

高 等 学 校 教 材



# 高分子材料工程 专业英语

大学英语专业阅读教材编写委员会组织编写

曹同玉 冯连芳 主编  
张菊华 主审



化学工业出版社

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## 前 言

组织编审出版系列的专业英语教材, 是许多院校多年来共同的愿望。在高等教育面向 21 世纪的改革中, 学生基本素质和实际工作能力的培养受到了空前重视。对非英语专业的学生而言, 英语水平和能力的培养不仅是文化素质的重要部分, 在很大程度上也是能力的补充和延伸。在此背景下, 教育部(原国家教委) 几次组织会议研究加强外语教学问题, 制订有关规范, 使外语教学更加受到重视。教材是教学的基本要素之一, 与基础英语相比, 专业英语教学的教材问题此时显得尤为突出。

国家主管部门的重视和广大院校的呼吁引起了化学工业出版社的关注, 他们及时地与原化工部教育主管部门和全国化工类专业教学指导委员会请示协商后, 组织全国十余所院校成立了大学英语专业阅读教材编委会。在经过必要的调研后, 根据学校需求, 编委会优先从各校教学(交流) 讲义中确定选题, 同时组织力量开展编审工作。本套教材涉及的专业主要包括化学工程与工艺、石油化工、机械工程、信息工程、生产过程自动化、应用化学及精细化工、生化工程、环境工程、制药工程、材料科学与工程、化工商贸等。

于七十年代末期, 全国各化工院校高分子材料与高分子化工专业都相继开设了“高分子专业英语”课。这门课为完成由基础英语向专业英语的过渡, 提高学生阅读高分子专业文献资料的能力发挥了重要作用。但是, 对于“高分子专业英语”这门课, 不同学校, 即使同一学校的不同教师, 甚至同一教师在不同年份, 所用教材、教学内容、教学要求和教学方法都不尽相同, 给人们的印象是这门课的随意性很大, 没有一定可遵循的规范, 教学质量也因地、因人、因时而异, 这很不利于学生专业英语能力的培养。如果能编写一本“高分子专业英语”全国统编教材, 各学校都按照这本教材的内容和要求进行规范的教学, 对于克服目前“高分子专业英语”课教学的混乱状态, 无疑会起到至关重要的作用。

这本《高分子材料工程专业英语》即是根据“全国部分高校化工类及相关专业大学英语专业阅读教材编审委员会”的要求和安排编写的。全书共分 32 课, 包括高分子化学、高分子物理、聚合反应工程、聚合物性能、成型加工及应用, 以及高分子材料的实验、研制与生产等多方面的内容。每课均由课文、重点词汇(单词、音标及解释)、词组、课文注释、练习、阅读材料等部分构成。每课的课文和阅读材料均为彼此独立的短文, 取材于不同国家、不同作者的 48 种英文高分子专业书籍、会议论文集、期刊、专利等英文原文资料, 集不同语言风格为一体, 具有词汇量大及科技英语语法覆盖面广等特点。本书主要作为全国各高等院校高分子专业英语教材, 也可以作为从事高分子合成、成型加工、研制及应用工作的科技人员、教师及研究生提高专业英语水平的参考书。

本书分工情况为: Unit 1~Unit 10 由曹同玉、袁才登编写, Unit 11~Unit 20 由冯连芳编写, Unit 21、Unit 27 及 Unit 28 由李瑞海编写, Unit 22、Unit 23 及 Unit 26 由雷勇编写, Unit 24、Unit 31 及 Unit 32 由孙树东编写, Unit 25、Unit 29 及 Unit 30 由胡泽容编写。全书由曹同玉、冯连芳主编, 由张菊华、欧阳庆主审。在编写过程中承蒙方道斌、姚兆玲、刘德华、陈锦言、赵勇等同志进行了审阅与校核, 提出了许多宝贵意见, 并给予了多方面的帮助, 在此深表谢意。限于作者水平, 书中一定会有不少错误, 望读者批评指正。

