高等教育“十三五”部委级规划教材

机械工程英语阅读教程

（第三版）

主编 周益军

東華大學出版社

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（第三版）

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编写说明

随着中国加入世贸组织,中国经济快速发展,经济全球化等,这些大背景给学生带来了更广阔的就业平台。但同时,对学生的英语水平也有了更高的要求。熟练的专业技术加上精良的专业英语知识无疑就是高技能、紧缺人才所必备的。因此,学好专业英语显得尤为重要。

本书是按照《高职高专院校机械工程类专业英语教学大纲》所编写的。编者在多年教学实践经验的基础上,力求按照行业培养的宽口径,使专业英语教材具有良好的通用性。并根据高职高专教育的应用性特征,使专业英语具有较强的实用性和针对性。

全书由材料科学、材料成形、机械制造、汽车、模具、机器人、CAD/CAM等七部分组成,共分成七个单元。每个单元均由课文、词汇、注释、相关练习和参考译文等五个部分组成。内容以材料工程、机械设计、机械制造、机电一体化、汽车制造与维修、模具设计与制造、数控技术、计算机辅助设计与制造等专业技术及其最新发展讯息为主,对所选的阅读材料中出现的语言重点和难点做了详细的注释。选材精炼,课文后配有生词短语表、注释和相应的练习,促进学生"学必思考,学练结合"。书后附有参考译文和练习答案,便于学生理解和核查自己学习与掌握的内容。

本书可作为高职高专机械设计与制造类、机电控制等专业的教材,也可供工商管理专业、经济类专业和英语专业学生、技术人员学习参考。建议教师根据各专业的学生情况,可不受教材编排顺序的限制,进行适当筛选。对老师没有选用的单元,学生可根据自己的兴趣和需要自学其中的部分内容,以拓宽专业英语的知识面。

本书由江苏省扬州职业大学周益军博士(副教授)任主编;南通纺织职业技术学院单敏老师任第一副主编;扬州职业大学池寅生硕士(讲师)任第二副主编。参编人员还有扬州职业大学肖淑梅博士、卫玉芬博士、孔纪兰

博士、朱丹凤硕士、徐小青硕士、刘敏硕士、赵翔硕士、南丽霞硕士、张承阳硕士以及张翔博士等。

具体编写分工为:第一单元由孔纪兰编写;第二单元由朱丹凤编写;第三单元由周益军编写;第四单元,肖淑梅;第五单元,池寅生;第六单元,卫玉芬;第七单元,徐小青。单敏同志对本教材的词汇和练习进行了认真设计与编写。

本书的编写工作得到了扬州职业大学领导的高度重视与支持。孟咸智副教授对本教材的编写提出了宝贵意见,在此表示衷心的感谢。由于编者的水平和经验有限,书中难免有缺陷和不足之处,恳请广大读者批评指正。

编　者

2009 年 4 月

修订说明

本次修订以原教材为蓝本,保留了绝大多数内容。根据使用原教材的部分师生的反馈意见,编者对教材的部分内容进行了删减。删除了内容偏向阐述抽象理论为主的章节;保留了内容以介绍技术技能知识为主的部分。为了适应现代制造技术发展的需求,增补了3D打印技术和互联网+及中国制造2025等内容。在本次修订过程中,还增加了专业英语语法及相关词汇(构词法),以便学生学习。

3D打印技术由池寅生老师编写;互联网+及中国制造2025由张建宏老师编写;专业英语语法及相关词汇(构词法)部分由何慧娟老师编写。使用原教材的部分师生的反馈意见主要由何慧娟老师收集。

整个修订方案由周益军确定。在修订过程中,第一、二、三单元修订工作以何慧娟老师为主;第四、五、六、七单元修订工作以池寅生老师为主;第八单元审核校对工作以周益军老师为主。

