普通高校"十二五"规划教材
PUTONG GAOXIAO SHIERWU GUIHUA JIAOCAI

- 机械制造技术
- 机械设计技术
- 机电一体化技术
- 应用科技文体
- 科技英语翻译与写作

王 丰 主编 李明颖 刘 欣 编
安立宝 主审

JIDIAN GONGCHENG ZHUANYE YINGYU

机电工程专业英语

北京航空航天大学出版社

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内 容 简 介

本书分为机械制造技术篇、机械设计技术篇、机电一体化技术篇、应用科技文体篇、科技英语翻译与写作篇。前3篇为教材的主体内容，各有10课，每课由课文、关键术语、课文注释组成；第4篇共有8课，涉及多种实用科技文体，可作为阅读材料供学生自由选读；第5篇系统地介绍科技英语的特点、翻译的标准和过程、常用翻译方法与技巧，英语科技论文写作的基本方法和技巧、国际学术会议论文的投稿与写作、机电工程专业英语学术论文选读等。书后附有专业术语总表及科技英语中的常用词缀。

本书可作为高等院校机械电子工程和机械设计制造及自动化专业本科生专业英语教材，也可供相关专业的工程技术人员学习专业英语使用，对相关学科学生和技术人员英语论文写作也有所帮助。

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前　言

编者在专业英语课程的教学实践中发现，学生虽然经过了数年的英语学习，但是在专业英语的阅读、翻译和写作方面仍常常感到力不从心。如何在课程学时不断压缩的情况下，通过学习使学生的科技英语综合应用能力得到提高，从而增强学生在就业竞争中的优势，是编者多年来不断探索的一个问题。

本书是河北理工大学教改项目“机电方向学生科技英语能力培养的探索与研究”的成果之一，其编写目的在于使学生在学完大学英语以及专业基础课程后，通过专业英语课程的学习，熟悉科技英语的特点，扩大专业术语词汇量，掌握科技英语翻译与写作的方法与技巧，为将来在学业深造和专业工作中熟练地完成英语科技文献的阅读、翻译与英语科技论文的写作打下良好的基础。

本书由经过精心挑选的、能够反映机械电子工程基本专业内容的英语文章构成，所有文章均选自近10年来的英文原版著作、教材、学术期刊和科技资料。为了使学生能够熟悉不同类型的英语科技文献的特点、提高英语科技文献的阅读能力，本书所用素材既有选自外版著作的理论性文章，又有实用科技文体，如学术论文、期刊征文启事、科技产品说明书及产品样本、科技动态、科技广告及国际会议通知等。本书注重全方位地培养学生的科技英语综合应用能力，除了在课文注释部分结合课文具体地介绍翻译方法的运用外，教材还在第5篇系统地介绍了科技英语翻译方法、英文科技论文写作技巧、国际学术会议论文的投稿与写作，并附有机电工程专业英文学术论文选读等，具有很强的实用性。因此，本书除了用于机电工程和机械设计制造及自动化专业的本科生教学外，还可以成为相关专业工程技术人员专业英语自学读物。

本教材内容共分为5个部分，分别是机械制造技术篇、机械设计技术篇、机电一体化技术篇、应用科技文体篇、科技英语翻译与写作篇。前3个部分为教材的主体内容，各有10课，每课包括课文、关键术语、课文注释；第4部分为阅读材料，共8课，每课都附有关键术语，以便于学生自学；第5部分为科技英语翻译与写作介绍，共有10个单元。各部分内容既有一定的内在联系又相对独立，可根据专业情况有所侧重、灵活选用，也可以根据学时情况进行适当的删减。全书参考学时30学时。本书的最后附有专业术语总表，并注明术语首次出现的课程序号，以便于查询。

本书由河北理工大学王丰担任主编并统稿，参加编写工作的还有大连交通大学李明颖和天津工业大学刘欣。全书由美国 Michigan Technological University 的博士后、河北理工大学安立宝教授审阅。在本书的编写过程中得到了北京航空