编者

1998. 8

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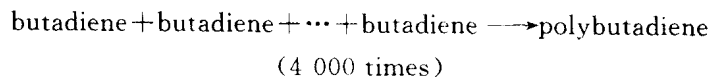
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## PART A Polymer Chemistry & Physics

### UNIT 1 What are Polymers?

What are polymers? For one thing, they are complex and giant molecules and are different from low molecular weight compounds like, say, common salt. To contrast the difference, the molecular weight of common salt is only 58.5, while that of a polymer can be as high as several hundred thousands, even more than thousand thousands. These big molecules or 'macro-molecules' are made up of much smaller molecules. The small molecules, which combine to form a big molecule, can be of one or more chemical compounds. To illustrate, imagine that a set of rings has the same size and is made of the same material. When these rings are interlinked, the chain formed can be considered as representing a polymer from molecules of the same compound. Alternatively, individual rings could be of different sizes and materials, and interlinked to represent a polymer from molecules of different compounds.

This interlinking of many units has given the polymer its name, *poly* meaning 'many' and *mer* meaning 'part' (in Greek). As an example, a gaseous compound called butadiene, with a molecular weight of 54, combines nearly 4 000 times and gives a polymer known as polybutadiene (a synthetic rubber) with about 200 000 molecular weight. The low molecular weight compounds from which the polymers form are known as monomers. The picture is simply as follows:



One can thus see how a substance (monomer) with as small a molecular weight as 54 grows to become a giant molecule (polymer) of  $(54 \times 4\,000 \approx) 200\,000$  molecular weight. It is essentially the 'giantness' of the size of the polymer molecule that makes its behavior different from that of a commonly known chemical compound such as benzene.<sup>13</sup> Solid benzene, for instance, melts to become liquid benzene at 5.5°C and, on further heating, boils into gaseous benzene. As against this well-defined behavior of a simple chemical compound, a polymer like polyethylene does not melt sharply at one particular temperature into clean liquid. Instead, it becomes increasingly softer and, ultimately, turns into a very viscous, tacky molten mass. Further heating of this hot, viscous, molten polymer does convert it into various gases but it is no longer polyethylene (Fig. 1.1).

Another striking difference with respect to the behavior of a polymer and that of a low molecular weight compound concerns the dissolution process. Let us take, for example, sodium chloride and add it slowly to a fixed quantity of water. The salt, which represents a



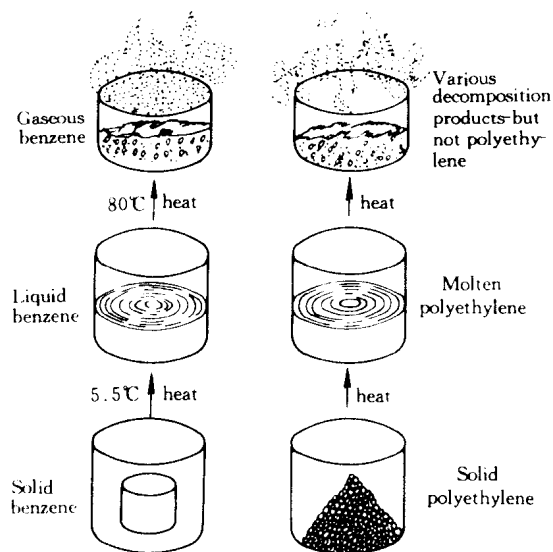


Fig. 1.1 Difference in behavior on heating of a low molecular weight compound (benzene) and a polymer (polyethylene)

low molecular weight compound, dissolves in water up to a point (called saturation point) but, thereafter, any further quantity added does not go into solution but settles at the bottom and just remains there as solid. The viscosity of the saturated salt solution is not very much different from that of water. But if we take a polymer instead, say, polyvinyl alcohol, and add it to a fixed quantity of water, the polymer does not go into solution immediately. The globules of polyvinyl alcohol first absorb water, swell and get distorted in shape and after a long time go into solution.<sup>2</sup> Also, we can add a very large quantity of the polymer to the same quantity of water without the saturation point ever being reached. As more and more quantity of

