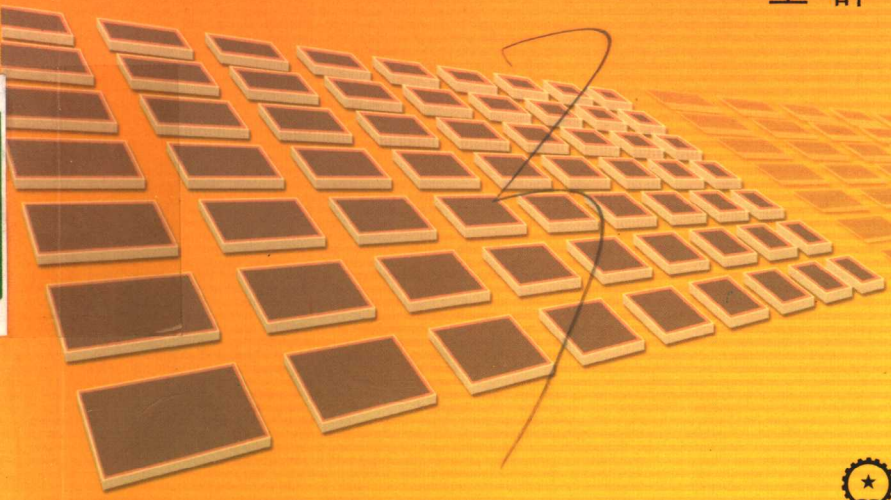
English for Die & Mould

模具专业英语

——设计·制造·报价·结算

—Design,Manufacture, Quotation and Settlement

王 群 童长清 ○主编



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本书共分7章，分别叙述了模具材料、塑料及其成型模具、冲压技术及模具、锻造工艺及模具、机械加工与特种加工、计算机在模具技术上的应用、模具外贸知识等。该书内容精炼，选材新颖；所有模具均以图例进行解说；每课后面附有生词、词组、句例浅析和习题；尤其是第7章所编“模具制造合同”、“模具报价策略和结算方式”等内容，更具有实用价值。本书的结尾还附有精心挑选的常用的模具设计、制造以及外贸专业英语单词及短语。

本书可作为大学“材料成形及控制工程”专业以及高职、高专“模具设计与制造”专业的教材，也可作为模具技术培训教材，还可供企业从事模具设计、制造以及模具外贸的人员参考。

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Foreword

模具是现代“工业之母”，模具技术已成为衡量一个国家机械制造水平的重要标志。随着我国经济持续、快速的增长，世界各大型工业集团纷纷将制造业转移到我国。由此，给我国模具工业带来了良好的发展机遇，同时也促进了本国企业与外商的交流和贸易的增加。

为了更好地帮助模具专业学生及模具企业的外贸人员尽快地适应国际、国内模具技术发展的需要，提高他们阅读和翻译有关模具外文资料以及直接参与模具外贸洽谈的能力，在湖南省模具设计与制造学会的组织下，我们编写了《模具专业英语》这本教材。

本书由湖南省模具学会理事长、湖南大学材料学院叶久新教授策划并构思，由湖南省模具学会副秘书长、湖南大学王群博士精心选材与加工，由长沙理工大学外国语学院童长清教授进行整理和编辑。全书共分7章，分别叙述了模具材料、塑料及其成型模具、冲压技术及模具、锻造工艺及模具、机械加工与特种加工、计算机在模具技术上的应用、模具外贸知识等内容。

本书的特点是：内容精炼，选材新颖；所有模具均以图例进行解说；每课后面附有生词、词组、句型、句例浅析和习题；尤其是第7章所编“模具制造合同”、“模具报价策略和结算方式”等内容，更具有实用价值。本书的结尾还附有精心挑选的常用的模具设计、制造以及外贸专业英语单词及短语。

