教育部高职高专规划教材

机电工程专业英语

张黎明　主编
孙见君　主审

化学工业出版社
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出版说明

高职高专教材建设工作是整个高职高专教学工作中的重要组成部分。改革开放以来，在各级教育行政部门、有关学校和出版社的共同努力下，各地先后出版了一些高职高专教育教材。但从整体上看，具有高职高专教育特色的教材极其匮乏，不少院校尚在借用本科或中专教材，教材建设落后于高职高专教育的发展需要。为此，1999年教育部组织制定了《高职高专教育专门课课程基本要求》（以下简称《基本要求》）和《高职高专教育专业人才培养目标及规格》（以下简称《培养规格》），通过推荐、招标及遴选，组织了一批学术水平高、教学经验丰富、实践能力强的教师，成立了“教育部高职高专规划教材”编写队伍，并在有关出版社的积极配合下，推出一批“教育部高职高专规划教材”。

“教育部高职高专规划教材”计划出版500种，用5年左右时间完成。这500种教材中，专门课（专业基础课、专业理论与专业能力课）教材将占很高的比例。专门课教材建设在很大程度上影响着高职高专教学质量。专门课教材是按照《培养规格》的要求，在对有关专业的人才培养模式和教学内容体系改革进行充分调查研究和论证的基础上，充分吸取高职、高专和成人高等学校在探索培养技术应用性专门人才方面取得的成功经验和教学成果编写而成的。这套教材充分体现了高等职业教育的应用特色和能力本位，调整了新世纪人才必须具备的文化基础和技术基础，突出了人才的创新素质和创新能力的培养。在有关课程开发委员会组织下，专门课教材建设得到了举办高职高专教育的广大院校的积极支持。我们计划先用2～3年的时间，在继承原有高职高专和成人高等学校教材建设成果的基础上，充分汲取近几年来各类学校在探索培养技术应用性专门人才方面取得的成功经验，解决新形势下高职高专教育教材的有无问题；然后再用2～3年的时间，在《新世纪高职高专教育人才培养模式和教学内容体系改革与建设项目计划》立项研究的基础上，通过研究、改革和建设，推出一大批教育部高职高专规划教材，从而形成优化配套的高职高专教育教材体系。

本套教材适用于各级各类举办高职高专教育的院校使用。希望各用书学校积极选用这批经过系统论证、严格审查、正式出版的规划教材，并组织本校教师以对事业的责任感对教材教学开展研究工作，不断推动规划教材建设工作的发展与提高。

教育部高等教育司

2001年4月3日

前　言

本教材是根据2003年10月在湖南长沙召开的“高职高专过程装备与控制专业国家规划教材工作会议”的部署，经全国化工高职教学指导委员会审定的专业教学计划编写的专业选修课教材，适用于过程装备与控制专业及制冷与空调、机电应用技术专业，也可供相近专业的工程技术人员作为英语阅读参考书。

外语水平是学生毕业后就业、继续深造和转移工作领域时的一种特长、一种能力。基础英语在听、说、读、写方面解决学生掌握英语的入门问题。而专业英语的教学目的是扩大专业词汇，提高查阅英汉技术词典的速度与能力，掌握科技英语的句法特点与翻译技巧，提高阅读专业英语资料的水平。本书根据专业的特点精选了30个单元，包括机械、电气化、计算机应用、仪表及自动化、泵和压缩机、分离机械、压力容器、塔器、反应器、换热器、制冷与空调等内容。每个单元由课文、单词及词组、课文注释、与课文内容相近的阅读材料及练习组成。书后附有课文及阅读材料的译文和练习参考答案。

本书由张黎明副教授任主编，武海滨副教授，林慧珠副教授，刘福新副教授、李志平高级工程师参加编写。孙见君副教授主审，参加审稿的还有丁传安，叶明生副教授。

本书的编写分工是：张黎明编写第1部分和第5部分；武海滨编写第2部分；刘福新编写第3部分；李志平编写第4部分；林慧珠编写第6部分；钮鑫、刘莎、孙菊妹老师负责文稿的录入与编排工作。

美国俄克拉荷马州大学楼继栋博士，常州工程职业技术学院颜惠庚院长提供了大量资料并校核了译文，全国化工高职教学指导委员会主任王绍良，徐州工程职业技术学院杜存臣副教授对本书提出了许多建议，朱春娟、王琳老师帮助校核译文。钮鑫、刘莎、孙菊妹老师负责文稿的录入与编排工作。在此一并表示感谢。