航天大学出版社的大力支持，河北理工大学路春光教授也为本书的编写提出了宝贵的意见，张广、武京伟、辛静、王咏梅等同学为本书的录入和校对做了大量的工作，在此谨致衷心的感谢。

本书选用了参考文献1～13中的部分内容和图表，有部分阅读材料取材于互联网，编者在此对其作者一并表达谢意。虽然本书经过编者多年的酝酿、筹划和准备而得以完成，但是由于机电工程专业涉及的领域宽、学科面广，不妥之处未可避免，敬请读者提出宝贵意见。

编　者

2010年6月于河北唐山

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Part I

Mechanical Manufacturing Technology

机械制造技术篇

Lesson 1 Manufacturing Processes

'Manufacturing Processes' is a very fundamental subject since it is of interest not only to mechanical engineers but also to those from practically every discipline of engineering. For various products such as plant machinery required for chemical, civil, electrical, electronic or textile industries, the manufacturing process forms a vital ingredient.

A detailed understanding of the manufacturing processes is thus essential for every engineer.① This helps him appreciate the capabilities, advantages and also the limitations of the process. This in turn helps in the proper design of any product required from him. Firstly he would be able to assess the feasibility of manufacturing from his designs. He may also find that there is more than one process available for manufacturing a particular product and he can make a proper choice of the process which would require the lowest manufacturing cost and would deliver the product of desired quality. He may also modify his design slightly to suit the particular manufacturing process he chooses.②

There are a large number of processes available for manufacture to the engineer. These processes can be broadly classified into four categories.

(a) Casting processes

(b) Forming processes

(c) Fabrication processes

(d) Material removal processes

Casting processes

These are the only processes where liquid metal is used. Casting is also the oldest known manufacturing process. It requires preparation of a cavity usually in a refractory material to resemble closely the final object to be made. Molten metal is poured into this refractory mould cavity and is allowed to solidify. The object after solidification is removed from the mould. Casing processes are universally used to manufacture a wide variety of products. The principal process among these is sand casting where sand is used as the refractory material. The process is equally suitable for the production of a small batch as well as on a large scale.③

Some of the other casting processes for specialised needs are:

- shell mould casting
- precision investment casting
- plaster mould casting
- permanent mould casting
- die casting
- centrifugal casting

Forming processes

These are solid state manufacturing processes involving minimum amount of material wastage and faster production. In a forming process, metal may be heated to a temperature which is slightly below the solidus temperature and then a large force is applied such that the material flows and takes the desired shape. The desired shape is controlled by means of a set of tools called dies which may be completely closed or partially closed during manufacture.④ These processes are normally used for large scale production rates. These are generally economical and in many cases improve the mechanical properties too.

Some of the metal forming processes are:

- rolling
- drop forging
- press forging
- upset forging
- extrusion
- wire drawing
- sheet metal operations

Fabrication processes

These are secondary manufacturing processes where the starting raw materials are processed by any of the previous manufacturing processes described. It essentially involves joining pieces either permanently or temporarily so that they would perform the necessary function. The joining can be achieved by either or both of heat and pressure and/or a joining material. Many of the steel structural constructions we see are first rolled and then joined together by a fabrication process.

Some of the processes of interest in this category are:

- gas welding
- electric arc welding
- electric resistance welding
- thermit welding
- cold welding
- brazing
- soldering

Material removal processes

These are also the secondary manufacturing processes where the additional unwanted material is removed in the form of chips from the blank material by a harder tool so as to obtain the final desired shape. Material removal is normally the most expensive manufacturing process because more energy is consumed, and also a lot of waste material is generated in the process. Still this is widely used because it delivers very good dimensional accuracy and good surface finish. It also generates accurate contours. Material removal processes are also called machining processes.

Various processes in this category are:

- turning

- drilling
- shaping and planing
- milling
- grinding
- broaching
- sawing

All these manufacturing processes have been continuously developed so as to obtain better products at a reduced cost. Of particular interest is the development of computers and their effect on the manufacturing processes. The advent of computers has made a remarkable difference to most of the above manufacturing processes. They have contributed greatly to both automation and designing the process.

