Федеральное агентство по образованию

Государственное образовательное учреждение
высшего профессионального образования

Владимирский государственный университет

Кафедра иностранных языков

Пластмассы и полимеры

Учебные задания к практическим занятиям
на английском языке для студентов II курса
специальности «Полимерные материалы»

Составитель
А. А. СКАКУНОВА

Владимир 2007

УДК 678
ББК 35.71
П37

Рецензент:
доцент кафедры иностранных языков
Владимирского государственного университета
Н.К. Яшина

Печатается по решению редакционно-издательского совета
Владимирского государственного университета

П37 **Пластмассы** и полимеры : учеб. задания к практ. занятиям на англ. языке для студентов II курса специальности «Полимерные материалы» / Владим. гос. ун-т ; сост. А. А. Скакунова. – Владимир : Изд-во Владим. гос. ун-та, 2007. – 36 с.

Представленные учебные задания включают тексты для изучающего и ознакомительного чтения по темам: «Полимеры и их применение», «Способы получения полимеров», «Пластмассы», «Методы переработки пластмасс», «Новые виды пластмасс и их переработка», «Пенопласты» и «Способы получения пенопластов», а также упражнения к текстам, предназначенные для активизации и закрепления активной лексики, проверки понимания текстов.

Предназначены для студентов II курса дневного отделения специальности «Полимерные материалы».

УДК 678
ББК 35.71

UNIT I
POLYMERS

I. Remember the following words and word combinations:

1) fur – мех
2) rubber – резина, каучук
3) starch – крахмал
4) resin – смола, полимер
5) precipitate – 1) осадок; 2) выпадать в осадок, осаждаться
6) to distil – перегонять, дистиллировать
7) viscosimer – вискозиметр
8) complexity – сложность
9) to reveal – обнаружить, раскрыть
10) gasoline – бензин
11) range – область, диапазон, предел
12) unit – единица, элемент, блок, прибор, комплект, узел
13) flexible – гибкий, эластичный, упругий
14) synthetic fibre – синтетическое волокно
15) to compete with – конкурировать с
16) structural material – конструкционный материал
17) to isolate – отделять, выделять; изолировать

II. *Find in the text sentences, in which the following words and word combinations are used. Translate them.*

1) dominate
2) feeble efforts
3) thorough investigation
4) molecular weight
5) repeating units
6) synthetic fibres
7) compete with

III. *Match the nouns in the column A with their adjectives in the column B.*

A	B
1) polymer	a) electronic
2) material	b) molecular
3) investigation	c) giant
4) microscope	d) repeating
5) weight	e) structural
6) molecule	f) natural
7) chain	g) thorough
8) units	h) flexible

IV. *Give English equivalents for the following words and word combinations.*

1) жирные кислоты; 2) рентгенографическое устройство; 3) материальные потребности; 4) крахмал; 5) глицерин; 6) растворять; 7) осаждать; 8) перегонять, перегонка; 9) выделять; 10) мощный; 11) обнару-

жить; 12) сложность; 13) фенолформальдегид; 14) молекулярный вес; 15) многочисленный.

V. ***Translate the following sentences paying attention to Infinitives and their functions.***
   1. Chemists studied sugar, glycerol, and fatty acids to determine what these substances were composed of.
   2. But only feeble efforts were made to investigate such common materials as wood, starch, silk.
   3. The substances composing these materials couldn't be crystallized from solutions.
   4. Giant molecules can be composed of a large number of repeating units.
   5. Numerous polymeric materials could compete with the structural materials such as metals and ceramics.

VI. ***Find in the text the sentence with the Absolute Participial Construction. Translate it.***

VII. ***Read the following text to find out the history of discovering synthetic polymers.***

TEXT IA

THE AGE OF POLYMERS

Nearly all of the material needs of man could be supplied by nature organic products: wood, fur, leather, wool, cotton, rubber, oils, paper and so on. The organic polymers, which these things are made from, include proteins, cellulose, starch, resins, etc. These natural polymers dominated, and even in ancient times people used them.

