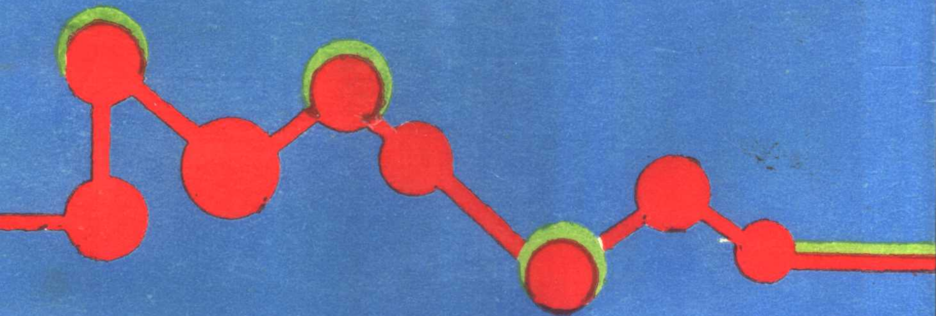
ENGLISH READING COURSE FOR CHEMICAL ENGINEERING

卞白桂 編著



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内 容 简 介

本书分14个单元，每一单元有4篇课文和一个阅读理解练习。书中课文均选自近年来出版的英美科技书刊，包括三传、精馏、吸收、反应器、结晶、流态化、催化、腐蚀、高分子、生化、仪器分析，过程控制、安全、环境等。书后附有补充读物和附录，内容包括化学文摘、工程索引、学位论文摘要、标准、化学化工常用英文工具书和期刊、练习答案以及总词汇表等。本书可作为化工、生化、高分子化工、化工管理、环保、精细化工等专业高年级学生的专业英语教材，也可作为研究生、教师和其他科技人员的自学用书。

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Supplement Reading

APPENDIX

Unit 1.

(1)Chemical Engineering

Chemical engineering is defined as "…the application of the principles of the physical sciences, together with the principles of economics and human relations, to fields that pertain directly to processes and process equipment in which matter is treated to effect a change in state, energy content, or compostion…".This very vague definition is intentionally broad and indefinite as to the extent of the field.It is probably as satisfactory a definition as any practicing chemical engineer would give.It should be noted that considerable emphasis is placed on the process and process equipment.The work of many chemical engineers would better be called process engineering.

The process may be any collection of steps involving changes in chemical composition or involving certain physical changes in material being prepared, processed, separated, or purified.① The work of many chemical engineers involves choosing the appropriate steps in the appropriate order to formulate a process for accomplishing a chemical manufacturing operation, a separation, or a purification. Since each of the steps constituting a process is subject to variations, the process engineer must also specify the exact conditions under which each step is to be carried out.②

As the process evolves and equipment must be desigend, the work of the chemical engineer merges with that of the mechanical and civil engineer. The transfer of primary responsibility from the process engineer to the mechanical engineer can take place satisfactorily at various stages of the design, so it is impossible to define a fixed extent to which the responsibility should be called that of a chemical engineer or a stage at which the mechanical engineer should take over responsibility for equipment.

At the time the definition quoted above was presented, the physical sciences referred to were primarily chemistry and some classical physics. As the understanding of mathematical models of chemical processes advances, the treatment of the chemisity and physics of the process is expressed in considerably more mathematical form. Increasing use of thermodynamics, fluid dynamics, and mathematical techniques such as probability and statistics, matrix manipulation, and complex variables is characteristic of modern chemical engineering practice. In most processes being carried out on a large scale, however, the chemistry has been previously worked out, and the physical changes incident to preparation and purification of the reaction mixtures demand considerably more study than does the chemical reaction. Frequent application of the principles of physics and of physcial chemistry is required in the processing steps that produce physical changes, such as vaporization, condensation, or crystallization. As a process evolves into a plant and the work merges with that of mechanical designers, the science of mechanics becomes increasingly important. The chemical engineer who specialize in equipment must have thorough and extensive grounding in mechanics of materials.

All of an engineer's work must be quantitative, and mathematics is therefore a fundamental tool of the engineer. Unfortunately, our understanding of mathematics is largely restricted to the domain of linear mathematics, and, equally unfortunately, chemical molecules seldom behave in accordance with linear mathematical rules. Energy and material balance calculations, which are fundamental to any process study, can usually be expressed with confidence and precision in terms of linear mathematics, as long as we omit atomic and nuclear processes from our considerations. In the economic study to determine the most profitable operating conditions—and in accounting for the sales receipts and distribution of income to profits and costs, including replacement of the plant—mathematical calculations are universal.

