Proposal for an Undergraduate Minor in Materials Science and Engineering

Materials Science and Engineering (MSE) is an interdisciplinary field that applies the fundamental knowledge of the physical sciences to create engineering innovations. In general, "engineering" implies actively designing a system for a given application; MSE enables the design of systems from the atoms up. MSE focuses on the interrelationship between a materials structure, from the subatomic- to the macro-scale, and the properties or behaviors that the material exhibits. Materials synthesis and processing techniques enable engineers to control and change the material structure in order to obtain the desired properties. Understanding the structure-properties-processing relationship requires a fundamental understanding of the underlying chemistry and physics, and is key to obtaining materials with the desired performance for engineering applications in a wide variety of fields, from computing to medicine to energy.

The proposed minor in MSE builds upon the fundamental insights into material structure and properties gained through required introductory courses in chemistry and materials science. Students then select at least two courses from specialization "pick lists" to gain depth in a particular application area. A free elective provides the opportunity to gain additional depth in the fundamentals or exposure to another application area.

For more information contact the advisor for the Minor in Materials Science and Engineering: Prof. Katharine Flores (MEMS), floresk@wustl.edu.

Requirements for the minor in MSE: 3 required course, 2 courses from specialization "pick lists", 1 free elective (17 credits). Some courses have prerequisites. Students will be approved for the minor after discussing appropriate course selection with the advisor for the minor.

Required courses[1]:

Chem 111A General Chemistry I (3 credits)
Chem 151 General Chemistry Laboratory I (2 credits)
MEMS 3610 Materials Science (3 credits) OR EECE 305 Materials Science (3 credits)

Specialization "pick lists":

Students should select at least 2 courses from any one of the following categories:

Structural Materials:

MEMS 3601 Materials Engineering (3)
MEMS 5506 Experimental Methods in Solid Mechanics (3)
MEMS 5507 Fatigue and Fracture Analysis (3)
MEMS 5560/BME 4904 Interfaces and Attachments in Natural and Engineered Structures (3)
MEMS 5601 Mechanical Behavior of Materials (3)
MEMS 5602 Non-metallics (3)
MEMS 5605 Mechanical Behavior of Composites (3)

[1] Students majoring in Geology, Geophysics, Geochemistry, or Environmental Earth Science may substitute EPS 352, Earth Materials, for the required combination of Chem 111A and Chem 151. In this case, EPS 352 may not be used to fulfill the specialization pick list or free elective requirements.

Electronic/Optical Materials:

Chem 542 Special Topics in Inorganic Chemistry: The Chemistry of Energy Storage (3)
Chem 543 Physical Properties of Quantum Nanostructures (3)
ESE 336 Principles of Electronic Devices (3)
ESE 531 Nano and Micro Photonics (3)
ESE 536 Introduction to Quantum Optics (3)
MEMS 463 Nanotechnology Concepts and Applications (3)
MEMS 5609 Electronic Materials Processing (3)
MEMS 5611/CSE 506M/EECE 595 Principles and Methods of Micro and Nanofabrication (3)
Phys 472 Solid State Physics (3)

Biomaterials/Soft Materials:

BME 461 Protein Structure and Dynamics (3)
BME 523 Biomaterials Science (3)
EECE 596 Computational Chemistry of Molecular and Nanoscale Systems (3)
MEMS 5560/BME 4904 Interfaces and Attachments in Natural and Engineered Structures (3)
MEMS 5606 Soft Nanomaterials (3)
MEMS 5607 Introduction to Polymer Blends and Composites (3)
MEMS 5608 Introduction to Polymer Science and Engineering (3)

Materials for Energy and Environmental Technologies:

Chem 542 Special Topics in Inorganic Chemistry: The Chemistry of Energy Storage (3)
EECE 504 Aerosol Science and Technology (3)
EECE 505 Aquatic Chemistry (3)
EECE 571 Industrial and Environmental Catalysis (3)

Natural Materials:

EPS 336 Minerals and Rocks in the Environment (3)
EPS 352 Earth Materials (5)
EPS 567 Planetary Materials (3)

Free electives:

To complete the minor, students may select one additional course from the categories above, or from the list of courses below.

Chem 465 Solid-State and Materials Chemistry (3)
EECE 418 Principles of Surface and Colloid Science (3)
EECE 420 Properties of Materials (3)
MEMS 4101 Manufacturing Processes (3)
MEMS 5102 Materials Selection in Design (3)
MEMS 5603 Materials Characterization Techniques I (3)
MEMS 5604 Materials Characterization Techniques II (3)
MEMS 5610 Quantitative Materials Science & Engineering (3)
MEMS 5612 Atomistic Modeling of Materials (3)
MEMS 5801 Micro-Electro-Mechanical Systems I (3)
Phys 217 Introduction to Quantum Physics (3)
Phys 318 Introduction to Quantum Physics II (3)
Phys 537 Thermodynamics and Kinetics of Materials (3)