polymer is added to water, the time taken for the dissolution of the polymer obviously increases and the mix ultimately assumes a soft, dough-like consistency. Another peculiarity is that, in water, polyvinyl alcohol never retains its original powdery nature as the excess sodium chloride does in a saturated salt solution.<sup>3</sup> In conclusion, we can say that (1) the long time taken by polyvinyl alcohol for dissolution, (2) the absence of a saturation point, and (3) the increase in the viscosity are all characteristics of a typical polymer being

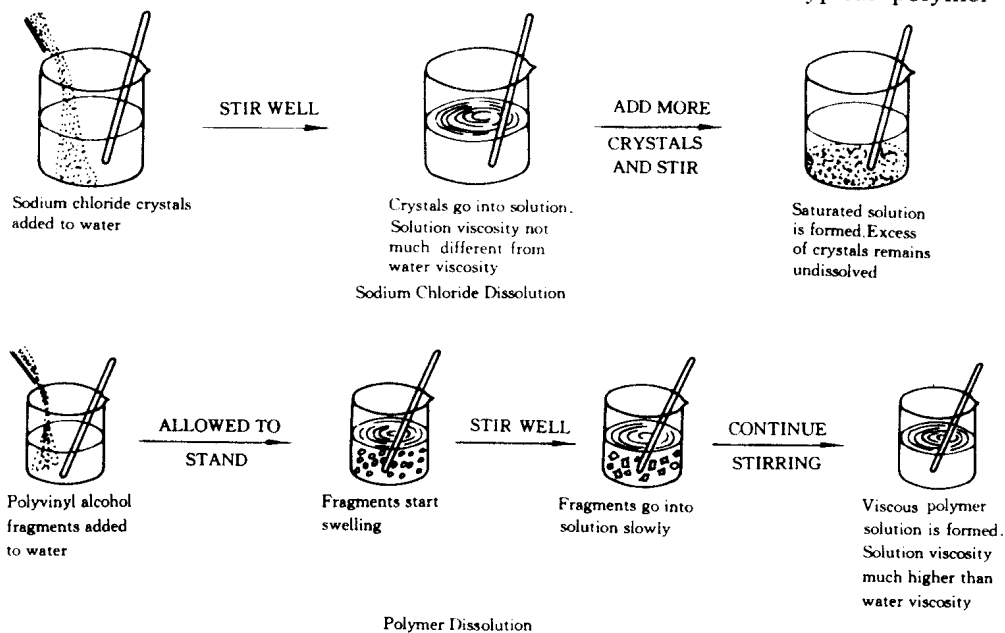


Fig. 1.2 Difference in solubility behaviour of a low molecular weight compound (sodium chloride) and a polymer (polyvinyl alcohol)

dissolved in a solvent and these characteristics are attributed mainly to the large molecular size of the polymer. The behavior of a low molecular weight compound and that of a polymer on dissolution are illustrated in Fig. 1. 2.

——Gowariker V R, Viswanathan N V, Sreedhar J. Polymer Science. New York: John Wiley & Sons, 1986. 6