本书可作为大学“材料成形及控制工程”专业以及高职、高专“模具设计与制造”专业的教材，还可供企业从事模具设计、制造以及模具外贸的人员参考。

担任本书副主编的为：湖南生物机电职业技术学院张秀玲、湖南涉外经济学院徐友良、湖南工业职业技术学院胡彦辉。参与本书编写的人员还有：湖南电子科技职业学院刘卫东、湖南科技职业学院许文全、湖南工学院张蓉、湖南科技大学伍先明、株洲科技职业学院沈言锦、长沙航天工业学校袁晓玲；此外，还有阎小宁、曾婷、陈芳、刘叶红、龙艳辉、童智等为本书的编写提供了很大的帮助；同时还得到了湖南省外语界知名教授廖世翘先生的斧正，在此一并表示衷心的感谢。

由于编者水平有限，错误之处在所难免，敬请读者批评、指正。

编者

2006年11月于长沙

Contents

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Chapter 1

Introduction of Die & Mold Materials

Lesson 1 Steels

Steels (first made in China and Japan around 600 – 800 AC) are generally divided into the categories of carbon steels and alloy steels (including tool steels).

Carbon Steels

Carbon steels are used extensively in tool construction. Carbon steels are those steels which only contain iron and carbon, and small amounts of other alloying elements. Carbon steels are the most common and least expensive type of steels used for tools. The three principal types of carbon steels used for tooling are low carbon, medium carbon, and high carbon steels. Low carbon steel contains between 0.05% and 0.3% carbon. Medium carbon steel contains between 0.3% and 0.7% carbon. And high carbon steel contains between 0.7% and 1.5% carbon. As the carbon content is increased in carbon steel, the strength, toughness, and hardness also increase when the metal is heat treated.

Low carbon steels are soft, tough steels that are easily machined and welded. Due to their low carbon content, these steels cannot be hardened except by case hardening. Low carbon steels are well suited for the following applications: tool bodies, handles, die shoes, and similar situations where strength and wear resistance are not required.

Medium carbon steels are used where greater strength and toughness are required. Since medium carbon steels have a higher carbon content they can be heat treated to make parts such as studs, pins, axles, and nuts. Steels in this group are more expensive as well as more difficult to machine and weld than low carbon steels.

High carbon steels are the most hardenable type of carbon steel and are used frequently for parts where wear resistance is an important factor. Other applications where

high carbon steels are well suited include drill bushings, locators, and wear pads. Since the carbon content of these steels is so high, parts made from high carbon steel are normally difficult to machine and weld.

Alloy Steels

Alloy steels are basically carbon steels with additional elements added to alter the characteristics and bring about a predictable change in the mechanical properties of the alloyed metal. Alloy steels are not normally used for most tools due to their increased cost, but some have found favor for special applications. The alloying elements used most often in steels are manganese, nickel molybdenum, and chromium.

Another type of alloy steel frequently used for tooling applications is stainless steel. Stainless steel is a term used to describe high chromium and nickel-chromium steels. These steels are used for tools which must resist high temperatures and corrosive atmospheres. Some high chromium steels can be hardened by heat treatment and are used where resistance to wear, abrasion, and corrosion are required. Typical applications where a hardenable stainless steel is sometimes preferred are plastic injection molds; Here the high chromium content allows the steel to be highly polished and prevents deterioration of the cavity from heat and corrosion.

Questions

1. *How are carbon steels classified?*
2. *What categories are steels generally divided into?*

New Words and Expressions

generally ['dʒenərəli]	*adv.* 一般，通常，一般地
category ['kætigəri]	*n.* 类别，分类
carbon steel	碳素钢
alloy steel	合金钢
element ['elimənt]	*n.* 要素，元素，成分；元件
principal ['prinsəp(ə)l, -sip-]	*adj.* 主要的，首要的
heat treat	热处理
machine [mə'ʃi:n]	*n.* 机器，机械 *vt.* 机器制造，用车床加工
weld [weld]	*vt.* 焊接 *n.* 焊接，焊缝

