材料工程技术专业英语

SPECIAL ENGLISH FOR MATERIAL ENGINEERING TECHNOLOGY

武丽华 主编

化学工业出版社

材料工程技术专业英语

SPECIAL ENGLISH FOR MATERIAL ENGINEERING TECHNOLOGY

武丽华　主编　　孟秀华　陈国强　安晓燕　副主编

化学工业出版社

本书共分为 6 个教学单元，每个单元由多篇课文和一篇课外阅读组成，分别介绍水泥、玻璃、混凝土、玻璃钢、建筑材料等的材料性能、组成、生产工艺等，重点介绍材料的生产工艺和设备。每篇课文后都附有形式多样的练习题，力求实用、简单。附录部分有英文元素周期表及各类材料分类的词汇表，方便读者查阅。

本书可作为高等院校材料工程技术及相关专业的英语教材及参考书，也可作为生产企业的培训教材。

图书在版编目（CIP）数据

材料工程技术专业英语/武丽华主编. —北京：化学工业出版社，2014. 1

ISBN 978-7-122-19023-9

Ⅰ.①材… Ⅱ. ①武… Ⅲ. ①工程材料-英语-高等学校-教材 Ⅳ. ①H31

中国版本图书馆 CIP 数据核字（2013）第 274611 号

责任编辑：吕佳丽　　装帧设计：韩　飞

责任校对：顾淑云

出版发行：化学工业出版社（北京市东城区青年湖南街 13 号　邮政编码 100011）

印　　装：三河市延风印装厂

787mm×1092mm　1/16　印张 10¾　字数 288 千字　　2014 年 2 月北京第 1 版第 1 次印刷

购书咨询：010-64518888（传真：010-64519686）　售后服务：010-64518899

网　　址：http: // www. cip. com. cn

凡购买本书，如有缺损质量问题，本社销售中心负责调换。

定　　价：**28. 00** 元

编写人员名单

主　　编　武丽华

副 主 编　孟秀华　陈国强　安晓燕

编写人员　武丽华　孟秀华　陈国强　安晓燕

　　　　　乔欢欢　王　昱　陈　福

前 言

高职教育要培养生产、服务和管理第一线需要的技能型人才，尤其是在人类信息时代的今天，科学技术日新月异，全球一体化进程迅速推进，而高水平科技信息主要以英语的形式出现。面对日益激烈的全球化市场竞争，中国制造业正在加速产品与设备的更新、改造与提升，企业对人才的需求也在这一方面有所提高，需要一线技术人员、管理人员掌握一定的专业英语知识，以便在引进、操作、维护进口设备时应对自如，在技术更新时能够更好地掌握新技术；在工作过程中，及时掌握最新动态，为职业技能的提高助一臂之力。因此，专业英语应当充分发挥其作用，我们应更好地培养学生对专业英语的理解能力和应用能力，使他们掌握专业阅读必需的专业术语和基本的翻译能力，从而能够以英语为工具获取新的专业科技知识和情报资料，熟练掌握先进生产设备的操作方法。

在高职院校专业英语的教学中，使用难度适中、内容得当的教材尤为重要。我们根据在材料工程技术及相关专业教学实践中的经验和体会，结合材料行业生产现状编写了本教材。本书共分 6 个教学单元，每个单元有多篇课文和一篇课外阅读，课文内容为水泥、玻璃、混凝土、玻璃钢、建筑材料等的材料性能、组成、生产工艺等，重点是材料的生产工艺和设备，每篇课文后附形式多样的练习题，力求实用、简单、趣味。附录部分有英文元素周期表及各类材料分类的词汇表。本书可作为各类高职、大专、成教、中专的材料工程技术及相关专业的英语教材及参考书，也可作为生产企业的培训教材。

本书由河北建材职业技术学院武丽华担任主编，孟秀华、陈国强、安晓燕担任副主编。具体编写分工是：武丽华编写 Unit 1、Unit 2，Unit 4 的 Text 1～Text 6；孟秀华编写 Unit 3；安晓燕编写 Unit 5；陈国强编写 Unit 6 的 Text 1～Text 4；绵阳职业技术学院乔欢欢编写 Unit 6 的 Text 5、Text 6 和课外阅读；四川工商职业技术学院王昱编写 Unit 4 的 Text 7 和课外阅读；秦皇岛玻璃工业研究设计院的陈福编写 Appendix；武丽华对全书进行统稿。本书在编写过程中参考了有关文献的部分资料，在此表示衷心的感谢！

由于编者水平有限，书中难免有疏漏和不妥之处，恳请广大读者、同行和专家批评指正。

编者

2014 年 1 月

Contents

Unit 1

Introduction to materials

Can you answer:

- *What are the properties of materials do we pay attention to?*
- *How many types of stress applied on structure materials are there?*
- *How to classify materials according to the composition or application?*
- *Which materials have good thermal insulating properties?*

Text 1

Types of materials

1 Materials and engineering

Materials are substances of which something is composed or made. Since civilization began, materials along with energy have been used by people to improve their standard of living. Materials are everywhere about us since products are made of materials. Some of the commonly encountered materials are wood (timber), concrete, brick, steel, plastic, glass, rubber, aluminum, copper and paper.

