大学英语应用提高阶段专业英语系列教材

新世纪理工科英语教程

总主编：程月芳　　顾　问：Geoff Thompson （英国）

材料科学与工程 学生用书

主　编：杨福玲

Materials Science and Engineering

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前　言

大学英语教学大纲(修订本)规定大学英语教学分为基础阶段(一至二年级)和应用提高阶段(三至四年级)。应用提高阶段的教学包括专业英语(Subject-Based English，简称SBE)和高级英语(Advanced English，简称AE)两部分。大纲明确指出:“大学英语教学的目的是培养学生具有较强的阅读能力和一定的听、说、写、译能力使他们能用英语交流信息。……以适应社会发展和经济建设的需要。”新世纪对人才在外语方面提出了更高的要求。抓好大学英语应用提高阶段的教学已势在必行。编写本教材的目的是帮助理工科学生在应用提高阶段进一步发展、巩固和提高基础阶段已掌握的读、听、写、说、译五种技能,并使部分有一定口语基础的学生在听说能力方面也能有较大的提高,以适应21世纪对高级人才的需求。

本教材主要适用于已完成基础阶段学习的高等学校理工科本科生,为应用提高阶段的必修课和选修课教材。也可用作研究生教学或工程技术人员的外语培训教材。

全套教材由专业教师和英语教师合作编写而成。它以英国语言学家H. G. Widdowson的交际法理论为依据,着重解决语言运用能力的培养问题,使学生将基础阶段已掌握的英语语言知识和技能在自己的专业领域中得到进一步实践和应用,从而达到能以英语为工具获取和交流信息的教学目的。

全套教材由以下十个分册组成:

1. *Mechanical Engineering*(《机械工程》),吉林工业大学编写。
2. *Electrical and Electronic Engineering*(《电气与电子工程》),燕山大学编写。
3. *Computer Engineering*(《计算机工程》),南开大学编写。
4. *Materials Science and Engineering*(《材料科学与工程》),天津大学编写。
5. *Civil Engineering and Architecture*(《土木工程与建筑》),大连理工大学编写。
6. *Chemistry and Chemical Engineering*(《化学和化工》),华东理工大学编写。
7. *Power Engineering*(《动力工程》),上海理工大学编写。
8. *Business Administration*(《工商管理》),湖南大学编写。
9. *Engineering Talk*(《工程师会话》),上海理工大学编写。
10. *Practical Writing and Translation Guidance*(《写作与翻译指导》),燕山大学和华东理工大学编写。

其中1　8分册为专业英语(SBE)必修课教材,旨在使学生通过有关专业题材文章的阅读和训练,不仅能提高英语水平,而且还能学到一定的专业知识,了解一些该专业的信息动态,熟悉和了解专业题材文章的语言特点,掌握一定量的专业词汇。在教材的练习编写上力

求做到新颖多样且实用，并在信息转换和语言表达方式转换能力的训练上下功夫。学生可以通过各种练习在读、听、写、说、译诸方面得到锻炼。实用文写作训练更应注重实用，旨在提高学生的书面表达能力，并向学生提供信函、实验报告、摘要、论文等实用文的表达模式和实例，以便他们在实际使用时作参考。八个分册写作部分原则上相同。

第9分册《工程师会话》作应用提高阶段高级英语(AE)选修课教材，旨在使一些学有余力且在会话方面较有培养前途的学生在口头交际能力上得到训练和提高。选材力求实用，尽量提供一些工程技术人员在实际工作中会遇到的题材，以使他们参加工作后能较快地适应英语口头交际的需要。

第10分册《写作与翻译指导》为教学辅导材料。供教师和学生在教学和学习中作参考。

全套理工科教程由吉林工业大学、燕山大学、南开大学、天津大学、大连理工大学、华东理工大学、上海理工大学和湖南大学合作编写。上海理工大学程月芳教授担任总主编。英国利物浦大学英语语言文学系专家 Mr. Geoff Thompson 担任顾问并协助审校。Mr. Geoff Thompson 和上海交通大学杨惠中教授对教材编写提出了许多宝贵意见。在教材编写的全过程中上海外语教育出版社社长庄智象教授和编辑室陈鑫源主任给予了大力的支持和帮助。特此表示衷心的感谢。

