· 高职高专“十二五”规划教材 ·

Mechanical and Materials Professional English

材料工程专业英语

王晓丽　朱燕玉　胡小龙　主编

冶金工业出版社
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内 容 简 介

本书是为高等职业技术学校和高等专科学校的材料、冶金及相近专业编写的专业英语教材。本书在编写过程中充分突出了职业技术教育的特点，在内容安排上尽量选择与生产实践相关的题材。

教材内容分为5部分，13章。除第11章外，每章由Text 1~Text 5五篇文章组成。内容基本覆盖了材料工程专业的各个主要方面，包括钢铁冶金的基础知识、铁矿石还原理论、炼铁、炼钢、连铸工艺、轧钢工艺知识、质量检测、设备操作说明书等内容。为加深理解和学用结合，每部分都附有思考题和习题，使学生能够掌握本专业最基本的英文词汇，为将来的学习及研究工作打下良好的基础。

本教材可作为高等职业技术教育和高等专科学校的材料成型、冶金及相关专业的专业英语教材，也可用作成人大专、职工培训和继续教育教材，并可供工程技术人员参考。

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《材料工程专业英语》

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前 言

本教材是根据21世纪高等职业教育的发展要求，在认真总结和充分吸收当前高职院校基于工作过程中的课程改革经验，针对高职高专材料工程(含冶金技术、材料加工)专业按照“材料工程”专业的教学计划和教学大纲的要求，贯彻“必需，够用和少而精”的原则编写的。

本教材根据高等职业学校材料、冶金专业英语课程新教学大纲要求，精心挑选课程内容。教材内容分为5部分，13章，除第11章外，每章可由Text 1~Text 5五篇文章组成，其中Text 1、Text 2两篇文章可作为精读材料；其余文章作为补充的阅读材料。这样既保证了教学，又可使学生有一定的自主学习的余地，使课堂的精讲多练与学生课余的自主学习相结合，形成材料工程专业英语教学的良性互动，提高教学质量。另外，为拓宽知识面，满足学生的需要，书中还附上了单词表和课文翻译。教材知识面广、综合性强、适用范围广，可作为金属材料工程、材料成型及控制、冶金技术等大学专科学校的专业英语教材，也可供有关工程技术人员参考。其适用教学学时数为40学时，使用时可结合各专业的具体情况进行调整，有些内容可供学生自学。

本教材由王晓丽、朱燕玉、胡小龙担任主编，史学红、王强、李荣担任副主编。本教材共13章，参加本书编写的有：包头钢铁职业技术学院王晓丽(第0、1章)，包头钢铁职业技术学院朱燕玉(第2~5章)，内蒙古科技大学赵鸣(第6章)，内蒙古机电职业技术学院胡小龙(第7章)，内蒙古机电职业技术学院王强(第8章)，山西工程职业技术学院史学红(第9章)，济源职业技术学院李荣(第10章)，济源职业技术学院程光辉(第11章)，包头钢铁职业技术学院周宜阳(第12章)，单词列表由包头钢铁职业技术学院朱燕玉、周宜阳、周丽编写。课文翻译由包头钢铁职业技术学院王晓丽、济源职业技术学院牛海云和河北科技大学冯捷编写。全书由王晓丽统稿。

由于编者水平有限，时间仓促，书中难免存在不少缺点，敬请广大读者和师生批评指正。

编 者

2013年10月

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0 The Steelmaking Process

First, the raw materials — either iron ore or scrap iron, depending on the process — are converted into molten steel (Fig.0-1). The ore-based process uses a blast furnace and the scrap-based process uses an electric arc furnace.