Chemists studied sugar, glycerol, fatty acids and other ordinary organic compounds – dissolving, precipitating, crystallizing and distilling them to learn what these substances were composed of.

But only feeble efforts were made to investigate such common materials as wood, starch, silk, etc. The substances composing these materials couldn't be crystallized from solutions, nor couldn't they be isolated by distillation.

It was only in the 20th century that the scientists began thorough investigation of these materials. They used some powerful physical instruments, an electron microscope, viscosimeter, X-ray diffraction apparatus and revealed the polymers in all their complexity. The first fully synthetic polymer – phenol-formaldehyde – was made in 1910.

The molecules of polymers were very large, the molecular weights running as high as millions of units, whereas simple organic substances such as, for instance, sugar and gasoline have molecular weights in the range of only 50-500.

Giant molecules can be composed of a large number of repeating units, they being given the name "polymer" from the Greek word "poly" (many) and "meros" (a part). Many polymers have the form of long, flexible chains.

This discovery led to the establishment of industries producing synthetic fibres and numerous polymeric materials, many of which were less expensive and could compete with the structural materials such as metals and ceramics.

Notes:

1) fatty acids – жирные кислоты
2) thorough – основательный, тщательный
3) X-ray diffraction apparatus – рентгенографическое устройство
4) feeble – слабый, незначительный, ничтожный
5) phenol-formaldehyde – фенолформальдегид

VIII. Answer the following questions.

1. What organic products provided nearly all of the material needs of man?
2. Did natural polymers dominate in ancient times?
3. In what way did chemists study sugar, glycerol, and fatty acids?
4. Did they investigate such common materials as wood, starch, silk?
5. When did the scientists begin to investigate these materials?
6. What instruments did they use for this purpose?
7. When was the first fully synthetic polymer made?
8. What was the size of molecules of polymers?
9. What is the origin of the term “polymer”?
10. What is the form of polymers?
11. What industries appeared with the discovery of synthetic polymers?
12. Could these polymers compete with structural materials?

IX. Think and say about:

1. Natural organic products.
2. Methods of their investigation.
3. The reasons of feeble efforts made to study such common materials as wood, starch, silk, etc.
4. Thorough investigation of these common materials.
5. The size, molecular weight and form of polymers.

X. Read another text on polymers, try to get it as a whole.

TEXT IB

MATERIALS OF THE FUTURE

Synthetic polymers, which appeared at the beginning of the 20^{th} century, have invaded all branches of industry, agriculture, household needs, medicine and even art.

Now research is under way for the development of new materials and improving the properties and extending the application of polymers.

A prime concern of researchers and engineers is to improve the quality of mass-produced goods.

The so-called "aging" of materials is a result of deterioration in the properties of polymers owing to chemical and physical changes caused by the effect of light, heat and humidity in operation. Many institutes and laboratories are conducting research to prevent these processes and in many cases "stabilizing agents" have been found.

Another way of improving the quality of polymers is to subject two or more components to polymerization. The resultant product combines the most valuable properties of the initial substances. The Institute of Chemical Physics and other research institutions have developed a series of methods for doing this and among other things succeeded in increasing the durability of polystyrene, which is generally fragile.

The properties of polymer products depend not only on chemical composition, but on the structure of individual molecules. Regularity of sequence in the links, which comprise the chain molecule of a polymer, considerably improves the properties of the material.

After many years of research chemists have found that the properties of polymers are largely determined by the pattern of their big molecules. Possible variants of different polymers patterns and ways of developing required structures have been investigated. This has opened up the possibility for developing substances with scheduled properties.

Polymers reach to new fields of application every day. In medicine they are used in surgery. Added to certain medicines, polymer groups can regulate the time medicine remains in the organism. Polymer materials are employed in the production of medical instruments.

Ion-exchange polymer resins are applied in the technology of chemical and pharmaceutical enterprises, in sugar production, water treatment, non-ferrous metallurgy, etc.

Synthetic polymers are still young, and they have a big future.

XI. Find answers to the following questions in the text.

1. What branches of industry, agriculture, medicine have synthetic polymers invaded?
2. What are the aims of research, which is under way now?

