The Department of Materials Science and Engineering is jointly operated by the Dwight Look College of Engineering and College of Science. The department offers Master of Science, Master of Engineering and Ph.D. degrees and has more than 100 graduate students currently in the program who are working on a wide range of materials-related interdisciplinary research projects. This multidisciplinary department includes faculty members from several disciplines, including aerospace engineering, biology, biomedical engineering, chemical engineering, chemistry, electrical engineering, mechanical engineering, nuclear engineering and physics. Many of today's most pressing scientific problems stem from the limitations of materials currently available, and this department is at the forefront of new knowledge and discovery at Texas A&M University.

What is Materials Science and Engineering?

Materials science and engineering involves the characterization of the physical and chemical properties of solid materials—metals and alloys, ceramics, magnetic materials, polymers, optical materials, semiconductors, superconductors, and composites—for the purpose of using, changing, or enhancing inherent properties to create or improve end products. Materials science and engineering involves examining how the microstructure (crystalline or amorphous) of a material can be changed to influence the strength, electrical conductivity, optical, or magnetic properties of a material. This field is inherently multidisciplinary, encompassing mechanical, chemical, biomedical, civil, electrical, and aerospace engineering; physics; and chemistry.

Materials science comprises the study of materials from the macro to the atomic scale—from highway building materials to carbon nanotubes—but, independent of scale, the study of materials is concerned fundamentally with the effect of structure and chemistry on the properties of materials. Materials have historically been so important that different eras of civilization were named according to the materials from which tools were fabricated; for example, the Stone Age, the Bronze Age, and the Iron Age. The development of the semiconductor spawned the modern era of information technology often called the Silicon Age. Advances in materials science might make this new millennium the Biomaterials/Nanomaterials/Optical Materials Age.

What do Materials Scientists and Engineers do?

In industry, materials scientists and engineers work with natural or synthetic materials and, most often, with combinations of materials, to improve existing products or to develop novel products. For instance, at Intel, the developer of the processing chip used in most PCs, materials scientists optimize the materials used in chip packaging, balancing differing coefficients of thermal expansion, heat dissipation, brittleness and compliancy, and cost for optimum performance and economic feasibility.

Other materials scientists are on the forefront of the revolution in biotechnology, developing materials for the components of artificial joints, heart valves, and other replacement body parts. Smart materials show a tremendous potential in medical and dental applications, such as compressible stents that reform to their intended shape upon contact with body heat once inserted into an artery, ceramic cement for bone repair, or shape-memory alloys to correct misplaced teeth or spine curvature. (Smart materials have one or more properties that can be dramatically altered, such as multiviscosity oil, with a viscosity that varies with temperature.)

Related research involves developing smaller and more reliable components, such as ferromagnetic activators acting as tiny machines in military and other applications. In aerospace engineering, materials scientists are developing airframe and fuselage materials with high strength-to-weight ratios, as well as developing smart materials into integrated sensors and actuators for reconfigurable wings and other adaptive structures.

For more information, visit the Department of Materials Science and Engineering (http://engineering.tamu.edu/materials) website.

Faculty

Arroyave, Raymundo, Associate Professor
Materials Science & Eng
PhD, Massachusetts Institute of Technology, 2004

Cagin, Tahir, Professor
Materials Science & Eng
PhD, Clemson University, 1988

Castaneda-Lopez, Homero, Associate Professor
Materials Science & Eng
PHD, Penn State University, 2001

Creasy, Terry, Associate Professor
Materials Science & Eng
PhD, University of Delaware, 1997

Hartwig, Karl, Professor
Materials Science & Eng
PhD, University of Wisconsin-Madison, 1977

Karaman, Ibrahim, Professor
Materials Science & Eng
PhD, University of Illinois at Urbana-Champaign, 2000

Liu, Li, Research Assistant Professor
Materials Science & Eng
PhD, Northwestern University, 2005

Needleman, Alan, Professor
Materials Science & Eng
PhD, Harvard University, 1971

Ozmetin, Ali, Research Assistant Professor
Materials Science & Eng
PHD, Texas A&M University, 2009

Qian, Xiaofeng, Assistant Professor
Materials Science & Eng
PhD, Massachusetts Institute of Technology, 2008

Radovic, Miladin, Associate Professor
Materials Science & Eng
PhD, Drexel University, 2001
Shamberger, Patrick, Research Assistant Professor
Materials Science & Eng
MS, University of Washington, 2010

Su, Hung-Jue, Professor
Materials Science & Eng
PhD, University of Michigan, 1988

Sukhishvili, Svetlana, Professor
Materials Science & Eng
PHD, Moscow State University, 1989

Young, Amanda, Tees Associate Research Scientist
Materials Science & Eng
PHD, Texas A&M University, 2008

**Minors**
- Materials Science and Engineering Minor

**Courses**

**MSEN 201 Introduction to Materials Science**
Credits 3. 3 Lecture Hours.
Processing, structure, properties and performance in materials; materials structure and defects over many orders of scale; mechanical, thermal, electrical, magnetic and optical properties.
Prerequisites: CHEM 102 or CHEM 104 or CHEM 107; PHYS 218.

**MSEN 285 Directed Studies**
Credits 1 to 4. 1 to 4 Other Hours.
Directed study of selected problems in the area of materials science and engineering. May be taken for credit 4 times.
Prerequisite: Approval of instructor.

**MSEN 289 Special Topics In...**
Credits 1 to 3. 1 to 3 Lecture Hours. 0 to 3 Lab Hours.
Selected topics in an identified area of materials science and engineering. May be repeated for credit.
Prerequisite: Approval of instructor.

**MSEN 310 Structure of Materials**
Credits 3. 3 Lecture Hours.
Symmetry, unit cell and the atomic structure of crystalline and non-crystalline materials; the bonding forces and energy for van der Waals, metallic, ionic and covalent crystals.
Prerequisites: MSEN 201 or approval of instructor; junior or senior classification.

**MSEN 410 Materials Processing**
Credits 3. 3 Lecture Hours.
Synthesis, properties and processing of technologically important inorganic materials (metals and ceramics); includes thermodynamics and kinetics of different materials processing methods, casting, deformation processing, heat treatments, powder processing and sintering, coating and thin films processing, etc.
Prerequisites: MSEN 201 or approval of instructor; junior or senior classification.

**MSEN 420 Polymer Science**
Credits 3. 3 Lecture Hours.
Polymer structure, processing, property characterization at the molecular, microscopic and macroscopic dimensional levels for thermosets, thermoplastics, elastomers, fibers and advanced non-particle filled composites and smart multi-performance structures.
Prerequisites: MSEN 201 or MEEN 222 or AERO 213 or CHEN 313; junior or senior classification.

**MSEN 460 Electronic, Optical and Magnetic Properties of Materials**
Credits 3. 3 Lecture Hours.
Prerequisites: MSEN 201 or approval of instructor; junior or senior classification.

**MSEN 485 Directed Studies**
Credits 1 to 4. 1 to 4 Other Hours.
Directed study of selected problems in the area of materials science and engineering. May be taken four times for credit.
Prerequisite: Approval of instructor.

**MSEN 489 Special Topics In...**
Credits 1 to 4. 1 to 4 Lecture Hours. 0 to 4 Lab Hours.
Selected topics in an identified area of materials science and engineering. May be repeated for credit.
Prerequisite: Approval of instructor.

**MSEN 491 Research**
Credits 1 to 4. 1 to 4 Other Hours.
Research conducted under the direction of a faculty member in materials science and engineering. May be taken four times for credit.
Prerequisites: Junior or Senior classification or approval of instructor.