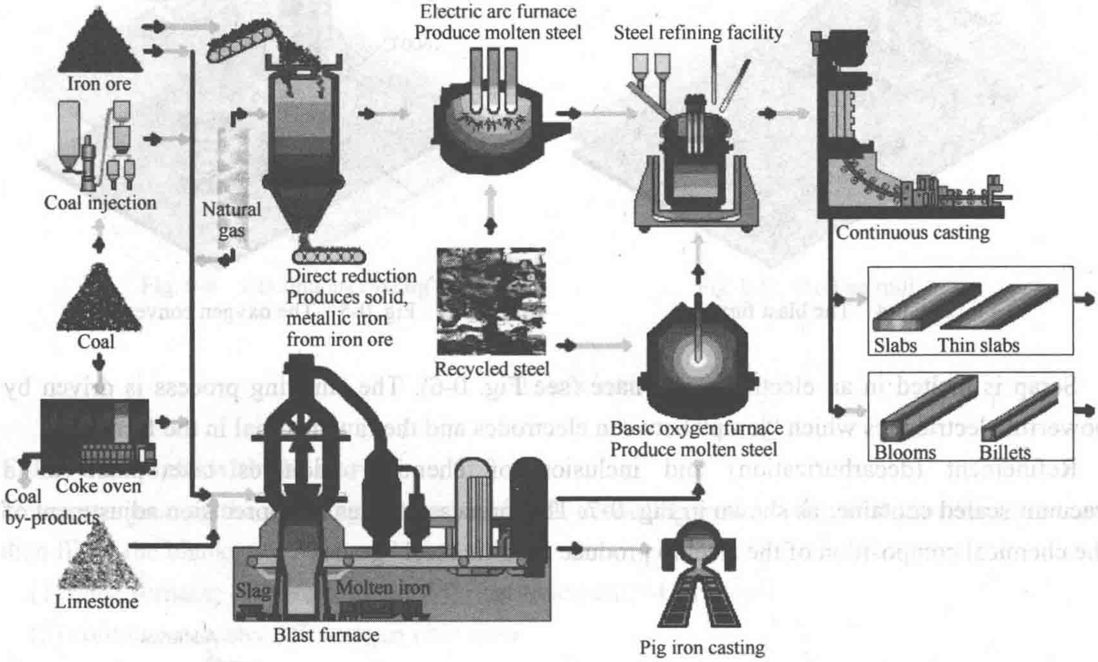


Fig. 0-1 Produces molten pig iron from iron ore

As shown in Fig. 0-2, the sinter plant is where the iron ore is prepared: the iron ore is crushed and calibrated into grains which are "sintered", or bonded together.

Coke is a combustible substance obtained by the dry distillation of coal in a coke oven (see Fig. 0-3). Burned in the blast furnace, it provides the heat and gases needed to melt reduce iron ore.

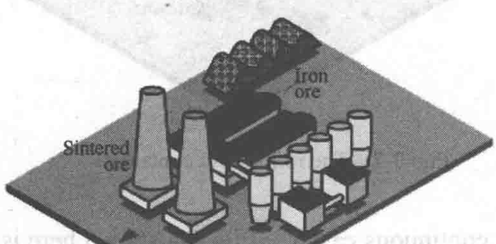


Fig. 0-2 The sinter plant

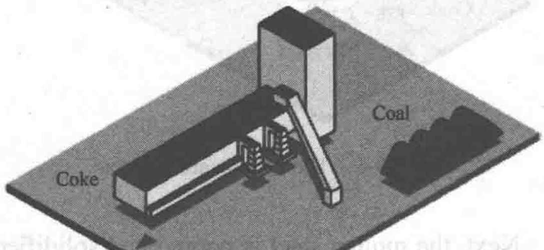


Fig. 0-3 Coke oven

The blast furnace is where the iron is extracted from the iron ore as shown in Fig. 0-4. The sintered iron ore is then crushed and fed, in alternating layers with coke, into the blast furnace.

The oxygen converter is where the pig iron is converted into steel as shown in Fig. 0-5. The molten pig iron is poured onto a layer of scrap iron. Unwanted substances, such as carbon and residues, are burnt off through injections of pure oxygen, to produce crude steel.

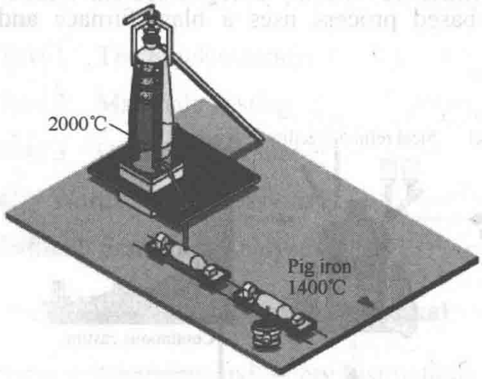


Fig. 0-4　The blast furnace

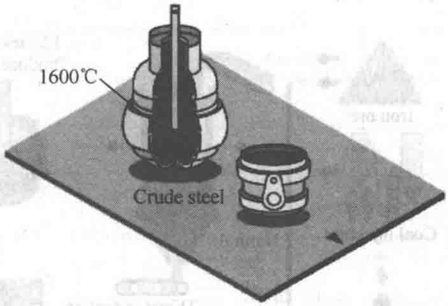


Fig. 0-5　The oxygen converter

Scrap is melted in an electric arc furnace (see Fig. 0-6). The smelting process is driven by powerful electric arcs which “jump” between electrodes and the raw material in the furnace.