3. Is improvement of the quality of mass produced goods a prime concern of researchers and engineers?
4. How do the researchers try to prevent the so-called “aging” of materials?
5. What is another way of improving the quality of polymers?
6. What methods have the researchers of the Institute of Chemical Physics developed?
7. What do the properties of polymer products depend on?
8. What have chemists found after many years of research?
9. What are new fields of application of polymers?
10. What can you say about the future of synthetic polymers?

XII. Tell about the ways of improving the quality of polymers mentioned in the text.

XIII. Think and prove that synthetic polymers have wide prospects.

UNIT II
PLASTICS

I. Remember the following words and word combinations:

1) addition polymerization – полиприсоединение
2) saturated – насыщенный
3) monomer – мономер
4) ethane = ethylene – этен, этилен
5) PVC = polyvinylchloride = polyethylene – поливинилхлорид
6) polystyrene – полистирол
7) perspex – плексиглас
8) water-proof – водонепроницаемый
9) to soften – 1) размягчать; 2) пластифицировать
10) flammable – огнеопасный, легковоспламеняющийся
11) to mould (to mold) – формовать, отливать в форму
12) a mould – форма, матрица, шаблон
13) powder – порошок
14) chip(s) – крошка
15) thermoplastic – термопласт
16) thermoset – термореактопласт
17) to set – отверждать(ся)

18) setting – отверждение, затвердевание

19) cross-link – поперечная связь

20) decay and corrosion resistant – устойчивый к гниению (разложению) и коррозии

II. *Find in the text English equivalents to the following chemical terms:*

1) поливинилхлорид
2) полистирол
3) этилен
4) размягчать
5) плексиглас
6) термопласт
7) термореактопласт
8) порошок

III. *Match the words in the column A with their synonyms in the column B.*

A	B
1) familiar	a) to accelerate
2) starting (material)	b) combustible
3) to melt	c) elastic
4) flammable	d) heating
5) flexible	e) known
6) to speed up	f) to distinguish
7) warming	g) initial
8) to differ	h) to fuse

IV. *Find English equivalents for the following Russian words and word equivalents in the right column.*

1) полиприсоединение	a) low density
2) длинноцепочечная молекула	b) cross-links
3) исходный материал	c) corrosion resistant
4) фторопласт (тефлон)	d) advantage
5) низкая плотность	e) food wrappers
6) коррозионностойкий	f) disadvantage
7) преимущество	g) a long-chain molecule
8) недостаток	h) polytetrafluoroethylene
9) поперечные связи	i) starting material
10) упаковочные материалы для пищевых продуктов	j) addition polymerization

V. *Translate the following sentences paying attention to Participles and Gerund.*

1. It is possible to make other plastics in similar polymerization reactions using different starting materials.
2. Stage 2 deals with the manufacture of plastic products by warming the powder in a mould.
3. Once formed, heating does not soften them.
4. In fact, warming is often the method chosen to speed up the setting of these materials.
5. Along with forming chains, they can form cross-links between the chains.
6. One of the properties of plastics is that they soften when warmed.

VI. *Read the following text carefully to find out properties, production and fields of plastics application.*

TEXT 2A

PLASTICS

Many polymer materials are familiar to us as plastics. They can be made by polymerization reactions, in particular, by addition polymerization. Addition polymerization is the reaction of many unsaturated monomer molecules of the same kind to make a long-chain molecule. The number of monomer units in a polymer chain is usually very large, but it varies from one chain to the next.

When the monomer is ethane, the polymer is called poly(ethene) or polythene. It is possible to make other plastics in similar polymerization reactions using different starting materials (monomers), e.g.: polystyrene (polyphenylethene), PVC – polyvinylchloride (polychloroethene), PTFE – polytetrafluoroethylene, etc.

The properties of different plastics vary slightly, but they usually have many properties in common. For example, most plastics are:

a. water-proof;
b. lightweight (low density);
c. easily softened or melted by heat;
d. flammable;
e. electrical resistors;
f. easily moulded;
g. decay and corrosion resistant.

