精细化学品生产技术专业（群）重点建设教材

国家骨干高职院校项目建设成果

浙江省精细化学品生产技术优势专业项目建设成果

精细化工专业英语

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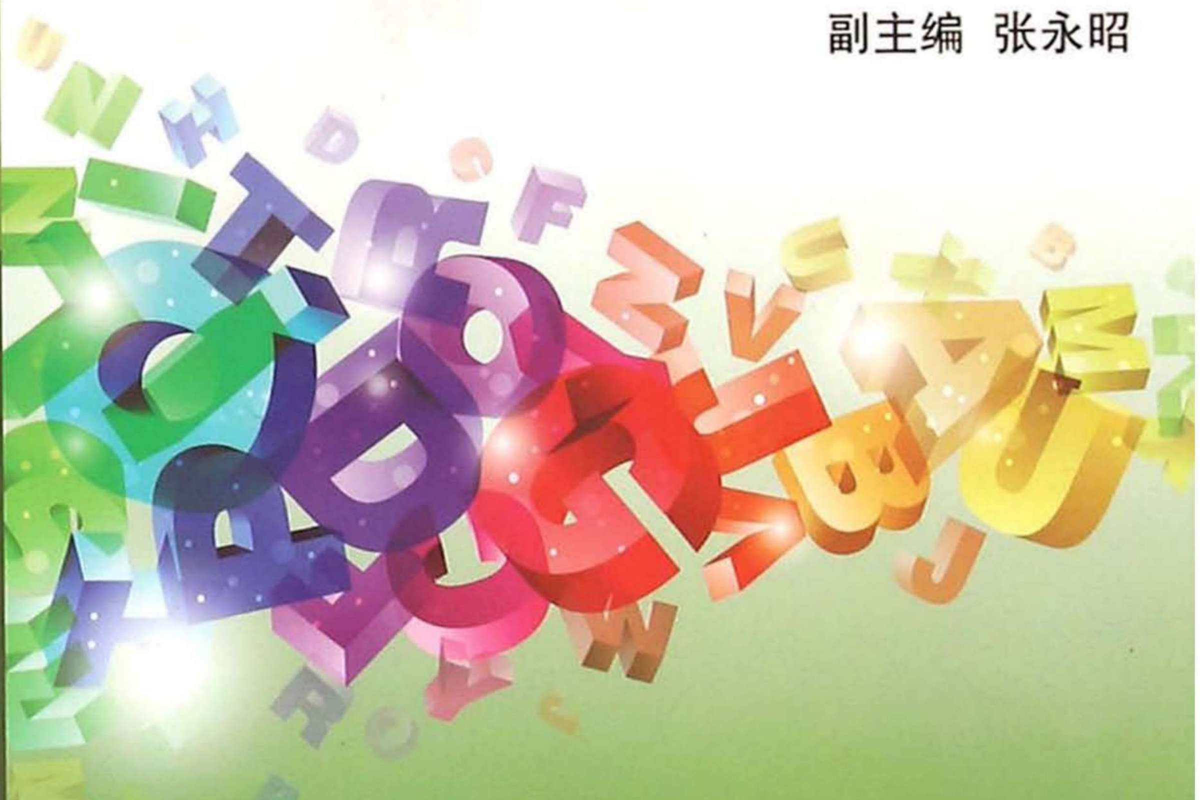

ZHEJIANG UNIVERSITY PRESS
浙江大学出版社

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图书在版编目(CIP)数据

精细化工专业英语 / 吴霜主编. —杭州:浙江大学出版社,2016.2

ISBN 978-7-308-14265-6

Ⅰ.①精… Ⅱ.①吴… Ⅲ.①化学工业－精细加工－英语－高等职业教育－教材 Ⅳ.①H31

中国版本图书馆 CIP 数据核字(2014)第 303511 号

精细化工专业英语

吴 霜 主编

责任编辑 石国华
封面设计 刘依群
出版发行 浙江大学出版社
(杭州市天目山路 148 号 邮政编码 310007)
(网址:http://www.zjupress.com)
排　　版 杭州星云光电图文制作有限公司
印　　刷 富阳市育才印刷有限公司
开　　本 710mm×1000mm 1/16
印　　张 6.5
字　　数 134 千
版 印 次 2016 年 2 月第 1 版 2016 年 2 月第 1 次印刷
书　　号 ISBN 978-7-308-14265-6
定　　价 18.00 元