本书修订后,由江苏省扬州职业大学周益军博士(教授)任主编;扬州职业大学池寅生硕士(讲师)、何慧娟硕士(讲师)、南通纺织职业技术学院单敏副教授任副主编。

编　者

2019年1月

Contents

Foreword

Unit 1

Lesson 1 The History of Metallurgy *1*

Lesson 2 Metallurgy *5*

Lesson 3 Metal *14*

Lesson 4 Materials in Industry *20*

Unit 2

Lesson 1 Casting *28*

Lesson 2 Forging *41*

Lesson 3 Welding *50*

Unit 3

Lesson 1 Lathe (metal) *59*

Lesson 2 Milling Machine *72*

Lesson 3 Types of Milling Cutter *83*

Unit 4

Lesson 1 Engine Operating Principles *92*

Lesson 2 Engine Construction *99*

Unit 5

Lesson 1 Forming of Sheet Metals *106*
Lesson 2 Metal Stamping Process and Die Design *111*
Lesson 3 Plastics and Injection Molding *122*
Lesson 4 Design of Injection Mold *129*

Unit 6

Lesson 1 Food Robotics *139*
Lesson 2 Robotic Inspection *152*

Unit 7

Lesson 1 Computer-Aided Design (CAD) *165*
Lesson 2 Computer Aided Manufacturing (CAM) *171*
Lesson 3 Computer Numerical Control *180*

Unit 8

Lesson 1 3D Printing Technology *187*
Lesson 2 "Internet +" & "Chinese wisdom made" *197*

Answer to Exercises *204*
Vocabulary *216*

Unit 1

Lesson 1 The History of Metallurgy

1 The earliest recorded metal employed by humans appears to be gold which can be found free or "native". Small amounts of natural gold has been found in Spanish caves used during the late Paleolithic period around 40,000 BC.

2 Silver, copper, tin and meteoric iron can also be found native, allowing a limited amount of metalworking in early cultures. Egyptian weapons made from meteoric iron occurred about 3000 B. C.. However, by learning to get copper and tin by heating rocks and combining copper and tin to make an alloy called bronze, the technology of metallurgy began about 3500 B. C. in the Bronze Age.

3 The extraction of iron from its ore into a workable metal is much more difficult. It appears to have been invented by the Hittites in about 1400 B. C., beginning the Iron Age. The secret of extracting and working iron was a key factor in the success of the Philistines.

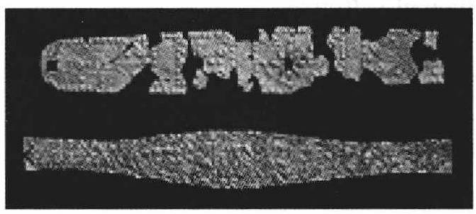

Fig. 1.1 – 1 **Gold headband from Thebes** 750-700 **BC**

4 Historical developments in ferrous metallurgy can be found in a wide variety of past cultures and civilizations. This includes the ancient and medieval kingdoms and empires of the Middle East and Near East, ancient Egypt and Anatolia (Turkey), Carthage, the Greeks and Romans of ancient Europe, medieval Europe, ancient and medieval China, ancient and medieval India, ancient and medieval Japan, etc. Of interest to note is that many applications, practices, and devices associated or involved in metallurgy were possibly established in ancient China before Europeans mastered these crafts (such as the innovation of the blast furnace, cast iron, steel, hydraulic-powered trip hammers, etc.).

Fig. 1.1 – 2 **Georg Agricola, author of De re metallica, an important early book on metal extraction**

5 A 16th century book by Georg Agricola called *De re metallica* describes the highly developed and complex processes of mining metal ores, metal extraction and metallurgy of the time. Agricola has been described as the "father of metallurgy".