Refinement (decarburization) and inclusion of chemical additives take place in a vacuum-sealed container as shown in Fig. 0-7. This process enables high-precision adjustment of the chemical composition of the steel to produce specific steel “grades”.

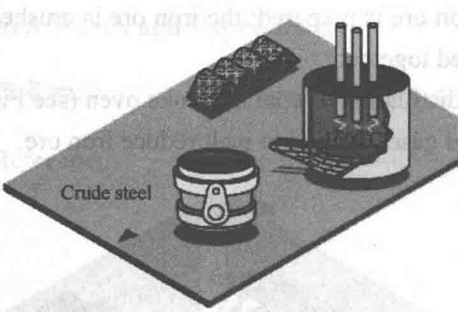


Fig. 0-6　The electric arc furnace

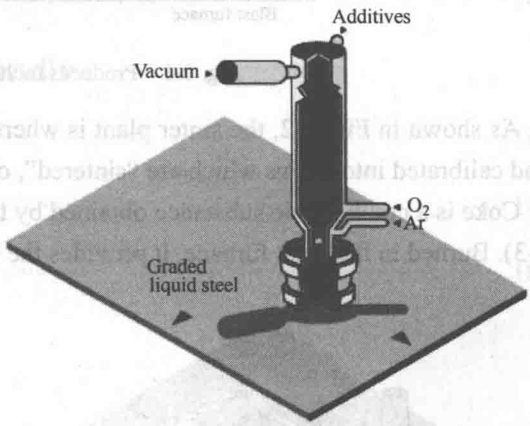


Fig. 0-7　The refinement container

Next, the molten steel is poured and solidified in a continuous caster.　Fig. 0-8 shown here is a slab being cast. This produces what are known as semi-finished products. These can be either slabs, which have a rectangular cross-section, or blooms or billets, which have a square cross-section. They are the blanks which are used to form the finished product.

Lastly, these semi-finished products are transformed, or "rolled" into finished products in the rolling mill (see Fig. 0-9). Some of these undergo a heat treatment, known as "hot rolling". More than half the hot-rolled sheet is subsequently rolled again at ambient temperatures (known as "cold rolling"). It can then be coated with an anti-corrosion protective material.

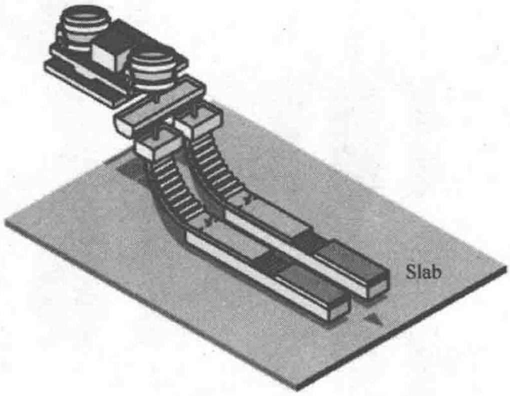


Fig. 0-8 Continuous casting

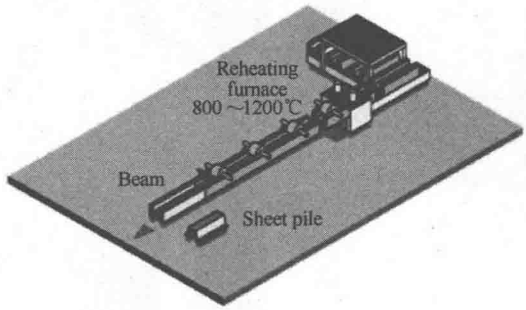


Fig. 0-9 Rolling mill

Exercises

Fill in the blanks with the words.

Please recognizing the meaning of word and rank according to the order of steelmaking process, then fill in the blanks (　　).

(1) blast furnace; (2) refining unit; (3) heat treatment; (4) roll mill;

(5) continuous caster ; (6)oxygen converter

cross-section. They are the metals which are used to form the finished products.

Lastly, these semi-finished products are transformed, or 'rolled' into finished products in the rolling mills (see Fig. 0.9). Some of these undergo a heat treatment, known as 'hot rolling'. More than half the hot-rolled steel is subsequently rolled again at ambient temperature (known as 'cold rolling'). It can then be coated with an anti-corrosion protective material.