Engineers design most manufactured products and the processing systems required for their production. Since products require materials, engineers should be knowledgeable about the internal structure and properties of materials so that they will be able to select the most suitable ones for each application and be able to develop the best processing methods.

The search for new materials goes on continuously. For example, mechanical engineers search for higher-temperature materials so that jet engines can operate more efficiently. Electrical engineers search for new materials so that electronic devices can operate faster and at higher temperatures. Aerospace engineers search for materials with higher strength-to-weight ratios for aircraft and space vehicles. Chemical engineers look for more highly corrosion resistant materials. These are only a few examples of the search by engineers for new and improved materials for applications. In many cases what was impossible yesterday is a reality today!

2 Types of materials

For convenience most engineering materials are divided into three main classes: metallic, polymeric(plastic), and ceramic materials. In this text we shall distinguish among them on the basis of some of their important mechanical, electrical, and physical properties.

2.1 Metallic materials

These materials are inorganic substances which are composed of one or more metallic elements and may also contain some nonmetallic elements. Examples of metallic elements are iron, copper, aluminum, nickel, and titanium. Nonmetallic elements such as carbon, nitrogen, and oxygen may also be contained in metallic materials. Metals have a crystalline structure in which the atoms are arranged in an orderly manner. Metals in general are good thermal and electrical conductors. Many metals are relatively strong and ductile at room temperature, and many maintain good strength even at high temperatures.

2.2 Polymeric (Plastic) materials

Most polymeric materials consist of organic(carbon-containing) long molecular chains or networks. Structurally, most polymeric materials are noncrystalline but some consist of mixtures of crystalline and noncrystalline regions. The strength and ductility of polymeric materials vary greatly. Because of the nature of their internal structure, most polymeric materials are poor conductors of electricity. Some of these materials are good insulators and are used for electrical insulative applications. In general, polymeric materials have low densities and relatively low softening or decomposition temperatures.

2.3 Ceramic materials

Ceramic materials are inorganic materials which consist of metallic and nonmetallic elements chemically bonded together. Ceramic materials can be crystalline, noncrystalline, or mixture of both. Most ceramic materials have high hardness and high-temperature strength but tend to have mechanical brittleness. Advantages of ceramic materials for engine applications are light weight, high strength and hardness, good heat and wear resistance, reduced friction, and insulative properties.

The insulative property along with high heat and wear resistance of many ceramics make them useful for furnace linings for high-temperature liquid metals such as steel.

In addition to the three main classes of materials, we should consider more other types, such as composite materials and electronic materials, because of their great engineering importance.

2.4 Composite materials

Composite materials are mixtures of two or more materials. Most composite materials consist of a selected filler or reinforcing material and a compatible resin binder to obtain the specific characteristics and properties desired. Composites can be of many types. Some of the predominant types are fibrous (composed of fibers in a matrix) and particulate (composed of particles in a matrix). There are many different combinations of reinforcements and matrices used to produce composite materials. Fiberglass reinforced plastic 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 reinforced plastic acquires strength from the glass and flexibility from the polymer.

2.5 Electronic materials

Electronic materials are not a major type of material by volume but are an extremely important type of material for advanced engineering technology. The most important electronic material is pure silicon which is modified in various ways to change its electrical characteristics.

3 Competition among materials

Materials compete with each other for existing and new markets. Over a period of time many factors arise which make it possible for one material to replace another for certain applications. Certainly cost is a factor.

Figure 1-1 shows graphically how the production of six materials in the United States on a weight basis varied over the past years. Aluminum and polymers show an outstanding increase in production since 1930. The production increases for aluminum, and polymers are even more accentuated since these are light materials.