❖ New Words and Phrases

metallurgy [me'tælədʒi] *n.*	冶金；冶金学；冶金术
intermetallic [ˌintə(:)mi'tælik] *adj.*	金属间化合的
compound ['kɔmpaund] *n.*	混合物，化合物
intermetallic compounds	金属间化合物
alloy ['ælɔi] *n.*	合金
craft [krɑ:ft] *n.*	工艺
metalworking ['metəlːˌwɛ:kiŋ] *n.*	金属加工
paleolithic [ˌpæliəu'liθik] *adj.*	旧石器时代的
paleolithic period	旧石器时代
meteoric [ˌmi:ti'ɔrik] *adj.*	流星的，昙花一现的
meteoric iron	陨铁
bronze [brɔnz] *n.*	青铜
Bronze Age	青铜器时代，青铜时代，铜器时代
ferrous ['ferəs] *a.*	铁的，含铁的
medieval [ˌmedi'i:vəl] *a.*	中古的，中世纪的
blast [blɑ:st] *n.*	爆破，冲击波
furnace ['fə:nis] *n.*	炉子，熔炉
blast furnace	鼓风炉，高炉
hydraulic [hai'drɔ:lik] *a.*	水的，液压的
trip hammer	杵锤
mining ['mainiŋ] *n.*	采矿(业)

❖ Notes

1. The earliest recorded metal employed by humans appears to be gold which can be found free or "native".

   最早记载的人类应用的金属，看起来是无偿获得的或"天然的"黄金。

语法补充：which 引导定语从句

一、本语法在注释一中的应用

which can be found free or "native"是定语从句，其中引导词 which 指代 gold。

二、对本语法的详细阐述

（一）which 可以引导限制性定语从句和非限制性定语从句。

a）限制性定语从句：与主句无逗号隔开，起修饰限制作用。

e. g. I like the coat which is very beautiful.

我喜欢这件非常漂亮的外套。

b）非限制性定语从句：与主句有逗号隔开，起补充说明作用。

e. g. This is a book, which I borrowed from my friend.

这是我从朋友那儿借来的一本书。

（二）which 引导定语从句时，可以指代前面一个词，也可以指代前面一句话。

a）指代前面一个词

e. g. He was reading a book, which was about war. （which 指代 a book）

他正在读一本关于战争的书。

b）指代前面一句话

e. g. He set free the birds happily, which was a celebration for his success. （which 指代 "He set free the birds happily"）

他开心地把鸟放了，这是对他成功的一种庆祝。

三、过去分词也可以起定语从句的作用，此时相当于省略了定语从句引导词 which 和 be 动词。如注释三中的 associated 和 involved。

e. g. This is a letter written （ = which is written） in German.

这是封用德语写的信。

2. However, by learning to get copper and tin by heating rocks and combining copper and tin to make an alloy called bronze, the technology of metallurgy began about 3500 B. C. with the Bronze Age.

然而，研究通过熔化矿石来制造铜和锡及通过熔化铜和锡来制造铜合金的冶金技术出现于大约公元前 3500 年的青铜时代。

3. Of interest to note is that many applications, practices, and devices associated or involved in metallurgy were possibly established in ancient China before Europeans mastered these crafts （such as the innovation of the blast furnace, cast iron, steel, hydraulic-powered trip hammers, etc.）.

值得注意的是，与冶金相关的许多应用、实践和设备，在中国古代出现的时间较欧洲早（如高炉，生铁，钢，水力杵锤等的发明）。

Check your understanding

Ⅰ. Give brief answers to the following questions.

1. Who is called the "father of metallurgy"?

Ⅱ. Match the items listed in the following two columns.

trip hammer	鼓风炉,高炉
compound	金属加工
blast furnace	杵锤
cast iron	陨铁
meteoric iron	冶金;冶金学
metalworking	生铁
metallurgy	混合物

冶金学的历史

最早记载的人类应用的金属,看起来是无偿获得的或"天然的"黄金。在西班牙洞穴中发现了少量的天然黄金,这些洞穴的使用时间是在旧石器时代晚期(公元前40 000年左右)。