These properties give plastics advantages over other materials. There is a wide range of application of plastics in everyday life: drainpipes, gutters, spectacles lenses, bottles, food wrappers and bags, flower pots, etc.

One of the properties of plastics is that they soften when warmed. This is a useful property from the manufacturer's point of view because it means that products from these plastics can be made in two separate stages:

Stage 1: Synthesis of the plastic material, for example, as powder or chips:

Stage 2: Manufacture of the plastic product by warming the powder in the mould.

Plastics of this type are called thermosoftening plastics or usually thermoplastics.

Some plastics behave differently from thermoplastics. Once formed, heating does not soften them. In fact, warming is often the method chosen to speed the setting of these materials, and they are therefore called thermosetting plastics or simply thermosets.

Thermosets are used for making items such as pan handles and coffee cups.

Notes:

1) long-chain molecule – длинноцепочечная молекула
2) starting material – сырье, исходный материал
3) PTFE – политетрафторэтилен, фторопласт
4) drainpipe – канализационная труба
5) gutter – водосточный желоб
6) so far – до сих пор
7) item – изделие, предмет, деталь

VII. Answer the following questions.

1. How can plastics be made?
2. What kind of a reaction is addition polymerization?
3. What is the number of monomer units in a polymer chain?
4. How are polystyrene, PVC and PTFE produced?
5. What are the properties of different plastics?
6. Do these properties give plastics advantages over other materials?
7. What are the fields of application of plastics in everyday life?
8. What is their useful property from the manufacturer's point of view?
9. What kinds of plastics are mentioned in the text?
10. In what way do thermosets differ from thermoplastics?
11. Are thermosets used for making pan handles and coffee cups?

VIII. Divide the text into logical parts and entitle them.

IX. Write a summary of the text and retell it.

X. Read another text on plastics, compare it with the first one and say what information is different.

TEXT 2B

PLASTICS

Plastics are organic substances made synthetically by polymerization, they can be formed into almost endless variety of products, e.g. threads, sheets, tubes and moulded objects. The ancestor of modern synthetic plastics is celluloid. Celluloid has certain disadvantages – its flammability and the fact that it is not easily moulded. The real foundation of synthetic plastic industry was laid with the discovery of bakelite in 1907.

Plastics that consists of long-chain molecules can be softened by heat and moulded into a desired shape. They are called thermoplastics. Plastics, in which the polymer chains are cross-linked, have much greater rigidity and cannot be soften readily. They are called thermosets. The terms "thermoplastics" and "thermosets" are also applied to resins, from which plastics are made.

The principal agent incorporated in plastic is the resin: it may be natural, like cellulose, but it is most generally synthetic.

The resin is also known as the binder. Substances added to the plastics to enhance certain properties, e.g. hardness, resistance to shock or abrasion, are called fillers. Asbestos, glass fibres, wood flour can be used as fillers.

Plasticizers are also included in the formation. Antioxidants may be added to improve chemical stability and thus prolong life. Catalysts are added to support the final cure, the stabilizers protect against sunlight, heat and other destructive factors.

The procedure used to shape a plastics into its final form depends on the properties of the plastic. Some plastics can be injection or extrusion moulded. Other plastics must be compression moulded: after they are filled into the mould they are subjected to pressure. Certain plastics are simple cast into their final shape.

XI. Find answers to the following questions in the text.

1. What is the ancestor of modern synthetic plastics?
2. Has celluloid certain disadvantages?
3. When was the real foundation of synthetic plastic industry laid?
4. Are the terms "thermoplastics" and "thermosets" also applied to resins?
5. What is the principal agent incorporated in a plastic?
6. What is the function of fillers?
7. What does the procedure of plastic formation depend on?

XII. Find sentences characterizing the following:

1) endless variety of products plastics can be formed into
2) characteristics of thermoplastics and thermosets
3) substances used as fillers
4) the role of plasticizers, antioxidants, catalysts, stabilizers
5) methods of plastic formation

XIII. Which of the following sentences are true according to the text?

1. The ancestor of modern synthetic plastics is cellulose.
2. Plastics that consist of long-chain molecules can be softened by heat.
3. The resin is also known as the binder.
4. Fillers don't enhance certain properties of plastics.
5. Catalysts are added to protect plastics against sunlight and heat.