The existence or contemplation of a process implies that a material is to be produced for which customers will pay. It must be delivered in a quantity, of a quality, and at a price which are acceptable to the customer. Simultaneously, it must pay for materials, labor, and equipment used in the manufacture and return a profit over and above all costs. Many materials produced by the chemical industry are planned and plants bulit before the real market potential has been developed. For a completely new product, some estimate of the size of the market must be made, and the plant should be scaled in proportion.

The human-relations aspect of engineering practice is not usually emphasized in undergraduate training because of the great quantity of technical information and techniques the student must learn. That this may be a fallacious course is implied by the fact that failures of young engineers because of personnel problems are at least five times as frequent as failures because of inadequate technical training. All engineers must realize that the industry in which they are working requires team effort of all personnel. Valuable information can be obtained from operators of limited educational background who have observed similar processes. The person who has "lived" with an operation has probably observed actions and effects and has learned methods of detailed control that cannot be approached by formal theory alone.[3] The best engineering job can be done only with proper regard for all available facts regardless of their source. A new process or the technical improvement of an existing one designed without due regard for the operators is usually destined to failure. The start–up of a new plant or the installation of a technical change is likely to be much smoother and the cost of it much less if the operating personnel understand the objectives and are convinced of their soundness.

New Words and Expressions

pertain	[pə: 'tein]	vi	与…有关(to)
quote	[kwout]	v	引用
evolve	[i'vɔlv]	v.	开展，发展
thermodynamics			热力学
matrix manipulation			矩阵转换
contemplation	[kɔntem'pleiʃən]	n.	规划
fallacious	[fə'leiʃəs]	a.	谬误的
start–up			开车

Notes

① The process …… purified. 这种过程可能是任何步

骤的组合，这些步骤包括要制备的、分离的或提纯的物料的化学组成变化或一定的物理变化。

② Since each …… carried out. 由于组成一个过程的每一步骤都含有变化影响，因此，过程工程师还必需确定完成每一个步骤的准确条件。

③ The person …… theory alone. 一个在某工段“生活”多年的人可能观察到了调节动作及其作用，他可能找到了仅仅用理论方法不能达到的精密控制。

(2) Unit Operations

Chemical processes may consist of widely varying sequences of steps, the principles of which are indepdent of the material being operated upon and of other characterstics of the particular system.[①] In the design of a process, each step to be used can be studied individually if the step are recognized. Some of the steps are chemical reactions, whereas others are physical changes. The versatility of chemical engineering originates in training to the practice of breaking up a complex process into individual physical steps, called unit operations, and into the chemical reactions.[②] The unit-operations concept in chemical engineering is based on the philosophy that the widely varying sequences of steps can be reduced to simple operations or reactions, which are identical in fundamentals regardless of the material being processed. This principle, which became obvious to the pioneers during the development of chemical industry, was first clearly presented by A.D.Little in 1915:

"Any chemical process, on whatever scale conducted, may be resolved into a coordinated series of what may be termed 'unit actions,' as pulverizing, mixing, heating, roasting, absorbing, condensing, lixiviating, precipitating, crystallizing, filtering, dissolving, electrolyzing and so on. The number of these basic unit operations is not very large and relatively few of them are involved in any particular process. The complexity of chemical engineering results from the variety of conditions as to temperature, pressure, etc., under which the unit actions must be carried out in different processes and from the limitations as to materials of construction and design of apparatus imposed by the physical and chemical character of the reacting substances.[3]"

The original listing of the unit operations quoted above names twelve actions, not all of which are considered unit operations. Additional ones have been designated since then, at a modest rate over the years but recently at an accelerating rate. Fluid flow, heat transfer, distillation, humidification, gas absorption, sedimentation, calssification, agitation, and centrifugation have long been recognized. In recent years increasing understanding of new techniques—and adaptation of old but seldom used separative techniques—has led to a continually increasing number of separations, processing operations, or steps in a manufacture that could be used without significant alteration in a variety of processes. This is the basis of a terminology of 'unit operations,' which now offers us a list of techniques, all of which cannot be covered in a reasonable text.

Very frequently chemical changes occur in a material being distilled or heated. In such cases the physical operation is the primary concern, and if a chemical change occurs simultaneously, it is commonly handled by a modification of the physical properties of the material. When chemical rate and equilibria are known, these may be mathematically modeled into the unit operation calculations.

The typical chemical manufacturing operation involves a few chemical steps that are probably straightforward and well understood. Extensive equipment and operations are usually needed for refining or further preparing the often complex mixture for use as an end product. The result is that the work of the typical process engineer is much more conerned with physical changes than with chemical reactions. The importance of the chemical reactions must not be overlooked because of the economic importance of small improvements in percentage yield from chemical reactions. In many cases a relatively small percentage improvement in yield may economically justify considerably more extensive