D., M.S.

This program is offered in Durham.

The materials science program offers the master of science degree in materials science and doctor of philosophy degree in materials science and engineering. The program offers research opportunities over a broad range of areas including synthesis and characterization of thin films, fullerenes and nanotubes, molecular templates, self-organizing nanostructures, polymers and polymer nanoparticles, using scanning probe microscopy, physical and chemical vapor deposition methods, micromechanics, molecular beam mass spectrometry, and computational methods.

Admission Requirements

Admission to the Master of Science and Doctor of Philosophy degree programs is based upon a strong undergraduate record. A minimum GPA of 3.0 is required, but undergraduate students with exceptional experience or other mitigating factors will also be considered. Except under special circumstances, applicants must submit current scores (within five years) from the general test of the Graduate Record Examination (GRE). Since materials science is an interdisciplinary field, students from mechanical engineering, chemical engineering, electrical engineering, chemistry, mathematics, physics, and other engineering- and science-related disciplines will be considered, however, at least one undergraduate introductory course in materials science should be completed before entering the program. The applicant's undergraduate program should also include, as a minimum, two semesters of calculus and preferably an additional course in differential equations. Members of the faculty are available to evaluate each student's undergraduate curriculum. A series of appropriate courses will be required for those students with deficiencies in their undergraduate program.

Qualified physics students at the University of New Hampshire may be admitted to an accelerated program leading to a combined Bachelor of Science degree in physics and a Master of Science in Materials Science within a total of five years. Please consult the materials science website for details.

https://ceps.unh.edu/materials-science

Programs

- Materials Science and Engineering (Ph.D.)
- Materials Science (M.S.)

Courses

Materials Science (MS)

MS 830 - Mechanical Behavior Materials
Credits: 4
Elastic and inelastic behavior of materials in terms of micro- and macro-mechanics. Stress, strain and constitutive relations related to recent developments in dislocation theory and other phenomena on the atomic scale and to the continuum mechanics on the macroscopic scale. Elasticity, plasticity, viscoelasticity, creep, fracture, and damping. Anisotropic and heterogeneous materials. Prereq: Mechanics II, Introduction to Materials Science; or permission. Lab.
Equivalent(s): ME 830
Grade Mode: Letter Grade

MS 861 - Diffraction and Imaging Methods in Materials Science
Credits: 0 or 4
Introduction to x-ray diffraction and electron microscopy. Basic crystallography; reciprocal lattice; x-ray and electron diffraction, x-ray methods; transmission and scanning electron microscopy. Prereq: General Chemistry, General Physics II, or permission. Lab.
Equivalent(s): ME 861
Grade Mode: Letter Grade

MS 862 - Electronic Materials Science
Credits: 4
This course provides engineering and science students with a foundation in the materials science of modern electronic devices. Topics include bonding and structure of solids, electrical and thermal conduction, elements of quantum mechanics, band theory of electrons in solids, semiconductors, magnetism, dielectrics and superconductors. Examples of applications are taken primarily from the fields of semiconductor electronics and nanotechnology, and illustrate how the electrical and optical properties of devices are obtained from their compositions, crystal structures and microstructures. Permission of instructor required.
Equivalent(s): ME 862
Grade Mode: Letter Grade

MS 895 - Special Topics
Credits: 2-4
New or specialized courses and/or independent study. May be repeated for credit.
Grade Mode: Letter Grade

MS 898 - Master's Project
Credits: 1-3
Students complete an independent project and submit a written report. Students can choose from a range of projects, including but not limited to an experimental, theoretical, or computational research project, an extensive literature review on an advanced materials science topic, or developing a new method in materials synthesis, processing, or characterization.
Repeat Rule: May be repeated for a maximum of 3 credits.
Grade Mode:

MS 899 - Master's Thesis
Credits: 1-6
Cr/F.
Repeat Rule: May be repeated for a maximum of 6 credits.
Grade Mode:

MS 900 - Seminar
Credits: 1
Topics of interest to graduate students and faculty; reports of research ideas, progress, and results; lectures by outside speakers. Continuing course: instructor may assign IA (continuous grading) grade at the end of one semester.
Repeat Rule: May be repeated for a maximum of 2 credits.
Grade Mode: Letter Grade

MS 905 - Macromolecular Synthesis
Credits: 3
Fundamentals of polymerization reaction mechanisms, kinetics, and chain structures as they are developed from the different chemistries available. Detailed discussions of the chemical mechanisms of step, free radical, ionic, and ring opening polymerizations. Treatment of the reaction parameters that control the rate of polymerization, molecular weight and chemical composition of the polymer chains. Introduction to stereo-chemical and catalytic polymerizations. Considerations of bulk, solution, and dispersion polymerization systems. Permission of instructor required. Open to Biochemistry, Chemical Engineering, Engineering: Chemical, Chemistry, Mechanical Engineering, Engineering: Mechanical, Materials Science, Engineering: Mat Science, and Physics majors only.
Grade Mode: Letter Grade

MS 910 - Macromolecular Characterization
Credits: 3
Molecular characterization of synthetic and natural macromolecules in solution and in the solid state. Emphasis on the principles of various analytical techniques designed to provide information on the chemical composition, polymer chain size and structure in solution and in the dry state. Extension to methods that measure the interaction and association between polymer molecules. Interpretations of data from important characterization techniques including liquid chromatography (GPC), spectroscopy (FTIR, NMR, MS), microscopy (TEM, AFM, Confocal Raman), thermal analysis (DSC), light scattering, sedimentation, and x-ray diffraction. Permission of instructor required. (Also listed as BCHM 950). Open to Biochemistry, Chemical Engineering, Engineering: Chemical, Chemistry, Chem: Chemistry Education, Mechanical Engineering, Materials Science, Engineering: Mat Science, and Physics majors only.
Equivalent(s): BCHM 950
Grade Mode: Letter Grade

MS 960 - Thermodynamics and Kinetics of Materials I
Credits: 3
Classical and statistical thermodynamics are used to establish the conditions of equilibrium for simple and multi-component, heterogeneous materials. Additionally, the thermodynamics of phase diagrams, miscibility, interfaces, and defects are explored. Examples and problems apply these concepts to various types of materials, including metals, ceramics, and polymers.
Grade Mode: Letter Grade

MS 961 - Thermodynamics and Kinetics of Materials II
Credits: 3
Introduction to diffusion and phase transformations in materials, and detailed descriptions of interfacial regions. Mechanisms of phase separation by spinodal decomposition and homogeneous nucleation. Kinetic processes leading to changes in phase structure driven by chemical reaction, temperature and diffusive processes (e.g. Ostwald ripening) are treated quantitatively. Applications to metals, ceramics and polymers. Prereq: Thermodynamics and Kinetics of Materials I.
Equivalent(s): ME 961
Grade Mode: Letter Grade

MS 995 - Graduate Special Topics
Credits: 2-4
Investigation of graduate-level problems or topics in Materials Science.
Grade Mode: Letter Grade

MS 999 - Doctoral Research
Credits: 0
Cr/F.
Grade Mode:

Faculty

See https://ceps.unh.edu/directory/all for faculty.