UNIT III

NEW MATERIALS: PROPERTIES AND PROCESSING

I. Remember the following words and word combinations:

1) injection molding (moulding) – инжекционное формование; литье под давлением
2) flow molding – формование раздувом, пневмоформование
3) extrusion – экструзия
4) compression moulding – прямое формование
5) to plasticize – пластифицировать
6) plasticizer – пластификатор, мягчитель
7) breakage – обрыв, разрыв; разрушение
8) pellet – гранула, шарик, таблетка
9) reinforced – армированный, упрочненный, наполненный
10) absorption – поглощение, впитывание
11) drier – сушильный аппарат, сушилка
12) compression ratio – степень сжатия; коэффициент уплотнения
13) wear-resistant – износостойкий
14) suction tube – всасывающая труба
15) blend – смесь
16) filament – нить
17) nozzle – сопло, наконечник
18) shot – впрыск; доза впрыска
19) heat conduction – теплопроводность

20) shear – сдвиг, смещение

21) molding – 1) отформованное изделие; отливка; 2) формование

II. *Find in the text English equivalents for the following chemical terms:*

1) инжекционное формование
2) термопласты, армированные длинным волокном
3) пластификатор
4) пневмоформование
5) поглощение
6) коэффициент уплотнения
7) дозирующее устройство
8) обезвоживание
9) смесь
10) износостойкий
11) теплопроводность

III. *Match the words in column A with their synonyms in column B*

A	B
1) to process	a) velocity
2) damp	b) to provide
3) gentle	c) mix
4) speed	d) even
5) to shorten	e) weak
6) blend	f) moist
7) uniform	g) to treat
8) to ensure	h) to cut

IV. *Match the Russian words and word combinations in A with their English equivalents in B:*

A	B
1) быть пригодным для	a) moisture absorption
2) разрыв волокна	b) incorrect storage
3) не допускать загрязнения	c) condition
4) влагопоглощение	d) reinforcing fibres
5) неправильное хранение	e) to be suitable for
6) условие	f) fibre breakage
7) армирующие волокна	g) to prevent contamination
8) уплотнение	h) metering zone
9) противодавление	i) internal friction
10) стальные нити	j) moulded part
11) внутреннее трение	k) nozzle
12) зона гомогенизации	l) seal
13) отформованная деталь	m) steel filaments
14) сопло	n) shear
15) смещение	o) back pressure

V. *Translate the following sentences paying attention to the modal verbs.*

1. The pellet should be stored in a dry place in closed containers.
2. Celstran can be processed by the various injection moulding methods commonly used for thermoplastics.
3. Depending on the matrix material, additional corrosion protection may be necessary.
4. Stainless steel filaments must not have any magnetic components.

VI. *Read the following text to find out new thermoplastics, their properties and processing.*

TEXT 3A

LONG-FIBRE-REINFORCED THERMOPLASTICS (LFT)

PART I

Recently new long-fibre-reinforced thermoplastics have been produced in Germany. Their trade marks are Celstran, Compel and Fiberod. They have outstanding mechanical properties combined with good chemical resistance.

Celstran is intended for injection moulding, blow moulding and extrusion. Compel is suitable for plasticizing/compression moulding. In processing all Celstran and Compel grades care should be taken to ensure that fibre breakage is kept to a minimum. The longer the glass fibres in the component, the better are its mechanical properties.

Preparation.

The pellets should be stored in a dry place in closed containers until they are processed so as to prevent contamination and moisture absorption (including condensation).

Celstran PP and Compel PP: drying is not normally required before processing. Should the material have become damp owing to incorrect storage, it must be dried for 2 hours at 80°C.

Celstran PA: drying in a dehumidifying drier for 4 hours at 80°C is recommended before processing. Other Celstran grades: drying in a drier is recommended before processing.