浙江大学出版社发行部联系方式:0571－88925591;http://zjdxcbs.tmall.com

丛书编委会

总　序

2008 年，杭州职业技术学院提出了"重构课堂、联通岗位、双师共育、校企联动"的教改思路，拉开了教学改革的序幕。2010 年，学校成功申报为国家骨干高职院校建设单位，倡导课堂教学形态改革与创新，大力推行项目导向、任务驱动、教学做合一的教学模式改革与相应课程建设，与行业企业合作共同开发紧密结合生产实际的优质核心课程和校本教材、活页教材，取得了一定成效。精细化学品生产技术专业(群)是骨干校重点建设专业之一，也是浙江省优势专业建设项目之一。在近几年实施课程建设与教学改革的基础上，组织骨干教师和行业企业技术人员共同编写了与专业课程配套的校本教材，几经试用与修改，现正式编印出版，是学校国家骨干校建设项目和浙江省优势专业建设项目的教研成果之一。

教材是学生学习的主要工具，也是教师教学的主要载体。好的教材能够提纲挈领，举一反三，授人以渔。而工学结合的项目化教材则要求更高，不仅要有广深的理论，更要有鲜活的案例、科学的课题设计以及可行的教学方法与手段。编者们在编写的过程中以自身教学实践为基础，吸取了相关教材的经验并结合时代特征而有所创新，使教材内容与经济社会发展需求的动态相一致。

本套教材在内容取舍上摈弃求全、求系统的传统，在结构序化上，首先明确学习目标，随之是任务描述、任务实施步骤，再是结合任务需要进行知识拓展，体现了知识、技能、素质有机融合的设计思路。

本套教材涉及精细化学品生产技术、生物制药技术、环境监测与治理技术 3 个专业共 9 门课程，由浙江大学出版社出版发行。在此，对参与本套教材的编审人员及提供帮助的企业表示衷心的感谢。

限于专业类型、课程性质、教学条件以及编者的经验与能力，难免存在不妥之处，敬请专家、同仁提出宝贵意见。

谢萍华

2014 年 12 月

前　言

近年来，高职高专的毕业生进入化工企业工作时，最大的困难是缺乏化学化工英语词汇，对仪器和设备的英文表达了解也不多。为了使学生毕业后能够尽快地融入工作，开设化工专业英语课程十分必要，为此我们编写了本教材。

本书编者为近年来从事精细英语专业教学的教师。本书在结构、内容安排等方面，吸收了编者在教学改革、教材建设等方面的经验，结合精细专业知识和科技英语基本翻译、阅读知识，力求体现高等职业技术教育的特点，满足当前教学改革的需要。

在教学过程中，我们了解到学生在学完基础英语后，虽然已具有一定的英语阅读能力，但在阅读专业英语时还会遇到不少困难。我们在编写过程中力求体现下列特点：

1.本书选材来源于原版英文书籍、杂志、英语化学化工网站、国内外知名企业仪器设备样本等；涉及各种题材类型，通过对各种题材内容的学习翻译，培养学生阅读和理解与本专业相关的英语资料的能力。

2.本书课文篇幅不长，知识结构安排合理，从化学命名逐步过渡到“专业英语”，使学生能循序渐进地熟悉和掌握科技英语的基本特点，为今后工作中拓宽自己的知识、吸收相关的专业信息打下较好的基础。

3.本书的内容与专业结合紧密，教师可以培养学生结合专业课程的学习来提高英语阅读与翻译的能力。

本书在编写过程中还得到了很多企业专家的支持，特别是液化空气（杭州）投资有限公司的杨宗江工程师，对本书提出了很多宝贵意见。在此，表示衷心的感谢。

限于编者的学识水平与实践经验，书中不足之处在所难免，恳请读者和同行的批评指正。

编　者

2015 年 8 月

Contents

Unit 1 Chemical Engineering

Reading and Translating

Chemical engineering is a branch of engineering that applies the natural(or experimental)sciences(e. g.， chemistry and physics)and life sciences(e. g.， biology， microbiology and biochemistry) together with mathematics and economics to produce， transform， transport， and properly use chemicals， materials and energy. It essentially deals with the engineering of chemicals， energy and the processes that create and/or convert them. Modern chemical engineers are concerned with processes that convert raw materials or chemicals into more useful or valuable forms. They are also concerned with pioneering valuable materials and related techniques—which are often essential to related fields such as nanotechnology， fuel cells and bioengineering. Today， the field of chemical engineering is a diverse one， covering areas from biotechnology and nanotechnology to mineral processing.

Chemical engineers develop economic ways of using materials and energy. Chemical engineers use chemistry and engineering to turn raw materials into usable products， such as medicine， petrochemicals and plastics on a large-scale， industrial setting. They are also involved in waste management and research. Both applied and research facets could make extensive use of computers.