handle ['hændl] *n.* 柄，把手，把柄 *vt.* 触摸；运用；买卖；处理；操作
die shoe *n.* 模脚
stud [stʌd] *n.* 柱头螺栓
pin [pin] *n.* 钉，销，栓
axle ['æksl] *n.* 轴，车轴，轮轴
nut [nʌt] *n.* 螺母
hardenable ['hɑ:dənəbl] *adj.* 可硬化的
frequently ['fri:kwəntli] *adv.* 常常，频繁地，经常地
wear resistance 耐磨性
drill bushing 钻套
locator [ləu'keitə] *n.* 定位器（表示位置之物）；土地
wear pad 耐磨垫板
alter ['ɔ:ltə] *v.* 改变
predictable [pri'diktəb(ə)l] *adj.* 可预言的
manganese [ˌmæŋgə'ni:z, 'mæŋgəni:z] *n.* [化] 锰（元素符号为 Mn）
nickel ['nikl] *n.* [化] 镍，镍币
molybdenum [mə'libdinəm] *n.* [化] 钼
chromium ['krəumjəm] *n.* [化] 铬
resist [ri'zist] *vt.* 抵抗，反抗，抗；忍得住
corrosive [kə'rəusiv] *adj.* 腐蚀的，蚀坏的，腐蚀性的 *n.* 腐蚀物，腐蚀剂
abrasion [ə'breiʒən] *n.* 磨损
preferred [pri'fə:d] *adj.* 首选的
polish ['pɔliʃ] *n.* 磨光；光泽 *vt.* 擦亮，发亮，磨光
deterioration [di,tiəriə'reiʃən] *n.* 变坏，退化；堕落

Notes

1. Carbon steels are those steels which only contain iron and carbon, and small amounts of other alloying elements. Carbon steels are the most common and least expensive type of steels used for tools.

译文：碳钢是指那些仅仅由铁和碳以及少量的其他合金元素构成的钢。碳钢是一种最常见的、最廉价的制造工具的钢。

解析：此句中 which 是关系代词，引导定语从句，修饰前面的名词 steels，并充当定语从句中的主语。used for tools 是过去分词短语做后置定语，修饰中心词 steels，它也可等同于一个定语从句 which/that are used for tools。

2. Low carbon steels are well suited for the following applications: tool bodies, handles, die shoes, and similar situations where strength and wear resistance are not required.
译文：低碳钢很适合于以下用途：工具主体、把柄、模脚以及一些不要求强度和耐磨性的类似情况。

3. High carbon steels are the most hardenable type of carbon steel and are used frequently for parts where wear resistance is an important factor.
译文：高碳钢是最可硬化的一种碳钢，并常用于对耐磨性要求非常高的部件。
解析：此句中 where 是关系副词，引导定语从句。

4. Some high chromium steels can be hardened by heat treatment and are used where resistance to wear, abrasion, and corrosion are required.
译文：一些高铬钢能够通过热处理硬化，被用于有耐磨损、耐大气腐蚀要求的场合。

5. Typical applications where a hardenable stainless steel is sometimes preferred are plastic injection molds: Here the high chromium content allows the steel to be highly polished and prevents deterioration of the cavity from heat and corrosion.
译文：常选用可硬化不锈钢的典型场合是塑料注射模具：因为高的含铬量使得钢材具有很好的抛光性，而且能够防止型腔由于受热和腐蚀而产生性能的退化。
解析：此句中 prevent... from 译为“阻止，妨碍”。

Exercise

Fill in the blanks with the proper words.

1. The three principal types of carbon steels used for tooling are low carbon, _____ carbon, and high carbon steels.
2. Low carbon steels are _____, tough steels that are easily machined and welded.

3. Since medium carbon steels have a higher carbon content they can be heat treated to make parts _____ studs, pins, axles, and nuts.
4. _____ the carbon content of these steels is so high, parts made from high carbon steel are normally difficult to machine and weld.
5. Alloy steels are not normally used for most tools _____ their increased cost, but some have found favor for special applications.

Reading Materials (1)

The Function of Alloying Elements in Alloy

Various alloying elements are added to iron in order to impart certain properties. These are summarized below. The major detrimental effects are stated in parentheses.

Carbon: hardenability, strength, hardness, and wear resistance.

Nickel: strength and toughness; minor effect on hardenability.