由于我们学识水平浅薄，教学经验不足，难免有错误和不妥之处，诚恳欢迎读者批评指正。

编者

2004年8月

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SECTION 1 Mechanical Engineering

UNIT 1

Text

Heat Treatment of Steels

Heat treating refers to the heating and cooling operations performed on a metal for the purpose of altering such characteristics as hardness, strength, or ductility. A tool steel intended to be machined into a punch may first be softened so that it can be machined. After being machined to shape, it must be hardened so that it can sustain the punishment that punches receive. Most heating operations for hardening leave a scale on the surface, or contribute other surface defects. The final operation must, therefore, be grinding to remove surface defects and provide a suitable surface finish.

When a steel part is to be either hardened or softened, its temperature must be taken above the critical temperature line; that is, the steel must be austenitized. Usually a temperature of 50 to 100 degree above the critical temperature is selected, to ensure that the steel part reaches a high enough temperature to be completely austenitized, and also because furnace temperature control is always a little uncertain.

The steel must be held at furnace temperature for sufficient time to dissolve the carbides in the austenite, after which the steel can be cooled. How much residence time in the furnace is required is to some degree a matter of experience with any particular steel.

Usually, for a 3/4 in. bar (1in=0.0254m), 20 minutes or slightly more will do. Double the time for twice the diameter. Alloy steels may require a longer furnace time; many of these steels are best preheated in a lower-temperature furnace before being charged into the hardening furnace.

When the heating time is completed, the steel must be cooled down to room temperature. The cooling method determines whether the steel will be hardened or softened. If the steel is quickly removed from the furnace and quenched into cold water, it will be hardened. If it is left in the furnace to cool slowly with the heat turned off, or cooled in air (small pieces of plain carbon steel cannot be air-softened, however), it will be softened. High-alloy steels may be hardened by air-cooling , but plain carbon steels must have a more severe quench, almost always water.

There are several softening methods for steels , and the word softening therefore does not indicate what softening process or purpose was used. The method of softening by slow cooling from austenite is called annealing, not softening, Annealing leaves the steel in the softest possible condition (dead soft) .

To conclude, the difference between hardening and annealing is not in the heating process but in the cooling process.

New Words

1. treatment ['tri:tmənt] *n.* 处理，加工；对待
2. refer (to) [ri'fə:] *v.* 指的是，涉及，查阅，参考
3. cool [ku:l] *a.* & *v.* 冷的，凉的；冷却
4. ductility [dʌk'tiliti] *n.* 可延性，韧性
5. machine [mə'ʃi:n] *v.* 机械加工，切削加工
6. punch [pʌntʃ] *n.* & *v.* 冲头，冲床，冲孔器；冲压
7. soften ['sɔ(:)fn] *v.* 软化，变软
8. harden ['hɑ:dn] *v.* 硬化，变硬；淬硬
9. sustain [səs'tein] *v.* 承受得住；支撑；维持；遭受
10. punishment ['pʌniʃmənt] *n.* 大负荷；损伤；惩罚
11. scale [skeil] *n.* & *v.* 氧化皮，刻度；起氧化皮
12. contribute [kən'tribju:t] *v.* 产生，促使，提供，贡献
13. defect [di'fekt] *n.* 缺陷，疵点
14. grind [graind] *v.* 磨，磨削，研磨
15. suitable ['sju:təbl] *a.* 适宜的，相适应的
16. finish ['finiʃ] *v.* & *n.* 结束，精加工，粗糙度
17. austenitize ['ɔ:stənətaiz] *v.* 使成奥氏体，奥氏体化
18. select [si'lekt] *v.* 选择，挑选
19. ensure [in'ʃuə] *v.* 确保，保证得到
20. uncertain [ʌn'sə:tn] *a.* 不定的；不可靠的；易变的
21. carbide ['kɑ:baid] *n.* 碳化物；硬质合金
22. austenite *n.* 奥氏体
23. residence ['rezidəns] *n.* 停留
24. bar [bɑ: (r)] *n.* 棒，棒料，杆，条
25. slight (~ly) [slait] *a.* & *ad.* 轻微的；稍微，轻微地
26. double (~ly) ['dʌbl] *a.* & *ad.* & *v.* & *n.* 两倍的；双重地；加倍；两倍
27. twice [twais] *ad.* 两倍；两次
28. diameter [dai'æmitə] *n.* 直径
29. preheat [pri:'hi:t] *v.* 预热
30. method ['meθəd] *n.* 方法，方式
31. quench [kwentʃ] *v.* & *n.* 淬火

