DEPARTMENT OF MATERIALS SCIENCE AND ENGINEERING

The Department of Materials Science and Engineering is jointly operated by the College of Engineering and College of Arts and Sciences.

The department offers Bachelor of Science, Master of Engineering, Master of Science, and Doctor of Philosophy degrees. 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: 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 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 at the forefront of the revolution in biotechnology, developing materials for the components of artificial joints, heart valves, and other replacement body parts. Smart materials in medical and dental applications show tremendous potential, 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 multi-viscosity 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 and developing smart materials into integrated sensors and actuators for reconfigurable wings and other adaptive structures.

Why is Materials Science and Engineering Important?

Many of the technologies that we need to solve pressing societal problems (efficient energy generation, access to clean water, information processing and storage, safe and efficient transportation, as examples) are fundamentally limited by the materials that we have available to us. Materials scientists and engineers are critical to discovering new materials to advance these technologies.

Materials Science and Engineering at Texas A&M University

The face of materials science and engineering is continuously evolving. Currently, there is massive interest domestically and internationally in new manufacturing processes (3-D printing, additive manufacturing, etc.) and in utilizing computational and informatics approaches to intelligently and rapidly design new materials. Here at Texas A&M, our faculty embrace these new aspects while maintaining vigorous educational and research efforts in the classical core tenants of materials structure, thermodynamics, and kinetics.

For more information, visit the Department of Materials Science and Engineering website.

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Majors

- Bachelor of Science in Materials Science and Engineering (http://catalog.tamu.edu/undergraduate/engineering/materials-science/bs/)

Minors

- Materials Science and Engineering Minor (http://catalog.tamu.edu/undergraduate/engineering/materials-science/minor/)

Certificates

- Corrosion Science and Engineering Certificate (http://catalog.tamu.edu/undergraduate/engineering/materials-science/corrosion-science-engineering-certificate/)
- Polymer Specialty Certificate (http://catalog.tamu.edu/undergraduate/engineering/materials-science/polymer-specialty-certificate/)