本书为 *Materials Science and Engineering* 分册。由天津大学杨福玲副教授主编，赵乃勤副教授任副主编，丁树德教授主审，郗梅、马铁军、贾欣岚、杨德安、刘文广、张健青、丁国声参加编写。郗梅负责 U.1～U.20 第一部分(I)的译文校对、习题编写及第二部分(II)的部分译文校对和习题编写工作；贾欣岚负责 U.1～U.20 的第二部分(II)中部分译文校对和部分习题的编写工作；杨福玲负责 U.1～U.20 中第三部分(III)的译文校对和习题编写工作；张健青负责 Glossary 的编写工作；马铁军负责 U.1，U.4～U.7，U.11 的选材和翻译；赵乃勤负责 U.2，U. 3，U.14，U.19 及 U.20 的选材和翻译；杨德安负责 U.8，U.9，U.12，U.17及 U.18 的选材和翻译；刘文广负责 U.10，U.13，U.15 及 U.16 的选材和翻译；本书的实用文写作部分由燕山大学丁国声教授统一编写，其中的专业写作部分由马铁军副教授编写。全书由丁树德教授审定。

由于编者水平有限，教材中不妥之处望广大使用者提出宝贵意见。

新世纪理工科英语教程编委暨
编 者
2001年12月

使 用 说 明

本书为 *Materials Science and Engineering* 分册，供材料科学及相关专业的大学本科学生作专业英语(Subject-Based English，简称 SBE)即大学第 5、6 学期教材，约需 68 学时。

本书分 Text(课文)，Practical Writing(实用文写作)和 Glossary(生词表)3 部分。Text(书中不注明)分 20 个单元，每个单元由 Reading and Comprehension，Reading and Practice 和 Reading and Translation 3 部分组成。全书选材面向 21 世纪的要求，以反映时代特色。材料选自国外原版教材、文选、论著、会议论文、实用文件、报刊杂志等。内容涉及材料科学及相关专业的基本物理概念、基础工程知识、发展简史或重大发明创造、人物传记、重要组织机构简介以及发展动向。

Reading and Comprehension 部分旨在培养和提高学生阅读和理解专业英语科技文献的能力。它由一篇 1,000～1,500 词的阅读文章和若干练习组成。选材注重科学性、可读性、知识性、趣味性和实用性。文章之后附有生词表，将大纲四级词表之外的词汇和专业术语按出现先后次序列出。对一些较复杂的问题或术语的注释在文章之后以 Notes 的形式出现。通过练习要求学生掌握文章的中心思想和要点，并就文章内容进行预测、分析、推理、判断和综合概括，及分析篇章结构等。

Reading and Practice 部分由一篇 1,000～1,500 词的阅读文章和四项练习 Exercise A、B、C、D 组成，旨在为学生提供运用语言的实践机会。选材偏重专业基础知识。练习按阅读材料的内容设计。文章之后附有生词表，列表方式与前一部分相同。Exercise A、B 偏重学生的语言能力训练。Exercise C 为听力练习，旨在训练学生的听说能力。学生在听完一篇 150～200 词的短文后需回答问题、复述文章内容或进行 Dictation、Spot Dictation 或 Compound Dictation 等练习。Exercise D 是重点，着重训练学生运用已掌握的语言知识和技能较准确地表达与专业有关的思想和概念的能力。该部分除围绕科技文章中经常出现的语言现象，如：定义、分类、描述、指令、论证、概括、举例、逻辑关系表达、计量与计算、数据表达与理解等某一功能意念或语言现象进行操练外，还包括参阅技能、通篇浏览、查找信息等学习技能的培养。练习设计打破了旧框框，将读、听、写、说四种技能的训练相互交融，使它们在专业领域中得到综合运用。

Reading and Translation 部分是为训练学生的翻译能力而设计的。A 为汉译英练习，以句子翻译为主，逐步过渡到段落和篇章的翻译。B 为英译汉练习。有一篇约 1,000 词的文章，要求学生将划线部分译成汉语。翻译中学生不仅要注意句子的译法，而且还须注意句子在上下文中的意思。