A chemical engineer may be involved in industry or university research where they are tasked in designing and performing experiments to create new and better ways of production， controlling pollution， conserving resources and making these processes safer. They may be involved in designing and constructing plants as a project engineer. In this field, the chemical engineer uses their knowledge in selecting plant equipment and the optimum method of production to minimize costs and increase profitability. After its construction, they may help in upgrading its equipment. They may also be involved in its daily operations. Chemical engineers may be permanently employed at chemical plants to manage operations. Alternatively, they may serve in a consultant role to troubleshoot problems, manage process changes and otherwise assist plant operators.

(Selected from *http://en.wikipedia.org/wiki/Chemical_engineering*)

New words and expressions

conserve/kən'sɜːv/	*v*.保护,保存;使守恒
construction/kən'strʌkʃn/	*n*.建造;建筑物
involve/ɪn'vɒlv/	*v* 包含;牵涉;使专心于
nanotechnology/ˌnænəʊtek'nɒlədʒɪ/	*n*. 纳米技术;纤技术
minimize/'mɪnɪmaɪz/	*v*. 把……减至最低数量[程度];对(某事物)作最低估计
permanently/'pɜːmənəntlɪ/	*adv*. 永久地,长期不变地
profitability/ˌprɒfɪtə'bɪlətɪ/	*n*. 获利(状况);收益率
scale/skeɪl/	*n*. 规模;比例;级别
upgrading/'ʌpgreɪdɪŋ/	*v* 提升;升级

Exercises

Ⅰ. Translate the following phrases into English or Chinese.

1. raw materials
2. fuel cells
3. mineral processing
4. industrial setting
5. 项目工程师
6. 增加盈利
7. 降低成

Ⅱ. Translate the following passages into Chinese.

Chemical engineering involves managing plant processes and conditions to ensure optimal plant operation. Chemical reaction engineers construct models for reactor analysis and design using laboratory data and physical parameters, such as chemical thermodynamics, to solve problems and predict reactor performance.

1. Plant design

Chemical engineering design concerns the creation of plans, specifications, and economic analyses for pilot plants, new plants or plant modifications. Design engineers often work in a consulting role, designing plants to meet clients' needs. Design is limited by a number of factors, including funding, government regulations and safety standards. These constraints dictate a plant's choice of processes, materials and equipment.

2. Process design

A unit operation is a physical step in an individual chemical engineering process. Unit operations (such as crystallization, filtration, drying and evaporation) are used to prepare reactants, purifying and separating its products, recycling unspent reactants, and controlling energy transfer in reactors. On the other hand, a unit process is the chemical equivalent of a unit operation. Along with unit operations, unit processes constitute a process operation. Unit processes (such as nitration and oxidation) involve the conversion of material by biochemical, thermochemical and other means. Chemical engineers responsible for these are called process engineers.

3. Transport phenomena

Transport phenomena occur frequently in industrial problems. These include fluid dynamics, heat transfer and mass transfer, which mainly concern momentum transfer, energy transfer and transport of chemical species respectively. Basic equations for describing the three phenomena in the macroscopic, microscopic and molecular levels are very similar. Thus, understanding transport phenomena requires thorough understanding of mathematics.

Unit 2 Naming Inorganic Compounds

Reading and Translating

With the discovery of thousands of new inorganic compounds, it has become necessary to revise the traditional rules of nomenclature. An international committee has recommended a set of rules for naming compounds, and these are now being adopted throughout the world. Many of the older names are still used, however, and our ensuing discussion will include in many cases both the old and new, with emphasis on the latter. One of the principal changes is that proposed by Albert Stock and now known as Stock system for the naming of compounds of metals(oxides, hydroxides, and salts) in which the metal may exhibit more than one oxidation state. In these cases the oxidation state of the metal is shown by a Roman numeral in parentheses immediately following the English name of the metal which corresponds to its oxidation number. If the metal has only one common oxidation number, no Roman numeral is used. Another important change is in the naming of complex ions and coordination compounds.

Writing Formulas

From the knowledge of oxidation numbers and valence and the understanding of atomic structure, it is now possible to write chemical formulas. The following table is a list of oxidation numbers often encountered in a first-year chemistry course.