### Words and Expressions

polymer	[ˈpɒlɪmə]	n.	聚合物[体], 高聚物
common salt		n.	食盐
macromolecule	[mækroˈmɒlɪkjʊ:l]	n.	大分子, 高分子
imagine	[ɪˈmædʒɪn]	v.	想象, 推测
interlink	[ɪntəˈlɪŋk]	v.	把...相互连接起来
		n.	连接
butadiene	[bju:təˈdaɪ:n]	n.	丁二烯
monomer	[ˈmɒnəmə]	n.	单体
synthetic	[sɪnˈθetɪk]	a.	合成的
behavior	[biˈheɪvjə]	n.	性能, 行为
polyethylene	[pɒliˈeθɪlɪn]	n.	聚乙烯
viscous	[ˈvɪskəs]	a.	粘稠的
tacky	[ˈtæki]	a.	(表面)发粘的
		n.	粘连[搭]性
dissolution	[dɪsəˈlu:ʃən]	n.	溶解
dissolve	[dɪˈsɒlv]	v.	使...溶解
saturation	[sætʃəˈreɪʃən]	n.	饱和
settle	[ˈsetl]	v.	沉淀[降], 澄清
viscosity	[vɪsˈkɒsɪti]	n.	粘度[性]
polyvinyl alcohol		n.	聚乙烯醇
globule	[ˈɡləbjʊ:l]	n.	小球, 液滴, 颗粒
swell	[swel]	v.; n.	溶胀
dough	[dəʊ]	n.	(生)面团, 揉好的面
consistency	[kɒnˈsɪstənsɪ]	n.	稠度, 粘稠性
powdery	[ˈpaʊdəri]	a.	粉状的
solvent	[ˈsɒlvent]	n.	溶剂
peculiarity	[pɪkjʊ:lɪˈærɪti]	n.	特性
crystal	[ˈkrɪstl]	n.	晶体, 结晶
fragment	[ˈfrægmənt]	n.	碎屑, 碎片

### Phrases

for one thing 首先

as an example 例如, 举例来说

as against 和...比起来, 和...相对照

convert... into... 把...转变[化]成...

with respect to 关于, 就...而论

a quantity of... 大量, 一些

in conclusion 总之, 最后

be attributed to... 归因于, 认为是...的结果

## Notes

- ① "It is essentially the 'giantness' of the size of the polymer molecule that makes its behavior different from that of a commonly known chemical compound such as benzene." 此处 It is ... that ... 为强调语气结构。the 'giantness' of the size of the polymer molecule 为被强调的句子的主语,可译为“巨大的聚合物分子尺寸”。句子的谓语是“makes”。“its behavior”是“makes”的宾语,可译为“聚合物的性能”;“different from...”为宾语补足语,其后的“that”代替前面已出现过的“behavior”,以避免重复。该句译文为:实质上,正是由于聚合物的巨大的分子尺寸才使其性能不同于像苯这样的一般化合物(的性能)。
- ② "The globules of polyvinyl alcohol first absorb water, swell and get distorted in shape and after a long time go into solution." 是一个简单句,“the globules”为主语,作“球粒”或“颗粒”解。本句有四个并列的谓语,即 absorb, swell, get distorted 及 go into。“get distorted in shape”为“get + 过去分词”表示的被动语态。全句的译文是:“聚乙烯醇颗粒首先吸水溶胀,发生形变,经过很长的时间以后,(聚乙烯醇分子)进入到溶液中”
- ③ "Another peculiarity is that, in water, polyvinyl alcohol never retains its original powdery nature as the excess sodium chloride does in a saturated salt solution." 连接词 that 后是表语从句,从句的宾语“its original powdery nature”可译成“其初始的粉末状态”,最后是 as 引导的方式状语从句,从句中的“does”用于替代前面出现的动词“retains”。全句译文为:“另一个特点是,在水中聚乙烯醇不会像过量的氯化钠在饱和盐溶液中那样能保持其初始的粉末状态。”

## Exercises

### 1. Translate the following into Chinese

Not all polymers are built up from bonding together a single kind of repeating unit. At the other extreme, protein molecules are polyamides in which  $n$  amino acid repeat units are bonded together. Although we might still call  $n$  the degree of polymerization in this case, it is less useful, since an amino acid unit might be any one of some 20-odd molecules that are found in proteins. In this case the molecular weight itself, rather than the degree of polymerization, is generally used to describe the molecule. When the actual content of individual amino acids is known, it is their sequence that is of special interest to biochemists and molecular biologists.

