Introduction & Classification of Materials

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Content

According to the content, this text mainly contains the following three parts:

- Part 1: Basic classification and engineering Materials
- Part 2: Advanced materials
- Part 3: Modern Materials Needs

Part 1: Basic classification and engineering Materials

Look through the Part 1 quickly with following questions:

- How many groups can solid materials be conveniently divided into?
- How many classifications can engineering materials be grouped into?

FQA:

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Solid materials have been conveniently grouped into three basic classifications: **metals, ceramics and polymers.**

FQA:

- How many classifications can engineering materials be grouped into?

In addition, there are three other groups of important engineering materials--**composites, semiconductor and biomaterials.**

Basic classification and engineering Materials

Solid materials have been conveniently grouped into three basic classifications: metals, ceramics and polymers. This scheme is based primarily on chemical makeup and atomic structure, and most materials fall into one distinct grouping or another, although there are some intermediates. In addition, there are three other groups of important engineering materials—composites, semiconductor, and biomaterials. Composites consist of combinations of two or more different materials, whereas semiconductors are utilized because of their unusual electrical characteristics; biomaterials are implanted into the human body. A brief explanation of the material types and representative characteristics is offered next.

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Basic classification and engineering Materials

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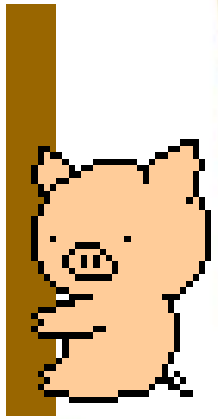
Metals:

- Can you give a definition to the metals?
- What are the representative characteristics of metals?

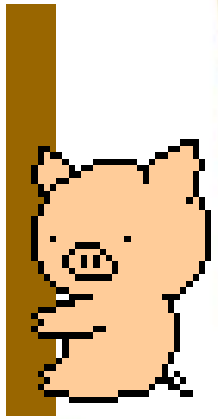


Metals:

Metals: Metallic materials are normally combinations of metallic elements. They have large numbers of nonlocalized electrons; that is, these electrons are not bound to particular atoms. Many properties of metals are directly attributable to these electrons. Metals are extremely good conductors of electricity and heat, and are not transparent to visible light; a polished metal surface has a lustrous appearance. Furthermore, metals are quite strong, yet deformable, which accounts for their extensive use in structural applications.

Ceramics:

- Can you give a definition to the ceramics?
- What are the representative characteristics of ceramics?



Ceramics:

Ceramics: Ceramics are compounds between metallic and nonmetallic elements; they are most frequently oxides, nitrides, and carbides. The wide range of materials that falls within this classification includes ceramics that are composed of clay minerals, cement, and glass. These materials are typically insulative to the passage of electricity and heat, and are more resistant to high temperatures and harsh environments than metals and polymers. With regard to mechanical behavior, ceramics are hard but very brittle.

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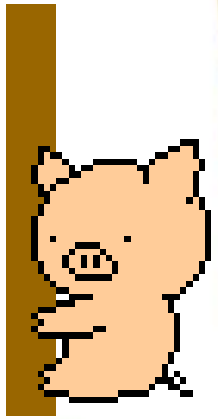
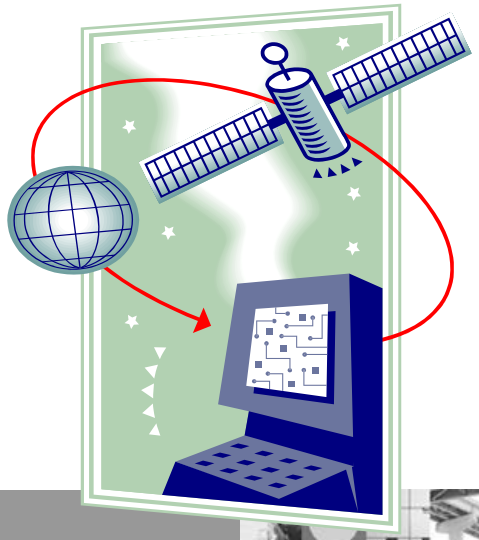


Polymer:

Polymers: Polymers include the familiar plastic and rubber materials. Many of them are organic compounds that are chemically based on carbon, hydrogen, and other nonmetallic elements; furthermore, they have very large molecular structures. These materials typically have low densities and may be extremely flexible.

Composites:

Composites: A number of composite materials have been engineered that consist of more than one material type. Fiberglass is a familiar example, in which glass fibers are embedded within a polymeric material. A composite is designed to display a combination of the best characteristics of each of the component materials. Fiberglass acquires strength from the glass and flexibility from the polymer. Many of the recent material developments have involved composite materials.



Composites

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Part 1: Basic classification and engineering Materials

semiconductors

Semiconductors: Semiconductors have electrical properties that are intermediate between the electrical conductors and insulators. Furthermore, the electrical characteristics of these materials are extremely sensitive to the presence of minute concentrations of impurity atoms, which concentrations may be controlled over very small spatial regions. The semiconductors have made possible the advent of integrated circuitry that has totally revolutionized the electronics and computer industries over the past two decades.

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Part 1: Basic classification and engineering Materials

Biomaterials

Biomaterials: Biomaterials are employed in components implanted into the human body for replacement of diseased or damaged body parts. These materials must not produce toxic substances and must be compatible with body tissue (i. e. must not cause adverse biological reactions). All of the above materials—metals, ceramics, polymers, composites and semiconductors—may be used as biomaterials. For example, some of the biomaterials such as CF/C (carbon fibers/carbon) and CF/PS (polysulfone) are utilized in artificial hip replacements.

FQA:

What are advanced materials?

Materials that are utilized in **high-technology** (or high-tech) applications **are** sometimes **termed** advanced materials.

Part 2: Advanced Materials

Materials that are utilized in high-technology (or high-tech) applications are sometimes termed advanced materials. By high technology we mean a device or product that operates or functions using relatively intricate and sophisticated principles; examples include electronic equipment (VCRs, CD players, etc.), computers, fiberoptic systems, spacecraft, aircraft, and military rocketry. These advanced materials are typically either traditional materials whose properties have been enhanced or newly developed, high-performance materials. Furthermore, they may be of all material types (e.g. metals, ceramics, polymers), and are normally relatively expensive.

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Part 3: Modern Materials needs

- ***In spite of*** the tremendous progress that has been made in the discipline of materials science and engineering within the past few years, ***there still*** *remain* technological challenges, including the development of even more sophisticated and specialized materials, as well as consideration of the environmental impact of materials production.

Modern Materials Needs

- Nuclear energy holds some promise, but the solution to the many problems that remain will necessarily involve materials …

- Significant quantities of energy are involved in transportation…..New high strength, low-density structural materials remain to be developed, as well as materials that have higher-temperature capabilities, for use in engine components.

Modern Materials Needs

- Furthermore, there is a recognized need to find new, economical sources of energy, and to use the present resources more efficiently. Materials will undoubtedly play a significant role in these developments….
- Additionally, environmental quality depends on our ability to control air and water pollution. Pollution control techniques employ various materials.


Goodbye!
音樂，
風很暖，
花好香，
帶我進入一個
天空好大，
美麗新世界。
世界好美