Chromium: strength, toughness, hardness, and wear resistance; increases depth of hardness penetration in heat treatment.

Molybdenum: hardenability, wear resistance, toughness; strength, creep resistance, and hardness at elevated temperatures.

Vanadium: strength, abrasion resistance, hardness at elevated temperatures; inhibits grain growth during heat treatment.

Copper: resistance to atmospheric corrosion, improve strength with little loss in ductility. (Can adversely affect surface quality and hot-working characteristics.)

Manganese: hardenability and ductility.

Lead: machinability. (Causes liquid-metal embrittlement.)

Sulfur: machinability. (Lowers impact strength and transverse ductility; impairs surface quality and weldability.)

Silicon: strength, high electrical conductivity; decreases magnetic hysteresis loss.

Phosphorus: strength, hardenability, corrosion resistance, machinability. (Decreases ductility and toughness.)

Boron: hardenability.

Tungsten and Cobalt: strength and hardness at elevated temperatures.

Columbium (Niobium): fine grain size, strength, lowers transition temperature.

Tellurium: machinability of leaded steels.

Zirconium and Cerium: control shape of inclusions (sulfides) and improve tough-

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ness in high-strength, low-alloy steels.

Aluminum, Silicon and Calcium: added to steels during solidification to remove oxygen and nitrogen.

New Words

impart	*n.* 给予（尤指抽象事物）；传授；告知，透露
detrimental	*adj.* 有害的
hardenability	*n.* ［冶］可硬性，淬透性，可淬性
vanadium	*n.* ［矿］钒，铅矿
ductility	*n.* 展延性，柔软性，顺从
sulfur	*n.* ［化］硫磺 *vt.* 用硫磺处理
transverse	*adj.* 横向的，横断的
hysteresis	*n.* 滞后作用；［物］磁滞现象
phosphorus	*n.* ［化］磷
tungsten	*n.* ［化］钨
cobalt	*n.* ［化］钴（符号为 Co）；钴类颜料；由钴制的深蓝色
columbium	*n.* ［化］铌
niobium	*n.* ［化］铌［旧名 columbium］
tellurium	*n.* ［化］碲
zirconium	*n.* ［化］锆
cerium	*n.* ［化］铈
aluminum	*n.* ［化］铝
solidification	*n.* 凝固

Lesson 2 Heat Treating of Steel

Specifications for heat-treating processes are among the most important of those shown on an engineering drawing. Proper heat treatment is a powerful tool for developing the best possible properties that a material can possess. In general, heat treatment may be described as a combination of heating and cooling operations, timed and applied to a metal or an alloy in the solid state in a way that will produce desired properties.

Principally, heat treatment is used to produce strengthening, but some heat-treating processes soften, toughen, or otherwise enhance properties.

Internally, a metal or alloy consists of one or more kinds of atoms packed together in orderly three-dimensional arrangements called crystals. The crystals, in turn, are bonded together in diverse ways which are described in terms of microstructure or grain structure. Any given structure can be altered to some extent by plastic deformation from compressive, tensile, or shear forces, but the available time-temperature treatments provide a greater variety of properties. Heat treatments are carefully controlled combinations of such variables as time, temperature, rate of temperature change, and furnace atmosphere. The selection of a specific treatment must be based upon knowledge of the properties desired in the finished part.

There is available today a multitude of metals and alloys designed for various purposes. There are also many different heat-treating processes. Not all the treatments can be used with each metal or alloy. In other words, the treatment selected must be one that is compatible with the specified material. Heat treatment cannot be selected independently of material. One is just as important as the other.

Reasons for Heat Treating

Ferrous Metals. Ferrous parts are heat-treated for several reasons: to relieve internal stresses, to change the icrostructure by refining the grain size or producing uniform grain throughout a part, to alter the surface chemistry by adding or deleting elements, and to strengthen a metal part.

Treatment of Ferrous Materials. Iron is the major constituent in the steels used in tooling, to which carbon is added in order that the steel may harden. Alloys are put into steel to enable it to develop properties not possessed by plain carbon steel, such as the ability to harden in oil or air, increased wear resistance, higher toughness, and greater safety in hardening.