### 2. Give a definition for each following word

- (1) molecule
- (2) monomer
- (3) polymer

### 3. Put the following words into Chinese

structure data equation pressure liquid laboratory solid  
molecule temperature measurement compound electrical

### 4. Put the following words into English

科学 技术 化学 物理 气体 原子 性质 试验 增加 减少 混合物

## Reading Materials

### Structure of Polymer Chains

In many cases polymer chains are linear. In evaluating both the degree of polymerization

and the extended chain length, we assume that the chain has only two ends. While linear polymers are important, they are not the only type of molecules possible. Branched and cross-linked molecules are also important. When we speak of a branched polymer, we refer to the presence of additional polymeric chains issuing from the backbone of a linear molecule. Substituent groups such as methyl or phenyl groups on the repeat units are not considered branches. Branching is generally introduced into a molecule by intentionally adding some monomer with the capability of serving as a branch. Let us consider the formation of a polyester. The presence of difunctional acids and difunctional alcohols allows the polymer chain to grow. These difunctional molecules are incorporated into the chain with ester linkages at both ends of each. Trifunctional acids or alcohols, on the other hand, produce a linear molecule by reacting two of their functional groups. If the third reacts and the resulting chain continues to grow, a branch has been introduced into the original chain. Adventitious branching sometimes occurs as a result of an atom being abstracted from the original linear molecule, with chain growth occurring from the resulting active site. Molecules with this kind of accidental branching are generally still called linear, although the presence of significant branching has profound effects on some properties of the polymer, most notably the tendency to undergo crystallization.

The amount of branching introduced into a polymer is an additional variable that must be specified for the molecule to be fully characterized. When only a slight degree of branching is present, the concentration of junction points is sufficiently low that these may be simply related to the number of chain ends. For example, two separate linear molecules have a total of four ends. If the end of one of these linear molecules attaches itself to the middle of the other to form a "T", the resulting molecule has three ends. It is easy to generalize this result. If a molecule has  $\nu$  branches, it has  $\nu+2$  chain ends if the branching is relatively low. Branched molecules are sometimes described as either combs or stars. In the former, branch chains emanate from along the length of a common backbone; in the latter, all branches radiate from a central junction.

If the concentration of junction points is high enough, even branches will contain branches. Eventually a point is reached at which the amount of branching is so extensive that the polymer molecule becomes a giant three dimensional network. When this condition is achieved, the molecule is said to be cross-linked. In this case, an entire macroscopic object may be considered to consist of essentially one molecule. The forces which give cohesiveness to such a body are covalent bonds, not intermolecular forces. Accordingly, the mechanical behavior of cross-linked bodies is much different from those without cross-linking.

Just as it is not necessary for polymer chains to be linear, it is also not necessary for all repeat units to be the same. We have already mentioned molecules like proteins where a wide variety of different repeat units are present. Among synthetic polymers, those in which a single kind of repeat unit are involved are called homopolymers, and those containing more than one kind of repeat unit are copolymers. Note that these definitions are based on the repeat unit, not the monomer. An ordinary polyester is not a copolymer, even though two

different monomers, acids and alcohols, are its monomers. By contrast, copolymers result when different monomers bond together in the same way to produce a chain in which each kind of monomer retains its respective substituents in the polymer molecule. The unmodified term *copolymer* is generally used to designate the case where two different repeat units are involved. Where three kinds of repeat units are present, the system is called a *terpolymer*; where there are more than three, the system is called a *multicomponent copolymer*.

The moment we admit the possibility of having more than one kind of repeat unit, we require additional variables to describe the polymer. First, we must know how many kinds of repeat units are present and what they are. This is analogous to knowing what components are present in a solution, although the similarity ends there, since the repeat units in a polymer are bonded together and not merely mixed. To describe the copolymer quantitatively, the relative amounts of the different kinds of repeat units must be specified. Thus the empirical formula of a copolymer may be written  $A_xB_y$ , where A and B signify the individual repeat units and  $x$  and  $y$  indicate the relative number of each. From a knowledge of the molecular weight of the polymer, the molecular weights of A and B, and the values of  $x$  and  $y$ , it is possible to calculate the number of each kind of monomer unit in the copolymer. The sum of these values gives the degree of polymerization of the copolymer. Note that we generally do not call  $n_A$  and  $n_B$  the degrees of polymerization of the individual units. The inadvisability of the latter will become evident presently.