(Selected from: P N Rao, Manufacturing Technology-Foundry, Forming and Welding, China Machine Press, 2006)

Key Terms

feasibility	可行性,可能性
casting	铸造;铸件
forming	成形加工
cavity	(铸造)型腔,腔体
refractory material	耐火材料
molten metal	金属液,熔融金属
mould	铸模
shell mould casting	壳型铸造,硬模铸造
investment casting	失蜡(熔模,蜡模)铸造
precision investment casting	精密熔模铸造
die casting	压铸;模铸
centrifugal casting	离心铸造;离心铸件
solidus	固相线,固态线
solidus temperature	固线温度
die	铸模
production rate	生产率,产量
mechanical property	机械性能(特性)
rolling	轧制
forging	锻造;锻件
press forging	压锻
extrusion	挤压成形
wire drawing	拔丝,拉丝
raw material	原料
welding	焊接
gas welding	气焊
electric arc welding	电弧焊
electric resistance welding	电阻焊
thermit	铝热剂

thermit welding	铝热焊
cold welding	冷压焊,冷焊
brazing	硬钎焊,铜焊,硬焊
soldering	软钎焊,锡焊,软焊
accuracy	准确度(性),精确性
surface finish	表面光洁度
turning	车削,切削外圆
drilling	钻削
shaping	牛头刨削
planing	龙门刨削
milling	铣削
grinding	磨削
broaching	拉削
sawing	锯削

Notes

1. A detailed understanding of the manufacturing process is thus essential for every engineer.

句中,to be essential for(to)... 意为"对……(来说)是必要的(必需的,必不可少的)"。全句可译为:"因此,**详细地了解**制造工艺对于每一个工程师来说都是必要的"。

2. He may also modify his design slightly to suit the particular manufacturing process he chooses.

句中,he chooses 是省略了关系代词的限定性定语从句,修饰 process。全句可译为:"他也可以对其设计略作修改,以适应**他所选择**的特定的制造工艺"。

3. The process is equally suitable for the production of a small batch as well as on a large scale.

词组 as well as 是并列连词,用于连接两个同等成分,意为"和……同样地;不仅……而且……;既……又……"。应当注意 as well as 和 not only... but also... 之间的不同:as well as 强调的是所连接的两个同等成分的前者,而 not only... but also... 强调的是连接成分的后者。

4. The desired shape is controlled by means of a set of tools called dies which may be completely closed or partially closed during manufacture.

句中,过去分词短语 called dies 作 tools 的后置定语。which 引导限定性定语从句,修饰 dies。

译写指导:在科技英语翻译中,如果限定性定语从句过长,则不宜译为定语,而应分译为短句,如本句中"... a set of tools called dies which may be completely closed or partially closed during manufacture"可译为:"……一组称为模子的工具,这些模子在制造过程中可完全闭合或部分闭合"。

Lesson 2 Engineering Properties

Manufacturing of a component is normally influenced by the mechanical and thermal properties of the work material. Also, the mechanical properties are affected by the manufacturing process employed.① Either way the knowledge of mechanical properties of engineering materials is important to a manufacturing engineer. In this chapter, some of the mechanical properties which are influential in or are influenced by the manufacturing processes and their measurement are discussed.

Strength

The resistance offered by a material on application of external force is called strength. Depending on the type of load applied, the strength could be tensile, compressive or shear. By application of load, the material is elastically deformed, which is called strain.② It can be defined as

$$\text{Strain} = \frac{\text{change in dimension}}{\text{original dimension}}$$

The resistance offered by the material is also referred to as stress which can then be defined as

$$\text{Stress} = \frac{\text{applied load}}{\text{area of cross section opposing the load}}$$

The deformation caused in a material is of two types, elastic and plastic. Elastic deformation is that part of the deformed material which when the applied load is removed, would spring back to its normal shape. Plastic deformation is on the other hand, permanently set in a material and cannot be regained.