32. plain [plein] *a.* 普通的，平常的；简易的
33. severe (～ly) [si'viə] *a.* & *ad.* 剧烈的；严格地
34. indicate ['indikeit] *v.* 表明，指示
35. anneal [ə'ni:l] *v.* 退火
36. soft [sɔft] *a.* 软的
37. conclude [kən'klu:d] *v.* 结束；断定
38. difference ['difərəns] *n.* 差异，区别，不同

Phrases and Expressions

1. heat treatment	热处理
2. for the purpose of	为了，以便
3. critical temperature	临界温度
4. to some degree	在某种程度上
5. room temperature	常温，室温
6. dead soft	极软
7. to conclude	最后（一句话）

Notes

1. A tool steel intended to be machined into a punch may first be softened so that it can be machined.

译文：要想把一块工具钢加工成一只冲头，可先使其变软，以便能进行机械加工。

本句为主从复合句。so that 引导的是目的状语从句，句中 intended to be machined into a punch 是 V-ed$_2$ 短语，相当于 which is intended to be machined into a punch，用来修饰 a tool steel，intend 可构成 SVOC 句型，用 to V 作补足语，变成 被动语态时就成为 SV（be＋V-ed$_2$）C 句型。例如：

We intended a tool steel to be machined into a punch.

译文：我们打算把一块工具钢加工成一只冲头。

A tool steel was intended to be machined into a punch.

译文：打算把一块工具钢加工成一只冲头。

2. Usually a temperature of 50 to 100 degree above the critical temperature is selected, to ensure that the steel part reaches a high enough temperature to be completely austenitized, and also because furnace temperature control is always a little uncertain.

译文：通常，所选择的温度要比临界温度高出 50～100℃，以确保钢件达到足够高的温度，从而完全奥氏体化，同时也由于炉温度控制总会有点偏差。

本句为主从复合句，that 引导的是宾语从句，because 引导的是原因状语从句。句中 high enough ... to be completel austenitized 是一个割裂的形容词短语，用来修饰 temperature. 本句可写成：... a temperature high enough to be copletely austenitized ...

Reading Material

Iron and Steel

The earth contains a large number of metals which are useful to man. One of the most important of these is iron. Modern industry needs considerable quantities of this metal, either in the form of iron or in the form of steel. A certain number of non-ferrous metals, including aluminum and zinc, are also important, but even today the majority of our engineering products are of iron or steel. Moreover, iron possesses magnetic properties, which have made the development of electrical power possible.

The iron ore which we find in the earth is not pure. It contains some impurities which we must remove by smelting. The process of smelting consists of heating the ore in a blast furnace with coke and limestone, and reducing it to metal. Blasts of hot air enter the furnace from the bottom and provide the oxygen which is necessary for the reduction of the ore. The ore becomes molten, and its oxides combine with carbon from the coke. The non-metallic constituents of the ore combine with the limestone to form a liquid slag. This floats on top of the molten iron, and passes out of the furnace through a tap. The metal which remains is pig-iron.

We can melt this down again in another furnace——a cupola——with more coke and limestone, and tap it out into a ladle or directly into mouds. This is cast-iron. Cast-iron does not have the strength of steel. It is brittle and may fracture under tension. But it possesses certain properties which make it very useful in the manufacture of machinery. In the molten state it is very fluid, and therefore it is easy to cast it into complicated shapes. Also it is easy to machine it. Cast-iron contains small proportions of other substances. These non-metallic constituents of cast-iron include carbon, silicon and sulphur, and the presence of these substances affects the behaviour of the metal. Iron which contains a small quantity of carbon, for example wrought-iron, behaves differently from iron which contains a lot of carbon.

The carbon in cast-iron is present partly as free graphite and partly as a chemical combination of iron and carbon which we call cementite. This is a very hard substance, and it makes the iron hard too. However, iron can only hold about 1.5% of cementite. Any carbon content above that percentage is present in the form of free graphite. Steel contains no free graphite, and its carbon content ranges from almost nothing to 1.5%. We make wire and tubing from mild steel with a very low carbon content, and drills and cutting tools from high carbon steel.