Hiemenz P C. *Polymer Chemistry*. New York: Marcel Dekker, 1984. 9

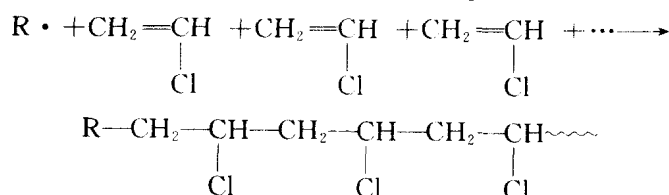
### Words and Expressions

linear polymer		n.	线形聚合物
branched polymer		n.	支链聚合物
homopolymer	[hɒmə'pɒlɪmə]	n.	均聚物
backbone	['bækbəʊn]	n.	主链
polyester	[pɒli'estə]	n.	聚酯
difunctional	[di'fʌŋkʃənl]	a.	二[双]官能度的
crystallization	[krɪstəlaɪ'zeɪʃən]	n.	结晶(作用)
emanate	['eməneɪt]	v.	源于,发源,发出,放射(出)
cohesiveness	[kəu'hi:sɪvnɪs]	n.	内聚性[力],粘结性
terpolymer	[tə:'pɒlɪmə]	n.	三元共聚物
inadvisability	[ɪnədvaɪzə'bɪlɪtɪ]	n.	不合理(性),不当

## UNIT 2 Chain Polymerization

Many olefinic and vinyl unsaturated compounds are able to form chain-like macromolecules through elimination of the double bond, a phenomenon first recognized by Staudinger. Diolefins polymerize in the same manner, however, only one of the two double bonds is eliminated. Such reactions occur through the initial addition of a monomer molecule to an initiator radical or an initiator ion, by which the active state is transferred from the initiator to the added monomer.<sup>1</sup> In the same way, by means of a chain reaction, one monomer molecule after the other is added (2 000~20 000 monomers per second) until the active state is terminated through a different type of reaction. The polymerization is a chain reaction in two ways; because of the reaction kinetics and because as a reaction product one obtains a chain molecule. The length of the chain molecule is proportional to the kinetic chain length.

One can summarize the process as follows ( $R \cdot$  is equal to the initiator radical):



One thus obtains polyvinylchloride from vinylchloride, or polystyrene from styrene, or polyethylene from ethylene, etc.

The length of the chain molecules, measured by means of the degree of polymerization, can be varied over a large range through selection of suitable reaction conditions. Usually, with commercially prepared and utilized polymers, the degree of polymerization lies in the range of 1 000 to 5 000, but in many cases it can be below 500 and over 10 000. This should not be interpreted to mean that all molecules of a certain polymeric material consist of 500, or 1 000, or 5 000 monomer units. In almost all cases, the polymeric material consists of a mixture of polymer molecules of different degrees of polymerization.

Polymerization, a chain reaction, occurs according to the same mechanism as the well-known chlorine-hydrogen reaction and the decomposition of phosgene.

The initiation reaction, which is the activation process of the double bond, can be brought about by heating, irradiation, ultrasonics, or initiators. The initiation of the chain reaction can be observed most clearly with radical or ionic initiators.<sup>2</sup> These are energy-rich compounds which can add suitable unsaturated compounds (monomers) and maintain the activated radical, or ionic, state so that further monomer molecules can be added in the same manner.<sup>3</sup> For the individual steps of the growth reaction one needs only a relatively small activation energy and therefore through a single activation step (the actual initiation