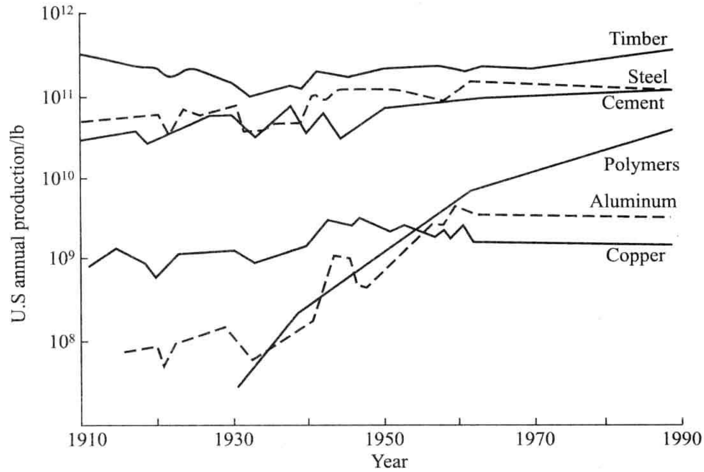

Figure 1-1 Competition of six major materials produced in the United States on a weight (pound) basis

For some applications only certain materials are able to meet the engineering requirements for a design, and these materials may be relatively expensive.

Ceramic materials are low in cost, but their processing into finished products is usually slow and costly. Also, most ceramic materials are easily damaged by impact because of their low or nil ductility. If new techniques for developing high-impact ceramics could be found, these materials could show an upsurge for engineering applications where high-temperature and high-wear environments exist.

4 Summary

The three main types of materials are metallic, polymeric, and ceramic materials. Two other types of materials which are very important for modern engineering technology are composite and electronic materials.

Exercise

The figure below shows the classification of materials. Please choose the best word for each blank.

cement	titanium	glass	polymeric materials
timber	glassfiber reinforced plastic	plastic	concrete
pure silicon	nickel	rubber	ceramic materials
copper	ceramic	aluminum	

- engineering materials
  - metallic materials
    - metal
      - iron
      - ________
      - ________
      - ________
      - ________
    - alloy
      - steel
      - nichrome
  - organic materials (________)
    - pitch
    - ________
    - ________
    - ________
  - inorganic nonmetallic materials (________)
    - refractories
    - ________
    - ________
    - ________
  - composite materials
    - ________
    - ________
  - electronic materials ________

Vocabulary thesaurus for yourself

Words or phrases	Paraphrase	Words or phrases	Paraphrase

Text 2

Properties of materials

1 Introduction

All materials used in structure and machines must have sufficient strength to prevent breakage. In most cases, strength is the primary concern; but in some cases, strength is secondary and the primary concern may be some factor such as stiffness, corrosion resistance, low or high unit weight, resilience, easy machining, appearance, or durability. In addition to mechanical properties, thermal, acoustical, electrical, and magnetic properties may be significant for specific uses.

Tests must be available for determining quantitative properties for proper selection; specifications for the guidance of producers and consumers are based on such tests. The results of the testing of many samples of materials are expressed by statistical methods, or on the basis of probability.

2 Properties of materials

2.1 Stress and strain

Stress is the intensity of the internal distributed forces which resist a change in the form of a body. There are three kinds of elementary stress: tensile, compressive, and shear. Flexure involves the combination of both tensile and compressive stresses. Torsion involves shearing stress.

Ceramic materials have a large difference between their tensile and compressive strengths, with the compressive strengths usually being about 5 to 10 times higher than the tensile strengths.

2.2 Ductility

Ductility pertains to the ability of a material to be deformed by stretching without fracture and without recovery of shape when the applied force is removed. The percentage elongation of a tensile-strength-test specimen is the usual criterion of ductility of metals. A brittle material is nonductile and lacking in toughness. Toughness denotes resistance to impact.

As a class of materials, ceramics are relatively brittle. The observed tensile strength of ceramic materials varies greatly, ranging from very low values of less than 0.69 MPa to about 7×10^3 MPa.

2.3 Plasticity

Plasticity is related to viscosity and denotes the characteristic of a material to remain in a deformed shape when loads that have been applied are removed; thus a plastic material is nonelastic.

Some materials are partly plastic and partly elastic. Some metals become plastic at high temperatures.

2.4 Hardness

Hardness of metals is usually determined by measuring the resistance to penetration of a ball or cone. The Brinell test on steel determines the resistance to indentation of a hardened steel ball 10mm in diameter under a load of 3000 kg (500kg for softer metals). The Brinell hardness scale is based on the ratio of the load in kilograms to the surface area of the indentation in square centimeters.

