

## CAREERS in Chemistry



### Materials Scientist

Almost everything we use or wear is composed of materials. Materials can include metals, ceramics, polymers, semiconductors, and composites. Metals have been used for thousands of years. Metals are good conductors of heat and electricity. They are strong but deformable. Ceramics are typically compounds made up of both metals and nonmetals. Usually, ceramics are insulators and are resistant to high temperatures. Examples of products that contain ceramics are dishes, building materials, bone and tooth replacements, and high-speed communications equipment. Polymers are generally organic compounds and have very large molecular structures. Polymer products include toys, storage containers, paints, and biomedical items; plastics (polymers) are everywhere. The electrical properties of semiconductors are between those of conductors and insulators. Computers, calculators, and cell phones are just a few examples of products that use semiconductors. Composites, such as ceramics and polymers, are found in flooring, tiles, bicycles, space shuttles, and insulation.

Materials science includes the study of the processing, structure, properties, and performance of materials. Processing involves manufacturing the material from its raw components. Structure refers to the arrangement of the material's components from an atomic to a macro scale. Understanding the structure helps materials scientists develop

new materials that have the desired properties. Typical properties of interest are mechanical, such as tensile strength or hardness; electrical, such as conductivity or resistivity; magnetic, such as magnetic susceptibility; optical, such as refractive index; thermal, such as heat capacity or thermal conductivity; and environmental, such as corrosion behavior. Performance testing and analysis ensures that the product has the desired properties. Because a property or a structural characterization of a material closely depends on the processing used, evaluation often improves the process used to make the material.

#### Careers in Materials Science

Materials scientists go by many different titles, such as process or production engineers, research scientists, metallurgists, polymer scientists, ceramic engineers, plant managers, and quality control engineers. Materials scientists are employed in industries such as transportation, electronics, aerospace, and biomedical engineering or work for research laboratories, the government, or universities. Materials scientists help determine what materials should be used in products based on desired properties, help synthesize new materials, and help produce these materials efficiently.

Because of the interdisciplinary nature of this field, many kinds of programs, disciplines, or majors can prepare a person for a career in materials



▲ *Materials scientists study the microstructure of materials, testing how they behave under various conditions.*

science. An undergraduate degree in materials science and engineering, chemistry, physics, or engineering can lead to a career in this field. Many materials scientists obtain a more advanced degree, such as a master's degree in materials science and engineering or a doctorate (Ph.D.) in chemistry, physics, or engineering.

The materials field is exciting and expanding. The ability to create materials to meet specific needs is just starting to be realized. With the developing field of materials science, many say we are living in the Materials Age.

#### Questions

1. Choose a product you might use in your daily life. Discuss the materials that compose the product and the properties that those materials give the product.
2. Using the Internet, find a profile of a materials scientist or engineer, and describe what that scientist or engineer does in her or his position.