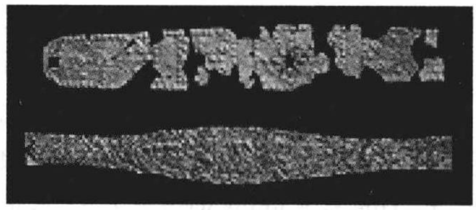

图 1.1-1 公元前750-公元前700年底比斯的金头饰

早期记载中也有天然的(含有限加工过的)银,铜,锡和陨铁等。用陨铁制造的埃及武器出现在公元前3 000年左右。然而,研究通过熔化矿石来制造铜和锡及通过熔化铜和锡来制造铜合金的冶金技术出现于大约公元前3 500年的青铜时代。

图 1.1-2 格奥尔格·阿格里科拉,《论矿冶》一书的作者,早期重要的金属冶炼的书

从矿石中提取金属铁要困难得多。大约在公元前1 400年,赫梯人发明了炼铁术,进入铁器时代。非利士人成功的一个重要因素是拥有提炼和加工铁的秘密技术。

各种各样的历史文化和文明中都有钢铁冶金史。这包括古代和中世纪的中东和近东的王国和帝国、古埃及和土耳其,迦太基,希腊和古代欧洲罗马,中世纪的欧洲,中国古代和中世纪,古代和中世纪印度,古代和中世纪的日本等。值得注意的是,与冶金相关的许多应用、实践和设备,在中国古代出现的时间较欧洲早(如高炉,生铁,钢,水力杵锤等的发明)。

16世纪由格奥尔格·阿格里科拉编著的《论矿冶》一书,描述了当时高度成熟和复杂的金属矿石的开采、金属提取和冶炼过程。阿格里科拉被称为"冶金之父"。

Lesson 2 Metallurgy

1 Metallurgy is a domain of materials science that studies the physical and chemical behavior of metallic elements, their intermetallic compounds, and their mixtures, which are called alloys. It is also the technology of metals: the way in which science is applied to their practical use. Metallurgy is commonly used in the craft of metalworking.

1. Extractive metallurgy

2 Extractive metallurgy is the practice of removing valuable metals from an ore and refining the extracted raw metals into a purer form. In order to convert a metal oxide or sulfide to a purer metal, the ore must be refined either physically, chemically, or electrolytically.

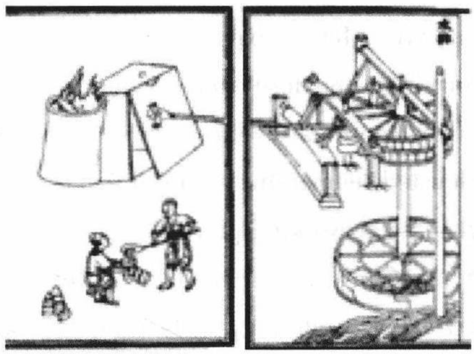

Fig. 1.2 - 1 Furnace bellows operated by waterwheels

3 The picture above is an illustration of furnace bellows operated by waterwheels, from the *Nong Shu*, by Wang Zhen, 1313 AD, during the Chinese Yuan Dynasty.

4 Extractive metallurgists are interested in three primary streams: feed, concentrate (valuable metal oxide/sulfide), and tailings (waste). After mining, large pieces of the ore feed are broken through crushing and/or grinding in order to obtain particles small enough where each particle is either mostly valuable or mostly waste. Concentrating the particles of value in a form supporting separation enables the desired metal to be removed from waste products.

5 Mining may not be necessary if the ore body and physical environment are conducive to leaching. Leaching dissolves minerals in an ore body and results in an enriched solution. The solution is collected and processed to extract valuable metals.

6 Ore bodies often contain more than one valuable metal. Tailings of a previous process may be used as a feed in another process to extract a secondary product from the original ore. Additionally, a concentrate may contain more than one valuable metal. That concentrate would then be processed to separate the valuable metals into individual constituents.