Exercises

1. True and false statements

(1) Heat treatment is a process of heating metals to alter their mechanical properties.

(2) Usually a steel part intended to be machined into a punch undergoes heat treatment both before and after being machined.

(3) A steel part must be heated to the critical temperature in order to be completely austenitized.

(4) The larger the piece to be hardened, the longer it must be held at furnace temperature.

(5) Annealing is not a method of softening.

(6) All methods of heat treatment differ in the cooling process.

2. Rephrasing

(1) (After it is machined to shape) the punch must be hardened.

(2) Generally, heating operations (cause) scaling or other surface defects.

(3) When a steel part is heated in a hardening furnace, a temperature (50 to 100 degree higher than the critical temperature) is usually selected.

(4) For a 3/4 in. bar, a residence time of 20 minutes or slightly more (will be suitable).

(5) (After) the heating (process) is completed, the steel part may be quenched into cold water.

(6) The steel part may be left in the furnace to cool slowly (when the heat is turned off.)

3. Complete the following abstract of the text.

Heat treatment refers to the process of heating and cooling a metal to _____ its mechanical properties. After being heat treated a metal part must be ground to _____ and provide _____.

In order to be either hardened or softened, the steel must be _____, that is, its temperature must be taken _____ the critical temperature line. Also, it must be held at _____ temperature for sufficient time. The residence time in the furnace depends on the operator's _____ with any particular steel.

The _____ determines whether the steel will be hardened or softened. A steel part will be hardened when quenched into _____, and softened when cooled in _____. There are several softening methods. Annealing leaves the steel in the _____ condition.

UNIT 2

Text

Forming and Machining

The initial step in the manufacture of a product is, of course, to produce the required shape. There are two basic processes used for this purpose: forming and machining.

Forming, by far the more important shaping operation in terms of tonnage of ceramics, plastics, rubbers, and metals brought to final shape, includes all those methods that use a combination of force and tooling to change material into the shape required. In extrusion the press supplies the required force, the dies are the tooling. Again, a sand casting is produced by using the force of gravity to fill a sand mold with molten metal.

Forming operations may be done cold, as in the bending of sheet metal, or hot, as in forging or casting. Extrusion of metals may be done hot or cold. Thermoplastics are hot-extruded.

The alternative to forming methods is machining. In machining, a sharpened tool of suitable shape removes material in the form of chips until the desired shape is produced. The use of computer and punched-tape control of machine tools makes it possible for the machining tool to follow any complex three-dimensional path.

Machining is suited to either brittle or ductile materials, preferably the former, but not to materials too hard or too soft. Soft materials deform under tool pressure with a consequent loss of cutting action. Hard materials destroy the tool point. Inasmuch as abrasive grinding, electric discharge machining, and electrochemical machining methods extend the range of possible hardness in both directions. It is slightly difficult to define what is too hard or too soft to machine. It depends on the machining method selected.

Machining is not an economical method of producing a shape, because good raw material is converted into scrap chips. As the quality and cost of materials increase in the future and more basic knowledge about the forming methods is developed, perhaps machining methods may decline in importance. Machining has the further limitation that it is slow. Only so many cubic inches of volume can be shaped per unit time by the machining tool. Shapes that can be produced in seconds by forming methods may require minutes to produce by machining.

However, machining can be done to standards of accuracy that are currently impossible to meet in forming methods. Few forgings can be produced to final dimensions, and they must be given a machining operation to obtain the exact dimensions required. Accuracy of 0.001 in. is possible in machining with cutter bits on metal stock. Greater accuracy is possible by

grinding methods, some of which are capable of accuracy approaching a millionth of an inch.

Best surface finish is provided by machining methods, especially by grinding. Sand castings, for example, have a rough surface usually containing some sand. Such a surface must be removed in a final machining or grinding operation.