2.5 Fatigue

Fatigue failure in metals occurs under repeated cyclic stresses due to the nucleation and growth of cracks within a work-hardened area of a specimen. In fatigue tests rotating beam machine is used which produces reversed stress from compression to tension with each half revolution. The endurance limit in fatigue testing is the stress below which the material is able to withstand a great number of repetitions of stress without failure. Overstressing beyond the endurance limit initiates cracking, the damage increasing with percentage of overstress.

2.6 Corrosion

Corrosion is the conversion of metals into compound forms by the action of natural agencies. The presence of oxygen and moisture is required for atmospheric and under water corrosion. Steels and irons rust, producing red oxide of iron. Corrosion prevention is important and may be accomplished by (1) application of paints, bituminous materials, and other coatings or by plating with corrosion-resistant metals, such as zinc, tin, lead, nickel, and chromium; (2) addition of chemicals to liquids to form a natural protective layer on the metal surface; (3) use of relatively pure metals such as "ingot iron" of low carbon content; and (4) by use of corrosion-resisting steels and irons manufactured by alloying with metals such as chromium, nickel, silicon, and copper.

2.7 Thermal properties

In general most ceramic materials have low thermal conductivities due to their strong ionic-covalent bonding and are good thermal insulators. Because of their high heat resistance, ceramic materials are used as refractories, which are materials that resist the action of hot environments, both liquid and gaseous. Refractories are used extensively by the metals, chemical, ceramic, and glass industries.

Exercise

Fill in the blanks with the following words.

corrosion plasticity brittle stress hardness

(1)____________is the intensity of the internal distributed forces which resist a change in the form of a body.

(2)____________ is the conversion of metals into compound forms by the action of natural agencies.

(3)______________ of metals is usually determined by measuring the resistance to penetration of a ball or cone.

(4)___________denotes the characteristic of a material to remain in a deformed shape when loads that have been applied are removed.

(5)A ________ material is nonductile and lacking in toughness.

Vocabulary thesaurus for yourself

Words or phrases	Paraphrase	Words or phrases	Paraphrase

Unit 2

Cement and its manufacture

Can you answer:

- *Do you have any knowledge of cement?*
- *When did cement first be produced?*
- *What about the chemical composition of portland cement?*
- *How many types of cement are there?*
- *What are the processes involved in cement hardening?*
- *How does cement break down?*
- *How to produce cement? What are the main processes?*
- *What are the equipments applied in producing cement?*

Text 1

History of cement

One of the most active areas in scientific research is the development of new and exciting materials for a wide variety of applications. In this text, it could be easy to lose sight of the importance of more common materials that are vitally important in many areas of our lives. Cement is one such material.

Portland cement takes its name from the small peninsula on the south coast of England where the limestone is similar to some extent to Portland cement.

Cements and cement-containing materials comprised some of the first structural materials exploited by humanity, as cement's components are common materials: sand, lime, and water. Its most important property is called hydraulicity—the ability to set and remain insoluble under water. Cement can be used as a mortar to bind large stones or bricks. When sand and stones are added to cement, the aggregate is called concrete.

Natural cementitious materials have existed for very long time; however, synthetic materials were perhaps first used by Egyptians and Chinese thousands of years ago, and the Romans used pozzolanic materials (a volcanic rock in powder form and used to make hydraulic cement) to build the Rome Coliseum. It was only until around 1824 when Joseph Aspdin, bricklayer of England, invented Portland cement by burning finely ground chalk with finely divided clay until carbon dioxide was driven off. The sintered product was ground and named as Portland cement after the building stones quarried at Portland, England.

Cement production dates back to the ancient Romans, who produced mortars using a mixture of lime, volcanic ash, and crushed clay. These cements are referred to as Pozzolanic cements after the pozzuolana region of Italy, which contained Italy's chief supply of ash. Pozzolanic cements derive their strength from rich aluminate phases present in the volcanic cash that promote efficient hydration of the final cement powders. Fine grinding and attention to consistency are also fundamental to the success of Roman cement, much of which is still in existence today in structures such as the Pantheon, the Pont du Gard, and the Basilica of Constantinople.

The art of cement production was lost in Europe after the fall of the Roman Empire. At that time, the access to volcanic ash was limited and the grinding and heating techniques required for cement production were lost.

Cements of this period, if still in existence, are inconsistent in composition. There was no significant breakthrough in the development of cement chemistry until 1756, when Smeaton was commissioned to rebuild the Eddystone lighthouse in Cornwall, England. In contrast to the methods of his contemporaries, Smeaton found superior results through experimentation by using an impure limestone with noticeable clay deposits. This produced extremely strong cement "that would equal the best merchantable Portland stone in solidity and durability.