reaction) a large number of olefin molecules are converted, as is implied by the term "chain reaction".<sup>④</sup> Because very small amounts of the initiator bring about the formation of a large amount of polymeric material (1 : 1 000 to 1 : 10 000), it is possible to regard polymerization from a superficial point of view as a catalytic reaction. For this reason, the initiators used in polymerization reactions are often designated as polymerization catalysts, even though, in the strictest sense, they are not true catalysts because the polymerization initiator enters into the reaction as a real partner and can be found chemically bound in the reaction product, i. e., the polymer. In addition to the ionic and radical initiators there are now metal complex initiators (which can be obtained, for example, by the reaction of titanium tetrachloride or titanium trichloride with aluminum alkyls), which play an important role in polymerization reactions (Ziegler catalysts). The mechanism of their catalytic action is not yet completely clear.

— Vollmert B. Polymer Chemistry. Berlin: Springer-Verlag, 1973. 40

### Words and Expressions

olefinic	[əulə'finik]	a.	烯烃的
vinyl	['vainil]	n. ; a.	乙烯基 (的)
unsaturated	[ʌn'sætʃəreitid]	a.	不饱和的
eliminate	[i'limineit]	v.	消除, 打开, 除去
double bond		n.	双键
diolefin	[dai'əuləfin]	n.	二烯烃
transfer	['træsfə:]	v.	(链) 转移, (热) 传递
initiator	[i'niʃieitə]	n.	引发剂
radical	['rædikəl]	n.	自由基
chain reaction		n.	连锁反应
terminate	['tə:mineit]	v.	(链) 终止
kinetic chain length		n.	动力学链长
polyvinylchloride	[pəli'vainil'kləraid]	n.	聚氯乙烯
polystyrene	[pəli'staɪərɪn]	n.	聚苯乙烯
degree of polymerization		n.	聚合度
polymeric	[pəli'merik]	a.	聚合(物)的
mechanism	['mekənizəm]	n.	机理 [制]
chlorine	['klɔ:ri:n]	n.	氯 (气)
hydrogen	['haɪdrɪdʒən]	n.	氢 (气)
decomposition	[di:kəmpə'ziʃən]	n.	分解
phosgene	['fəʒdʒi:n]	n.	光气, 碳酰氯
initiation	[iniʃi'eɪʃən]	n.	(链) 引发
activation	[ækti'veɪʃən]	n.	活化 (作用)
irradiation	[ɪreɪdi'eɪʃən]	n.	照射, 辐照
ultrasonic	[ʌltrə'sɒnik]	n.	超声波
catalyst	['kætəlist]	n.	催化剂, 触媒

ionic	[ˈaɪˈɒnɪk]	a.	离子的
complex	[ˈkɒmpleks]	n.	络合物
titanium tetrachloride		n.	四氯化钛
titanium trichloride		n.	三氯化钛
aluminum alkyl		n.	烷基铝

### Phrases

by means of... 借助于...	energy-rich 高能(级)的
one... after the other 一个接一个...	from a superficial point of view 从表面上看
be proportional to... 和...成正比	in the strictest sense 严格地讲 [说]
over a large range 在很大的范围内	play an important role in... 在...方面起重要作用
lie in... 处于, 落在, 在于	
bring about 引起, 产生, 导致	