New Words

1. tonnage ['tʌnidʒ] *n.* 吨位，总吨数
2. tooling ['tu:liŋ] *n.* 工具（总称），刀具（总称）
3. extrusion [eks'tru:ʒən] *n.* 挤压，挤出
4. press [pres] *n.* & *v.* 压机，压床，冲床；压，压制
5. die [dai] *n.* 模具，冲模，锻模
6. sand [sʌnd] *n.* 沙，型砂
7. casting ['kɑ:stiŋ] *n.* 铸造；铸件
8. fill [fil] *v.* 加注，注满，装满
9. mold [məuld] *n.* & *v.* 模，铸模，铸型；造型，制模
10. bend [bend] *v.* 弯曲，使屈服
11. sheet [ʃi:t] *n.* 板，片，图表
12. thermoplastic [ˌθə:mə'plæstik] *n.* & *a.* 热塑性塑料；热塑性的
13. extrude [eks'tru:d] *v.* 挤压，挤出
14. alternative (～ly) [ɔ:l'tə:nətiv] *n.* & *a.* & *ad.* 替换物；选择的；二者取一地
15. sharpen ['ʃɑ:pən] *v.* 磨锐，刃磨
16. chip [tʃip] *n.* 切屑，铁屑
17. desire [di'zaiə] *v.* & *n.* 要求，期望
18. tape [teip, tep] *n.* 纸带，磁带；卷尺
19. dimensional [di'menʃənəl] *a.* 一维的，尺寸的
20. ductile ['dʌktail] *a.* 可延的，韧性的
21. preferable (～ly) ['prefərəbl] *a.* & *ad.* 更好的；更好地，优先地
22. deform [di'fɔ:m] *v.* 变形
23. consequent (～ly) ['kɔnsikwənt] *a.* & *ad.* 随之发生的；因此
24. inasmuch (as) [ˌinəz'mʌtʃ] *conj.* 因为，由于
25. abrasive [ə'breisiv] *n.* & *a.* 磨料，研磨剂；研磨的
26. discharge [dis'tʃɑ:dʒ] *n.* & *v.* 放电，卸下，排出
27. electrochemical [iˌlektrəukemikəl] *a.* 电化学的
28. extend [iks'tend] *v.* 延伸，扩展，增大，推广
29. raw [rɔ:] *a.* 未加工的，原始的
30. scrap [skræp] *n.* & *a.* 边角料，切屑；零碎的，废的
31. decline [di'klain] *v.* 减少，下降
32. limitation [ˌlimi'teiʃən] *n.* 限度，限制，局限（性）
33. cubic ['kju:bik] *a.* 立方的，体积的

34. accuracy [ˈækjurəsi] *n.* 精度，准确性
35. current (～ly) [ˈkʌrənt] *a.* & *ad.* 现在的，通用的；目前，通常地
36. dimension [diˈmenʃən] *n.* & *v.* 尺寸；标出尺寸
37. cutter [ˈkʌtə] *n.* 刀具
38. stock [stɔk] *n.* 毛坯
39. capable [ˈkeipəbl] *a.* 有能力的
40. approach [əˈprəutʃ] *v.* & *n.* 接近，探讨；方法
41. especially [isˈpeʃəli] *ad.* 特别
42. rough (～ly) [rʌf] *a.* & *v.* & *ad.* 粗加工的；粗加工；粗糙地

Phrases and Expressions

1. by far	……得多；最
2. sand casting	砂型浇铸；砂型铸件
3. fill . . . with	把……注入，用……充满
4. sand mold	砂型
5. sheet metal	金属板
6. punched tape	穿孔带
7. machine tool	机床
8. tool point	刀锋
9. abrasive grinding	强力磨削
10. electric discharge machining	电火花加工
11. electrochemieal machining	电化学加工
12. raw material	原（材）料
13. cutter bit	刀头，刀片
14. capable of	有……能力的，能……的

Notes

1. forming 可以指“成型加工”、“加工成型”、“仿型加工”，也可以指“压力加工”。

2. Forming, by far the more important shaping operation in terms of tonnage of ceramics, plastics, rubbers, and metals brought to final shape, includes all those methods that use a combination of force and tooling to change material into the shape required.

译文：就加工成型的陶瓷、塑料、橡胶以及金属等制品的总吨数来说，压力加工是一种重要得多的成型方法。

by far the more important . . . to final shape，是一个带有较长的修饰语的名词短语，by far 修饰形容词 more important。in terms of . . . to final shape 是一个介词短语，修饰 by far the more imprtant shaping operation. 介词短语中 brought to final shape 是一个 V-ed$_2$ 短语，修饰 tonnage of ceramics, plastics, rubbers, and metals。in terms of 相当于 with regard to，意为“关于”、“就……而论”。