Heat treatment of ferrous materials involves several important operations which are customarily referred to under various headings, such as normalizing, spheroidizing, stress relieving, annealing, hardening, tempering, and case hardening.

Normalizing involves heating the material to a temperature of about 100 – 200°F (55 – 100℃) above the critical range and cooling in still air. This is about 100°F (55℃) over the regular hardening temperature.

The purpose of normalizing is usually to refine grain structures that have been coarsened in forging. With most of the medium-carbon forging steels, alloyed and unalloyed, normalizing is highly recommended after forging and before machining to produce

more homogeneous structures, and in most cases, improved machinability.

High-alloy air-hardened steels are never normalized, since to do so would cause them to harden and defeat the primary purpose.

Spheroidizing is a form of annealing which, in the process of heating and cooling steel, produces a rounded or globular form of carbide—the hard constituent in steel.

Tool steels are normally spheroidized to improve machinability. This is accomplished by heating to a temperature to 1380 – 1400℉ (749 – 760℃) for carbon steels and higher for many alloy tool steels, holding at heat one to four hours, and cooling slowly in the furnace.

Stress Relieving. This is a method of relieving the internal stresses set up in steel during forming, cold working, and cooling after welding or machining. It is the simplest heat treatment and is accomplished merely by heating to 1200 – 1350℉ (649 – 732℃) followed by air or furnace cooling.

Large dies are usually roughed out, then stress-relieved and finish-machined. This will minimize change of shape not only during machining but during subsequent heat treating as well. Welded sections will also have locked-in stresses owing to a combination of differential heating and cooling cycles as well as to changes in cross section. Such stresses will cause considerable movement in machining operations.

Annealing. The process of annealing consists of heating the steel to an elevated temperature for a definite period of time and, usually, cooling it slowly. Annealing is done to produce homogenization and to establish normal equilibrium conditions, with corresponding characteristic properties.

Tool steel is generally purchased in the annealed condition. Sometimes it is necessary to rework a tool that has been hardened, and the tool must then be annealed. For this type of anneal, the steel is heated slightly above its critical range and then cooled very slowly.

Hardening. This is the process of heating to a temperature above the critical range, and cooling rapidly enough through the critical range to appreciably harden the steel.

Tempering. This is the process of heating quenched and hardened steels and alloys to some temperature below the lower critical temperature to reduce internal stresses setup in hardening.

Case Hardening. The addition of carbon to the surface of steel parts and the subsequent hardening operations are important phases in heat treating. The process may involve the use of molten sodium cyanide mixtures, pack carburizing with activated solid

material such as charcoal or coke, gas or oil carburizing, and dry cyaniding.

Questions

1. *What are the common methods of heat treating?*
2. *What is the purpose for heat treating of steel?*

New Words and Expressions

microstructure ['maikrəu'strʌktʃə]	*n.* 微观结构，显微结构
tensile ['tensail]	*adj.* 可拉长的，可伸长的；[物] 张力的，拉力的
shear [ʃiə]	*v.* 剪，修剪，剪切 *n.* 剪，切；切力
furnace ['fə:nis]	*n.* 炉子，熔炉
multitude ['mʌltitju:d]	*n.* 多数，群众
be compatible with	与……适合，一致
specify ['spesifai]	*vt.* 指定，限定；详细说明；列入清单
independently [indi'pendəntli]	*adv.* 独立地，自立地
ferrous ['ferəs]	*adj.* 铁的，含铁的；[化] 亚铁的
refine [ri'fain]	*vt.* 精炼，精制
grain size	粒度，颗粒尺寸，结晶粒度 [大小]
uniform ['ju:nifɔ:m]	*adj.* 统一的，相同的，一致的 *n.* 制服 *vt.* 使成一样
normalizing ['nɔ:məlaiziŋ]	*n.* 正火
spheroidizing ['sfiərɔidaiziŋ]	*n.* 球化（处理）
stress relieving	应力消除
annealing [æ'ni:liŋ]	*n.* 退火
hardening ['hɑ:dəniŋ]	*n.* 淬火
tempering ['tempəriŋ]	*n.* 回火
case hardening	表面硬化
homogeneous [ˌhɔməu'dʒi:njəs]	*adj.* 同类的；相似的；均一的，均匀的
machinability [məʃi:nə'biliti]	*n.* 机械加工性，切削性