2. Production engineering of metals

7 In production engineering, metallurgy is concerned with the production of metallic components for use in consumer or engineering products. This involves the production of alloys, the shaping, the heat treatment and the surface treatment of the product. The task of the metallurgist is to achieve balance between material properties such as cost, weight, strength, toughness, hardness, corrosion and fatigue resistance, and performance in temperature extremes. To achieve this goal, the operating environment must be carefully considered. In a saltwater environment, ferrous metals and some aluminum alloys corrode quickly. Metals exposed to cold or cryogenic conditions may endure a ductile to brittle transition and lose their toughness, becoming more brittle and prone to cracking. Metals under continual cyclic loading can suffer from metal fatigue. Metals under constant stress at elevated temperatures can creep.

2.1 Metal working processes

8 Metals are shaped by processes such as casting, forging, flow forming, rolling, extrusion, sintering, metalworking, machining and fabrication. With casting, molten metal is poured into a shaped mould. With forging, a red-hot billet is hammered into shape. With rolling, a billet is passed through successively narrower rollers to create a sheet. With extrusion, a hot and malleable metal is forced under pressure through a die, which shapes it before it cools. With sintering, a powdered metal is compressed into a die at high temperature. With machining, lathes, milling machines, and drills cut the cold metal to shape. With fabrication, sheets of metal are cut with guillotines or gas cutters and bent into shape.

9 "Cold working" processes, where the product's shape is altered by rolling, fabrication or other processes while the product is cold, can increase the strength of the product by a process called work hardening. Work hardening creates microscopic defects in the metal, which resist further changes of shape.

10 Various forms of casting exist in industry and academia. These include sand casting, investment casting (also called the "lost wax process"), die casting and continuous casting.

2.2 Joining

2.2.1 Welding

11 Welding is a technique for joining metal components cohesively by melting the base material, making the parts into a single piece. A filler material of similar composition (welding rod) may also be melted into the joint.

2.2.2 Brazing

12 Brazing is a technique for joining metals adhesively at a temperature below their melting points. A filler with a melting point below that of the base metal is used, and is drawn into the joint by capillary action. Brazing results in a mechanical and metallurgical bond between work pieces.

2.2.3 Soldering

13 Soldering is a method of joining metals below their melting points using a filler metal. Soldering, like brazing, results in an adhesive joint and occurs at lower temperatures than brazing, specifically below 450℃ (840 F).

2.3 Heat treatment

14 Metals can be heat treated to alter the properties of strength, ductility, toughness, hardness or resistance to corrosion. Common heat treatment processes include annealing, precipitation strengthening, quenching, and tempering. The annealing process softens the metal by allowing recovery of cold work and grain growth. Quenching can be used to harden alloy steels, or in precipitation hardenable alloys, to trap dissolved solute atoms in solution. Tempering will cause the dissolved alloying elements to precipitate, or in the case of quenched steels, improve impact strength and ductile properties.

2.4 Surface treatment

2.4.1 Plating

15 Electroplating is a common surface-treatment technique. It involves bonding a thin layer of another metal such as gold, silver, chromium or zinc to the surface of the product. It is used to reduce corrosion as well as to improve the product's aesthetic appearance.

2.4.2 Thermal spraying

16 Thermal spraying techniques are another popular finishing option, and often have better high temperature properties than electroplated coatings.

2.4.3 Case hardening

17 Case hardening is a process in which an alloying element, most commonly carbon or nitrogen, diffuses into the surface of a monolithic metal. The resulting interstitial solid solution is harder than the base material, which improves wear resistance without sacrificing toughness.

3. Metallurgical techniques

18 Metallography allows metallurgists to study the microstructure of metals.

19 Metallurgists study the microscopic and macroscopic properties using metallography, a technique invented by Henry Clifton Sorby. In metallography, an alloy of interest is

ground flat and polished to a mirror finish. The sample can then be etched to reveal the microstructure and macrostructure of the metal. A metallurgist can then examine the sample with an optical or electron microscope and learn a great deal about the sample's composition, mechanical properties, and processing history.