Hardness

Hardness is a very important property since the manufacturing depends on it to a great extent. Hardness is the resistance offered by a material to indentation. Moh's scale of hardness is based on ten standard minerals as shown in Table 2 - 1. It can generally be measured by the indentation made by a harder material. The indentation made depends upon the applied load, the sharpness of the indenter and the time for which the applied load is maintained.

There are a number of indentation tests to measure the hardness of a material normally. These usually involve a ball, a cone or a pyramid of a harder material which is indented into the material under test with a specified load. The permanent indentation thus made is measured to give an indication of the hardness on the given scale for the tests.

Table 2 - 1 Moh's scale of hardness

Mineral	Moh's hardness	Mineral	Moh's hardness
Talc	1	Orthoclase	6
Gypsum	2	Quartz	7
Calcite	3	Topaz	8
Fluorite	4	Corundum	9
Apatite	5	Diamond	10

Ductility

It is the measure of the amount of plastic deformation a material can undergo under tensile forces without fracture. In quantitative terms it is normally measured as the ratio of elongation of the material at fracture during the tensile test to the original length, expressed as a percentage.③ The final value of elongation obtained during the tensile test immediately after the fracture could be taken as the ductility. Since the elongation is dependent upon the gauge length chosen for the tensile test, the length needs to be specified along with the elongation values.④ Alternatively, it may also be expressed as the ratio of reduction in cross-sectional area in the fractured specimen to the original cross-section area. This is independent of the gauge length and hence is a more convenient measure for ductility. It is also termed as the ability of a material to be drawn into wires since only ductile materials can be drawn into continuous wires without breaking in-between.⑤ Typical values of ductilities are given in Table 2 - 2 for engineering materials.

Brittleness is the property opposite to that of ductility.

Table 2 - 2 Ductility values

Material	Ductility, % reduction in area
Cast iron	0
Structural steel	70～40
Stainless steel	75～65
Aluminium alloys	35～39
Copper annealed	73
Monel, Ni-Cu alloy	75

Toughness

This is the property which signifies the amount of energy absorbed by a material at the time of fracture under impact loading. In short it is the capacity to take impact load.⑥ It can be considered as the total area under the stress strain curve since it is an indication of the amount of work done on the material without causing fracture. Thus toughness can be considered as a parameter consisting of both strength and ductility.

(Selected from: P N Rao, Manufacturing Technology-Foundry, Forming and Welding, China Machine Press, 2006)

Key Terms

tensile strength	抗拉强度
compressive strength	抗压强度
shear strength	抗剪强度,剪切强度
strain	应变
stress	应力
elastic deformation	弹性变形
plastic deformation	塑性变形
hardness	硬度
Moh's scale of hardness (Moh's hardness)	莫氏硬度
indentation	压痕,刻痕
indenter	(硬度试验)压头,压痕器
ductility	延展性
tensile force	拉力
elongation	延伸率
tensile test	拉力(抗拉)试验
cross-section	横截面
cross-sectional area	截面积
specimen	样本(品),试样(件)
gauge length	标距(长度)
brittleness	脆性
toughness	韧性
loading	负载,载荷

Notes

1. Also, the mechanical properties are affected by the manufacturing process employed.
句中,过去分词 employed 作后置定语,修饰 manufacturing process。

译写指导: 在科技英语中较多地使用被动语态,在进行翻译处理时应尽可能译成主动语态,这样将更加符合汉语习惯。如果被动句中有介词短语表示的逻辑语(如本句中的 the manufacturing process employed),可将逻辑语译为主语,而将原来的主语译为宾语。本句可译为:"所采用的制造工艺也会影响机械特性"。

2. By application of load, the material is elastically deformed, which is called strain.
句中,由 which 引导的非限定性定语从句用来说明前面整个句子的情况。

译写指导: 科技英语中大量使用名词化结构,即"表示动作意义的名词+of+名词(+修饰语)",以达到简化句子结构的目的。翻译时,可将此结构中的表示动作意义的名词转译为其他词性。本句可译为:"通过施加载荷,材料发生弹性变形,这叫做应变"。由此可见,名词化结构 application of load 中的 application 由名词转译成了动词。