air-hardened ['eəhɑ:dənd]	*adj.* 空气（冷却）硬（化）的，自硬的
accomplish [ə'kɔmpliʃ]	*v.* 完成
furnace cooling	（随）炉冷却
finish-machined	*adj.* 精加工的
welded section	焊接区域
locked-in ['lɔkt'in]	*adj.* 牢固的
elevated ['eliveitid]	*adj.* 高的，提高的；严肃的
homogenization [ˌhəumədʒənai'zeiʃən]	*n.* （均）匀化，均质化，同质化，纯一化
equilibrium [ˌi:kwi'libriəm]	*n.* 平衡；平静；均衡，保持平衡的能力；沉着，安静
critical temperature	临界温度
subsequent ['sʌbsikwənt]	*adj.* 后来的，并发的
molten sodium cyanide	熔融的氰化钠
carburizing ['kɑ:bjuraiziŋ]	增碳剂，渗碳剂
charcoal ['tʃɑ:kəul]	*n.* 木炭
coke [kəuk]	*n.* 焦炭 *v.* （使）成焦炭
cyaniding ['saiənaidiŋ]	*n.* 氰化

Notes

1. In general, heat treatment may be described as a combination of heating and cooling operations, timed and applied to a metal or an alloy in the solid state in a way that will produce desired properties.

译文：通常，热处理被描述为对金属或合金按一定的速度进行加热和冷却的一种处理过程，以此来获得理想的性能。

解析：句中 describe as：描述为……。

apply to：将……应用于。

in a way 译为“在某种程度上，稍稍”。又如：

I like the new styles, in a way. 某种程度上我喜欢这些新款式。

In a way, you're right. 从某一点上看，你是对的。

2. Any given structure can be altered to some extent by plastic deformation from compressive, tensile, or shear forces, but the available time-tempera-

ture treatments provide a greater variety of properties.

译文：由压缩、拉伸或剪切力带来的塑性变形不但可以在某种程度上改变任何给定的物质结构，而且还能结合给定的热处理工艺获得较宽范围内的性能的变化。

解析：句中 given 译为“特定的，给定的”。又如：

We will meet at a given time and location. 我们将在指定的时间和地点见面。

3. Not all the treatments can be used with each metal or alloy. In other words, the treatment selected must be one that is compatible with the specified material.

译文：并非所有的热处理都能用于每种金属或合金。换句话说，选择的热处理工艺必须和指定材料所需要的热处理工艺相一致。

解析：句中 Not all 表部分否定，有时相当于“All... not...”。又如：

All is not gold that glitters. 发光的并不总是金子。

4. Heat treatment of ferrous materials involves several important operations which are customarily referred to under various headings, such as normalizing, spheroidizing, stress relieving, annealing, hardening, tempering, and case hardening.

译文：含铁材料的热处理包含几个重要操作，常常被冠以如下这些称谓，例如正火、球化、消除应力、退火、淬火、回火和表面硬化。

解析：句中 such as 译为“例如……”，“像这种的”。refer to：提到，谈到，指的是。

5. The purpose of normalizing is usually to refine grain structures that have been coarsened in forging.

译文：正火的目的通常是为了细化锻造过程中被粗化的晶粒。

解析：句中 grain structures 译为“晶粒结构”。that 在句中是关系代词，引导定语从句，修饰先行词 grain structures，并代替先行词在从句中做主语。

6. The process of annealing consists of heating the steel to an elevated temperature for a definite period of time and, usually, cooling it slowly. Annealing is done to produce homogenization and to establish normal equilibrium conditions, with corresponding characteristic properties.

译文：退火过程常为将钢加热至高温并保温一定的时间，然后慢慢冷却。退火

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