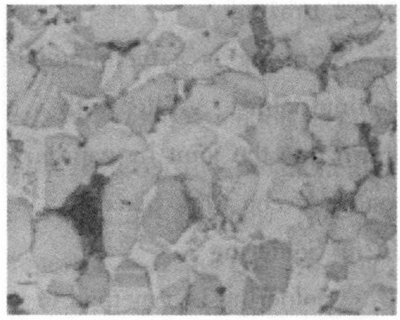

Fig. 1.2 – 2 The microstructure of metals

20 Crystallography, often using diffraction of x-rays or electrons, is another valuable tool available to the modern metallurgists. Crystallography allows the identification of unknown materials and reveals the crystal structure of the sample. Quantitative crystallography can be used to calculate the amount of phases present as well as the degree of strain to which a sample has been subjected.

21 The physical properties of metals can be quantified by mechanical testing. Typical tests include tensile strength, compressive strength, hardness, impact toughness, fatigue and creep life.

❖ New Words and Phrases

extractive [iksˈtræktiv] *adj.* 抽取的
extractive metallurgy 提取冶金,冶炼
joining [ˈdʒɔiniŋ] *n.* 连接
welding [ˈweldiŋ] *n.* 焊接
brazing [breiziŋ] *n.* 硬钎焊
soldering [ˈsɔldəriŋ] *n.* 软钎焊
heat treatment 热处理
surface treatment 表面处理
plating [ˈpleitiŋ] *n.* 电镀
refining [riˈfainiŋ] *n.* 精炼
sulfide [ˈsʌlfaid] *n.* 硫化物
electrolytically [iˌlektrəuˈlitikəli] *adv.* 以电解
metallurgist [meˈtælədʒist] *n.* 冶金家,冶金学家
concentrate [ˈkɔnsentreit] *v.* 浓缩,富集
tailings [ˈteiliŋz] *n.* 残渣,尾矿
toughness [ˈtʌfnis] *n.* 韧性
hardness [ˈhɑːdnis] *n.* 硬度

cryogenic [ˌkraiəuˈdʒenik] *a.* 低温学的;低温实验法的;制冷的,冷冻的
cyclic [ˈsaiklik] *a.* 循环的
cyclic loading 周期载荷
creep [kriːp] *n. /vi* 蠕变
rolling [ˈrəuliŋ] *n.* 轧制
extrusion [eksˈtruːʒən] *n.* 挤出
sintering [ˈsintəriŋ] *n.* 烧结
lathe [leið] *n.* 车床
milling [ˈmiliŋ] *n.* 磨
milling machine *n.* 铣床
drill [dril] *n.* 钻床
guillotine [ˈgilətiːn] *n.* 轧刀,裁切机,剪床
annealing [ˈaːniːliŋ] *n.* 退火
precipitation [priˌsipiˈteiʃən] *n.* 坠落,沉淀
precipitation strengthening 析出强化
quenching [ˈkwentʃiŋ] *n.* 淬火
tempering [ˈtempəriŋ] *n.* 回火
nitrogen [ˈnaitrədʒən] *n.* 氮
interstitial [ˌintə(ː)ˈstiʃəl] *adj.* 组织间隙的,间质的
interstitial solid solution 间隙固溶体
metallography [ˌmetəˈlɔgrəfi] *n.* 金属组织学,金相学
microstructure [ˌmaikrəuˈstrʌktʃə] *n.* 微观结构
macrostructure [ˌmækrəuˈstrʌktʃə] *n.* 宏观结构

Notes

1. Metallurgy is a domain of materials science that studies the physical and chemical behavior of metallic elements, their intermetallic compounds, and their mixtures, which are called alloys.
冶金学属于材料科学领域,是研究金属元素、金属间化合物及其混合物(即合金)的物理和化学特性的科学。
2. After mining, large pieces of the ore feed are broken through crushing and/or grinding in order to obtain particles small enough where each particle is either mostly valuable or mostly waste.
开采后,为了获得足够小颗粒,大块的矿石被破碎和/或碾碎,基本上使得每个颗粒或者有用或者成为废料。