Practical Writing 部分除写作指导和练习外，还向学生提供信函、实验报告、摘要、论文

等应用文的表达模式，以便他们在实际使用时作参考。该部分集中放在书后，以便自成体系，便于学生参考使用。教师应选用相应章节对学生进行训练。该部分的注释、常用表达方式、练习答案和补充范例请参阅第10分册《写作与翻译指导》。

Glossary 将生词表中出现的所有单词按字母顺序排列并注明词性、词义和所在单元，便于学生复习和查找。

本书阅读总量约100,000词，总生词量为1,000。讲课时教师应注重读、听、写、说、译综合技能的训练和交际能力的培养。学生宜在课前做好预习工作。由于阅读量和练习量较大，教师可按学生的实际情况安排教学，对教材进行有选择的使用。

新世纪理工科英语教程编委暨
编　者
2001年12月

Contents

UNIT ONE

Materials Science and Engineering

Reading and Comprehension

Introduction to Materials Science and Engineering

1.1 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. There are many more kinds of materials, and one only has to look around oneself to realize that. Because of constant research and development, new materials are frequently being created.

The production and processing of materials into finished goods constitutes a large part of our present economy. 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.

Research and development engineers work to create new materials or to modify the properties of existing ones. Design engineers use existing, modified, or new materials to design and create new products and systems. Sometimes the reverse is the case, and design engineers have a problem in their design which requires a new material to be created by research scientists and engineers. For example, engineers designing a hypersonic-speed transport will have to develop new high-temperature advanced materials to be able to withstand temperatures as high as 1800℃ (3250℉) so that airspeeds as high as Mach[1] 12 to 25 can be attained. Research is currently (1989) underway in developing titanium-

metal matrix composites and other types of **refractory** composites for this application. Titanium aluminides and other types of refractory **intermetallic** compounds are also under investigation for hypersonic flight vehicles. Another example of a challenge for engineers is the permanently manned space station. One proposal involves **fabricating** the space station's main structure in space using in-orbit-produced **I beams** and channels made of **polyetherimide** and **polyetheretherketone** composite materials.

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!

1.2 MATERIALS SCIENCE AND ENGINEERING

Materials science is primarily concerned with the search for basic knowledge about the internal structure, properties, and processing of materials. Materials engineering is mainly concerned with the use of fundamental and applied knowledge of materials so that the materials can be converted into products necessary or desired by society. The name materials science and engineering combines both materials science and materials engineering. Materials science is at the basic knowledge end of the materials knowledge **spectrum** and materials engineering is at the applied knowledge end, and there is no **demarcation** line between the two (Fig. 1.1).

Figure 1.2 shows a three-ringed diagram which indicates the relationship among the basic sciences (and mathematics), materials science and engineering, and the other engineering **disciplines**. The basic sciences are located within the first ring or core of the diagram, while the various engineering disciplines (mechanical, electrical, civil, chemical, etc.) are located in the outermost third ring. The applied sciences, **metallurgy**, **ceramics**, and **polymer** science are located in the middle or second ring. Materials science and engineering is shown to form a bridge of materials knowledge from the basic sciences (and mathematics) to the engineering disciplines.

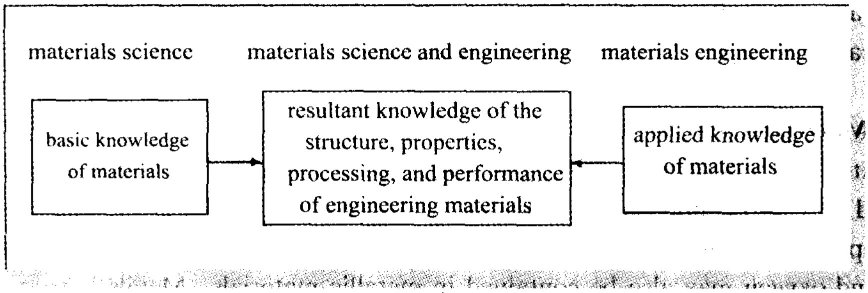

Fig. 1.1 Materials knowledge spectrum. Using the combined knowledge of materials from materials science and materials engineering enables engineers to convert materials into the products needed by society.