Fig. 0.9 Rolling mill

Fig. 0.8 Continuous caster

Exercises

Fill in the blanks with the words.

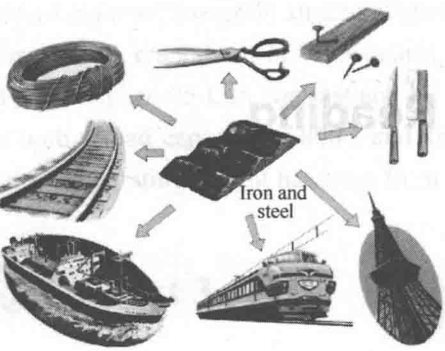
Please recognizing the meaning of word and rank according to the order of steelmaking process, then fill in the blanks ( ) using the words.

(1) blast furnace; (2) refining unit; (3) heat treatment; (4) roll mills

(5) continuous caster; (6) oxygen converter

PART I

Introduction to Iron and Steel



1 The Application of Steel

Text 1

The Versatility of Steel

For more than 3000 years, steel has served as a basis of technological progress and improved quality of life. Trend-setting engineering progress such as the steam engine, the railway, the motor car, aviation, telecommunications, space travel and computer technology would have been impossible but for steel. ①

Number of different steel grades continuously matched to address rising requirements in a variety of fields. This development has also benefited other materials which nowadays compete with steel. The production and the processing of plastics, concrete, aluminum and ceramics would have been impossible without steel.

No other production material has been used in so many different areas for achieving such outstanding final product properties. The variety of property features combined with the many different forms of delivery such as plates and sheets, tubes, sections, beams, bars, wires or ropes, make steel virtually indispensable in almost all areas of engineering.

In many final products, steel is the predominant material. Impressive examples of this are automotive engineering, bridge building, machine-building and ship building as well as transportation systems and entire industrial complexes. Steel assumes important functions in the fields of aviation and space travel, medicine, telecommunications, energy as well as in information and communications technology. Wherever we look we find that steel is always a component of a final product which is required to satisfy the highest demands.

Steel can be used in so many different ways because it has so many highly dissimilar basic properties. For making an autobody, sheet must deform very well. In an accident, the impact energy is absorbed by the plastic deformation of the sheet. A contrary effect is achieved by steel when used for springs. Without manifesting any fatigue, the spring elastically absorbs a load many millions of times and, after stress removal, returns to its original shape. In the medical and food sectors, sterility and hygiene are of top priority. For this purpose, stainless steel and tinplate products are successfully used.

Supplementary Reading

Text 2

The Development of New Steel Grades

Steel has such a broad spectrum of application properties by the aid of the large number of differing production techniques. Certain structures are obtainable by metallurgical means or specific heat treatment. Other forms of surface treatment open up other areas of application. The demands made of steel may concern its physical or its chemical properties.

The steels are constantly being improved and adapted to new applications. Within a brief period of time, new grades have been developed by the steel making industry to match changing requirements of the market. Examples of these: the development of offshore energy resources calls for gigantic structures exposed to extremely high stresses. The use of conventional structural steels would have increased the weight of such structures far beyond an acceptable level. This has led to the development of high-strength weldable fine-grain structural steels which, despite their considerably greater strength, can be processed without any problems. ②The advantages of such grades have meanwhile been employed for pressure vessels, pipelines and cranes.

The "oil shocks" of the 70s encouraged us to rethink how we handle raw materials and energy. The automotive industry was faced with the challenge of building fuel-efficient vehicles and needed for this purpose sheet which, while maintaining the same good processing properties, offered a weight reduction without any compromise in quality and safety. The outcome of the research was sheets with greater strength and improved corrosion protection, allowing autobodies to shed up to 25% of their weight.

The extent of developments leading to a decrease in the specific consumption of steel becomes apparent if we analyze the situation over a lengthy period. The 320m tall Eiffel Tower built in 1889 required 7000 t of steel. Nowadays, only 2000t would be needed.

Destroyed in 1945, the bridge crossing the Rhine near Cologne- Church weighed 14808 t. The new bridge, erected on the same site with new construction elements and higher capacity steel grades, weight only 7860 t.

Railroad rails laid in 1960 weighed 49kg/m, and at an annual transportation load of 15 million tonnes, life was 14 years. Today's rails are somewhat heavier at 60kg/m; however, at the same load, they last about 40 years. Under development are rails with a hardened head permitting a further extension of service-life.