Injection moulding of Celstran including mould making

Machine requirements

All Celstran grades can be processed on commercial injection moulding machines. For optimum care of the reinforcing fibres and to prevent feed problems because of the relatively long pellets, fairy large plasticizing machines should be used, preferably with a screw diameter of more than 40 mm.

Pellets 7 mm long are available for processing glass-fibre-reinforced Celstran PA 66 grades on smaller machines. Three-zone screws are recommended, if possible with a deep-flighted feed zone, low compression ratio and three-piece annular non-return valve of large cross-section to ensure smooth even flow. Plasticizing units with mixing zones are not suitable.

Since all Celstran grades contain reinforcing fibres, it is necessary for the plasticizing unit to be wear-resistant. Depending on the matrix material, additional corrosion protection may be necessary, e.g. PA 66 or PPS.

PART II

Processing conditions

Celstran can be injection-moulded without any problems. Machine settings that result in optimum finished parts are dependent on the moulded part geometry, the injection mould and the injection moulding machine used.

Plasticizing and cylinder temperatures

Gentle plasticizing is necessary to keep fibre length reduction during melting to a minimum. The required melt temperature is achieved firstly by cylinder heating (heat supply from outside by heat conduction) and secondly by friction (heat supply through internal and external friction, produced by back pressure and screw speed).

The melt shear occurring on melting may shorten the long reinforcing fibres. It is therefore particularly important to maintain very low back pressure or even to plasticize without back pressure, but at the same time to ensure uniform metering and adequate melt homogeneity. It is recommended that the screw speed should be as low as possible so that about 90% of the cooling time can be utilized for metering. In order for a maximum amount of heat to be supplied via the cylinder heating, the pellets should melt rapidly in the feed zone. For this material, therefore, a somewhat higher temperature profile should be chosen than for processing corresponding short-fibre compounds.

Mould wall temperatures

The mould wall temperatures depend on the matrix material. For Celstran PP mould wall temperatures of 40 to 50 °C have proved successful.

Mouldings with a very good surface are obtained if the mould wall temperature is raised to 70°C. The mould wall temperatures for Celstran PA are normally 90°C.

Notes:

1) trademark – торговая (фабричная) марка
2) grade – класс, сорт
3) long fibre reinforced thermoplastics (LFT) – термопласты, армированные длинным волокном
4) damp – влажный, сырой
5) dehumidifying – обезвоживание, осушение
6) back pressure – противодавление, сопротивление потока
7) metering equipment – дозирующее (измерительное) оборудование
8) pin gate – точечный литник
9) sprue gate – центральный литник
10) screw feeder – шнековый питатель, подающее устройство
11) metering zone – зона гомогенизации
12) non-return valve – обратный (запорный) клапан

13) throughput – производительность, выход, выработка

14) gentle – слабый, легкий

VII. Answer the following questions

1. Where have new LFT been produced?
2. What are their trademarks?
3. What are their properties?
4. What do their mechanical properties depend on?
5. Why should the pellets be stored in a dry place in closed containers before processing?
6. Is drying of Celstran PP and Compel PP required before processing?
7. Can all Celstran grades be processed on commercial injection molding machines?
8. Why should fairly large plasticizing machines be used?
9. What pellets are available for processing glass- fibre-reinforced Celstran PA 66 on smaller machines?
10. Why is it necessary to use wear-resistant plasticizing units?
11. What machines can produce optimum finished parts?
12. What plasticizing is necessary to keep fibre length reduction during melting to a minimum?
13. How is the required melt temperature achieved?
14. Why is it important to maintain very low back pressure or even to plasticize without back pressure?
15. What mould wall temperatures are used for Celstran PP?
16. How are mouldings with a very good surface obtained?

VIII. Fill in blanks with information taken from the text:

1. The longer the glass fibres in the component, the better are its ….

2. … the material have become damp owing to incorrect storage, it must be dried for 2 hours at 80°C.
3. All Celstran grades can be processed on ….
4. … units with mixing zones are not suitable.
5. Depending on …, additional corrosion protection may be necessary.
6. The melt shear occurring on melting may shorten ….
7. The mould wall temperature depends on ….