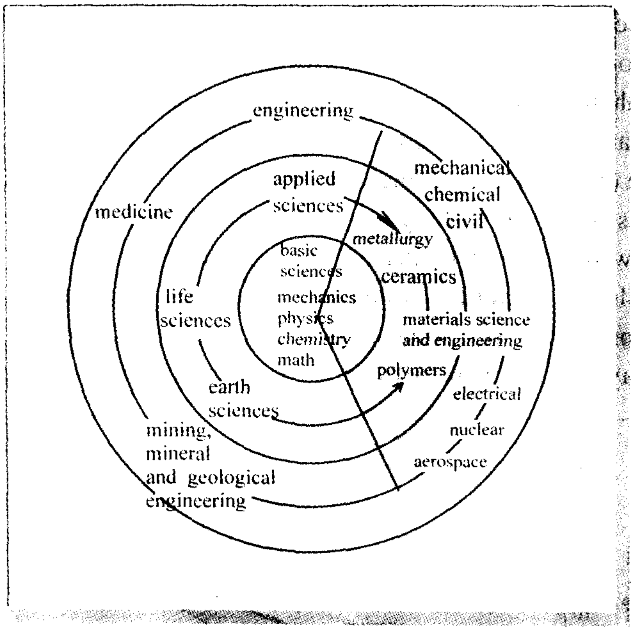

Fig. 1.2 This diagram illustrates how materials science and engineering form a bridge of knowledge from the basic sciences to the engineering disciplines. (*Courtesy of the National Academy of Science.*)

1.3 TYPES OF MATERIALS

For convenience most engineering materials are divided into three main classes: metallic, polymeric (plastic) and ceramic materials. In addition to the three main classes of materials, we shall consider two more types, composite materials and electronic materials, because of their great engineering importance.

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.

Metals and alloys are commonly divided into two classes: ferrous metals and alloys that contain a large percentage of iron such as the steels and cast irons and nonferrous metals and alloys that do not contain iron or only a relatively small amount of iron. Examples of nonferrous metals are aluminum, copper, zinc, titanium, and nickel.

The commercial aircraft jet engine is made primarily of metal alloys. The metal alloys used inside the engine must be able to withstand the high temperatures and pressures generated during its operation. Many years of research and development work by scientists and engineers were required to perfect this advanced-performance engine. Figure 1.3 shows how materials and materials processes have been associated with more efficient gas-turbine engine propulsion performance over the past years. Metal-matrix and ceramic-matrix materials may lead to even further increased performance in the future.

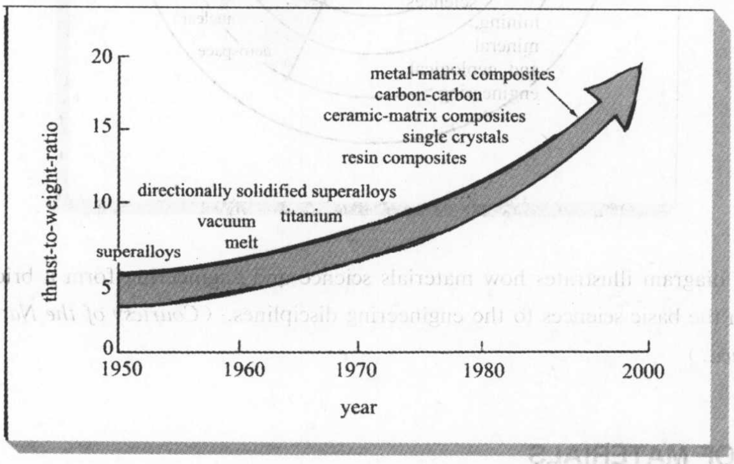

Fig. 1.3 Materials and materials processes over the past years have been associated with the increase in performance of gas-turbine engines. (*After Adv. Mat. & Proc.*, 133(1):88(1988).)