### Notes

- ① “Such reactions occur through the initial addition of a monomer molecule to an initiator radical or an initiator ion, by which the active state is transferred from the initiator to the added monomer.” 主语 “such reaction” 是指上面所提到的打开单体双键而形成聚合物的反应。谓语 “occur” 后面为由 “through” 引导的介词短语作方式状语, 可译为 “这些反应是通过...而进行的”。最后为非限定性的定语从句, 不是说明某个名词, 而是说明前面整个句子。“by which” 在从句中作方式状语。“active state” 可译作活性中心。全句译文: “这样的反应是通过单体分子首先加成到引发剂自由基或引发剂离子上而进行的, 靠这些反应活性中心由引发剂转移到被加成的单体上。”
- ② “The initiation of the chain reaction can be observed most clearly with radical or ionic initiators.” 该句是一个简单句, 句末介词短语 “with radical or ionic initiators” 是主语 “the initiation” 的定语, 为了使句子匀称, 避免头重脚轻, 后置定语没有紧接它要说明的主语, 而是被其他成分如谓语等分隔开, 这在英语语法中称作分割现象。被分割的定语可以是介词短语, 也可以是定语从句。该句是一个起后置定语作用的介词短语被分割的例句, 可译作: “用自由基型引发剂或离子型引发剂引发连锁反应可以很清楚地进行观察。”
- ③ “These are energy-rich compounds which can add suitable unsaturated compounds (monomers) and maintain the activated radical, or ionic, state so that further monomer molecules can be added in the same manner.” 主句的表语 “energy-rich compounds” 意指 “高能态化合物”, 紧跟其后的句子为以 “which” 引导的定语从句。最后为由 “so that” 引导的结果从句。译文为: “这些(化合物)是高能态化合物, 它们可以加成不饱和化合物(单体), 并且(在完成一步加成以后仍然)可以保持自由基活性中心或离子活性中心, 致使单体分子可以用同样的方式进一步加成。”
- ④ “For the individual steps of the growth reaction one needs only a relatively small activation energy and therefore through a single activation step (the actual initiation reaction) a large number of olefin molecules are converted, as is implied by the term ‘chain reaction.’” 句中主语 “one” 用以代表前面的复数名词 “steps”, “one” 是单数, 意指在 “steps” 中的一步。句子的最后为 as 引导的定语从句, 用以说明前面整个句子, “as” 在从句中作主语, 全句译文为: “对于链增长反应的诸多步骤来说, 每一步仅需要相当少的活化能, 因此, 通过一步简单的活化反应(即引发反应)即可将许多烯类单体分子转化(成聚合物), 这正如连锁反应这个术语的内涵那样。”



## Exercises

1. Please fill in the correct answers into the blanks in the following passage

Another striking difference with respect to the behavior of a polymer and \_\_\_\_\_ of a low molecular weight compound concerns the dissolution process. Let us take, for example, sodium chloride and add it slowly to a fixed \_\_\_\_\_ of water. The salt, which represents a \_\_\_\_\_ molecular weight compound, dissolves in water up to a point (called \_\_\_\_\_ point) but, thereafter, any further quantity added does not go into solution but settles at the \_\_\_\_\_ and just remains there as solid. The viscosity of the saturated salt solution is not very \_\_\_\_\_ different from that of water. But if we take a polymer instead, say, polyvinyl alcohol, and add it to a fixed quantity of water, the polymer does not go into solution immediately. The globules of polyvinyl alcohol first \_\_\_\_\_ water, swell and get distorted in shape and after a long time go into solution.

2. Translate the following into English

乙烯分子带有一个双键，为一种烯烃，它可以通过连锁聚合大量地制造聚乙烯，目前，聚乙烯已经广泛地应用于许多技术领域和人们的日常生活中，成为一种不可缺少的材料。

3. Put the following words into Chinese

macromolecule tacky settle behavior molten polymer distort viscous butadiene synthetic  
globule powdery fragment

1. Put the following words into English

氯化钠 粘度 吸收 溶胀 单体 苯 分子量 化合物 溶液 形状 低分子化合物  
高分子化合物

## Reading Materials

### Overall Kinetics of Chain Polymerization

Radical chain polymerization is a chain reaction consisting of a sequence of three steps - *initiation, propagation, and termination*. The initiation step is considered to involve two reactions. The first is the production of free radicals by any one of a number of reactions. The usual case is the homolytic dissociation of an initiator or catalyst species I to yield a pair of radicals R ·



where  $k_d$  is the rate constant for the catalyst dissociation. The second part of the initiation involves the addition of this radical to the first monomer molecule to produce the chain initiating species  $M_1 \cdot$



where M represents a monomer molecule and  $k_i$  is the rate constant for the initiation step (Eq. (2.2)). For the polymerization of  $CH_2=CHY$ , Eq. (2.2) takes the form