Categories	Monovalent (Ⅰ)	Divalent (Ⅱ)	Trivalent (Ⅲ)	Tetravalent (Ⅳ)	Pentavalent (Ⅴ)
METALS Cations(+)	Hydrogen H Potassium K Sodium Na Silver Ag Mercury (mercurous) Hg Copper (cuprous)Cu Gold (aurous)Au Ammonium (NH_4)	Barium Ba Calcium Ca Cobalt Co Magnesium Mg Lead Pb Zinc Zn Mercury (mercuric)Hg Copper (cupric)Cu Iron(ferrous) Fe Manganese (manganous) Mn Tin (stannous)Sn	Aluminum Al Gold (auric) Au Arsenic (arsenious)As Chromium Cr Iron (ferric) Fe Phosphorus (phosphorous) P Antimony (antimonous) Sb Bismuth (bismuthous) Bi	Carbon C Silicon Si Manganese (manganic) Mn Tin (stannic)Sn Platinum Pt Sulfur S	Arsenic As Phosphorus (phosphoric) P Antimony (antimonic) Sb Bismuth (bismuthic) Bi
NONMETALS Anions(−)	Fluorine F Chlorine Cl Bromine Br Iodine I	Oxygen O Sulfur S	Nitrogen N Phosphorus P	Carbon C	
	Last syllable nonmetal is changed to-ide in binary compound.				
RADICALS (−)	Hydroxide (OH) Bicarbonate (HCO_3) Nitrite (NO_2) Nitrate (NO_3) Hypochlorite (ClO) Chlorate (ClO_3) Chlorite (ClO_2) Perchlorate (ClO_4) Acetate ($C_2H_3O_2$) Permanganate (MnO_4) Bisulfate (HSO_4)	Carbonate (CO_3) Sulfite(SO_3) Sulfate(SO_4) Tetraborate (B_4O_7) Silicate(SiO_3) Chromate (CrO_4) Oxalate (C_2O_4)	Borate(BO_3) Phosphate (PO_4) Phosphite (PO_3) Ferricyanide [$Fe(CN)_6$]	Ferrocyanide [$Fe(CN)_6$]	

General Observations

The symbols of the metals have + signs while those of the nonmetals and all the radicals except the ammonium radical have − signs.

When an element exhibits two possible oxidation states, the lower state can be indicated with the suffix -ous and the higher one with -ic. Another method of indicating this difference is to use the Roman numeral of the oxidation state in parentheses after the name of the element. For example, ferrous iron or iron(Ⅱ)for the +2 oxidation state of iron.

A radical is a group of elements which act like a single atom in the formation of a compound. The bonds within these radicals are predominantly covalent, but the groups of atoms as a whole have an excess of electrons when combined, and thus are negative ions.

When you attempt to write a formula, it is important to know whether it actually exists. For example, one can easily write the formula of carbon nitrate but no chemist has ever prepared this compound. Here are the basic rules for writing formulas with three examples carried through each step:

1. Represent the symbols of the components using the positive part first, and then the negative part.

Sodium chloride	Calcium oxide	Ammonium sulfate
$NaCl$	CaO	$(NH_4)SO_4$

2. Indicate the respective oxidation numbers above and to the right of each symbol. (Enclose radicals in parentheses for the time being)

$Na^{1+}Cl^{1-}$	$Ca^{2+}O^{2-}$	$(NH_4)^{1+}SO_4^{2-}$

3. Write a subscript number equal to the oxidation number of the other element or radical. This is the same as the mechanical criss-cross method. Since the positive oxidation number shows the number of electrons that may be lost or shared and the negative oxidation number shows the number of electrons that may be gained or shared, you must have just as many electrons lost (or partially lost in sharing) as are gained (or partially gained in sharing).

$Na_1^{1+} Cl_1^{1-}$ $Ca_2^{2+} O_2^{2-}$ $(NH_4)_2^{1+} (SO_4)^{2-}$

4. Now rewrite the formulas, omitting the subscript 1, the parentheses of the radicals which have the subscript 1, and the plus and minus numbers.
5. As a general rule, the subscript numbers in the final formula are reduced to their lowest terms. There are, however, certain exceptions, such as hydrogen peroxide (H_2O_2), and acetylene (C_2H_2). For these exceptions, you must know more specific information about the compound.

 The only way to become proficient at writing formulas is to memorize the oxidation numbers of common elements (or learn to use the period chart group numbers) and practice writing formulas.

Naming Compounds

Binary compounds consist of two elements. The name of the compound consists of the two elements, the second name having its ending changed to -ide, such as NaCl = sodium chloride; AgCl = silver chloride. If the metal has two different oxidation numbers, this can be indicated by use of the suffix -ous for the lower one and -ic for the higher one. The more modern way is to use a Roman numeral after the name to indicate the oxidation state.

Examples:

$FeCl_2$ = ferrous chloride or iron(Ⅱ) chloride

$FeCl_3$ = ferric chloride or iron(Ⅲ) chloride

If elements combine in varying proportions, thus forming two or more compounds of varying composition, the name of the second element may be preceded by a prefix. The prefixes used are mono-(one), sometimes reduced to mon-, di-(two), tri-(three), tetra-(four), penta-(five), hexa-(six), hepta-(seven), octa-(eight), nona-(nine), and deca-(ten). Generally the letter "a" is omitted from the prefix (from tetra on) when naming a nonmetal oxide and often mono is omitted from the name altogether. Some examples are: carbon dioxide, CO_2; carbon monoxide, CO; phosphorous trioxide, P_2O_3; phosphorous pentoxide, P_2O_5. Notice that, when these prefixed are used, it is not necessary to indicate the oxidation state of the first element in the name since it is given indirectly by the prefixed second element.

Ternary compounds, consisting of three elements, are usually made up of an element and a radical. To name them, you merely name each in the order of positive first and negative second.

Binary acids use the prefix hydro- in front of the stem or full name of the nonmetallic element, and add the ending -ic. Examples are hydrochloric acid (HCl) and hydrosulfuric acid (H_2S).

Ternary acids usually contain hydrogen, a nonmetal, and oxygen. Since the amount of oxygen often varies, the most common form of the acid in the series consists of merely the stem of the nonmetal with the ending -ic. The acid containing one less atom of oxygen than the most common acid has the ending -ous.

The acid containing one more atom of oxygen than the most common acid has the prefix per- and the ending -ic. The aid containing one less atom of oxygen than the -ous acid has the prefix hypo- and the ending -ous.

You can remember the names of the common acids and their salts by learning the following simple rules.

Rule	Example
-ic acids form -ate salts.	Sulfuric acid forms sulfate salts.
-ous acids form -ite salts.	Sulfurous acid forms sulfite salts.
Hydro-(stem) -ic acids form -ide salts.	Hydrochloric acid forms chloride salts.

Where the name of the ternary acid has the prefix hypo- or per-, that prefix is retained in the name of the salt (hypochlorous acid $\longrightarrow$ sodium hypochlorite).

(Selected from *Fundamental English in Chemistry and Chemical Engineering* by Qingwen Liu, Chemical Engineering Press, 2008)

New words and expressions

aluminum/əˈljuːminəm/	***n.*** 铝
anion/ˈænaɪən/	***n.*** 阴离子
cation/ˈkætaɪən/	***n.*** 阳离子,正离子
chlorate/ˈklɔːrɪt/	***n.*** 氯酸盐
chloric/ˈklɔːrɪk/	***adj.*** 氯的,含氯的
chlorine/ˈklɔːriːn/	***n.*** 氯,氯气
chlorite/ˈklɔːraɪt/	***n.*** 亚氯酸盐,绿泥石
chlorous/ˈklɔːrəs/	***adj.*** 亚氯酸的,与氯化合的
committee/kəˈmɪtɪ/	***n.*** 委员会
covalent/kəuˈveɪlənt/	***adj.*** 共有原子价的,共价的
criss-cross/ˈkrɪskrɒs/	***n.*** 十字形;***adj.*** 十字形的
ferric/ˈferɪk/	***adj.*** 铁的,含铁的,(正)铁的,三价铁的
ferrous/ˈferəs/	***adj.*** 铁的,含铁的
hypochlorite/ˌhaɪpəuˈklɔːraɪt/	***n.*** 次氯酸盐
hypochlorous/ˌhaɪpəuˈklɔːrəs/	***n.*** 次氯酸
ion/ˈaɪən/	***n.*** 离子
nomenclature/nəˈmenklətʃə(r)/	***n.*** 系统命名法;命名(过程)
oxide/ˈɔksaɪd/	***n.*** 氧化物
parentheses/pəˈrenθɪsɪs/	***n.*** 插入语;圆括号
positive/ˈpɔzɪtɪv/	***n.*** 正的,阳性的
predominantly/prɪˈdɔmɪnəntlɪ/	***adv.*** 占主导地位地;占优势地;显著地
proficient/prəˈfɪʃənt/	***adj.*** 精通的,熟练的
radical/ˈrædɪkəl,ˈrædɪkl/	***adj.*** 根本的,基本的;彻底的,完全的
respective/rɪsˈpektɪv/	***adj.*** 各自的;各个的
silver/ˈsɪlvə/	***n.*** 银
subscript/ˈsʌbˌskrɪpt/	***adj.*** 下标的,脚注的
suffix/ˈsʌfɪks/	***n.*** 后缀,词尾
sulfur/ˈsʌlfə/	***n.*** 硫磺,硫黄