IX. Think and say about:

1) properties of LFT
2) preparation of Celstran and Compel
3) machine requirements
4) processing conditions
5) plasticizing and cylinder temperatures
6) mould wall temperatures

X. Read the text, try to get it as a whole

TEXT 3B

NEW MATERIALS – TOPAS

As a cyclic olefinic copolymer (COC) Topas offers the best of both worlds: it combines the typical properties of polyolefins, e.g. water vapour barriers effect, low water absorption, good resistance to hydrolysis/chemical media and low density, with the advantage derived from norbornenes, e.g. high transparency, low birefringence, variable heat deflection temperature and high rigidity. By varying the manufacturing conditions Topas can be individually customized to suit its extremely diverse applications. The current product range, for example, includes materials with glass transition temperatures ranging from 80°C to 180°C. COC grades can be processed by injection moulding, injection blow moulding or extrusion. The range of applications for Topas is correspondingly wide. Usually Topas can be processed on conventional machinery. The excellent water vapour barrier properties, high transparency and physiological inertness of Topas make it particularly suitable for producing pharmaceutical blister packs. The low glass transition temperature of the special grade Topas 8007 means that it is very economic to process. Its low thermoforming temperature ensures high output and cuts energy consumption. Because of the low longitudinal and transverse shrinkage of this material, consistently perfect reproduction of blister shape is possible and so material savings are gained. In medical technology, special Topas grades are used to produce unbreakable, highly transparent bottles for liquid pharmaceutical products. The excellent water vapour barrier effect of COCs ensures that the concentration and therefore the quality of the solution remains constant. With selection of the appropriate material, different sterilization methods can be employed – an essential requirement for the use of Topas in injection moulded syringe systems. For capacitor films Topas offers the particular advantage that its electrical properties are largely independent of temperature. Its relative permittivity and film shrinkage values are extremely low and remain virtually constant up to the typical glass transition temperatures of 120°C to 130°C. The low dissipation factor of Topas prevents films heating up. Highly transparent lenses, prisms and sensors can be produced very economically from Topas by injection moulding. These have extremely precise geometry and, because of the material’s low water absorption, retain this precision even under unfavourable climatic conditions. The light weight of these mouldings enables them to replace glass – a much heavier material – in many applications. The low optical dispersion and birefringence of Topas make it suitable for the production of high-quality optical systems.

Continuing investment is being made in systematic further development of the properties of Topas and its markets. The first commercial plant for Topas was built at Ruhrchemie site in Oberhausen (Germany) in 2000. The plant has a capacity of 30,000 metric tons per annum.

XI. Find the answers to the following questions in the text.

1. What properties does the cyclic olefinic copolymer Topas combine?
2. Can it be individually customized to suit its diverse application?
3. What materials does the current product range include?
4. What methods are used to process COC?
5. Can it be processed on conventional machinery?
6. What properties of Topas make it particularly suitable for producing pharmaceutical blister packs?
7. What does its low thermoforming temperature ensure?
8. For what purpose are special Topas grades used in medical technology?
9. What particular advantage does Topas offer in the production of capacitor films?
10. How are highly transparent lenses, prisms and sensors produced from Topas?

11. When and where was the first commercial plant for Topas built?
12. What is its capacity?

XII. Find sentences characterizing the following:

1) diverse applications of Topas
2) methods of processing
3) Topas grades used in medicine
4) the particular advantage of Topas
5) high-quality optical systems produced of Topas

UNIT IV

PLASTIC FOAMS MANUFACTURING TECHNIQUES

I.Remember the following words and word combinations from the text

1. to agitate (agitation)	1. перемешивать, взбалтывать (перемешивание)
2. emulsion	2. эмульсия
3. suspension	3. суспензия, взвесь
4. froth	4. пена
5. to gel	5. желатинировать
6. to fuse	6. плавить(ся), расплавлять(ся)
7. to cure	7. отверждать(ся), вулканизировать(ся)
8. rubber – latex – foam	8. латексная пенорезина
9. to afford	9. давать, представлять, быть в состоянии позволить себе что-либо
10. to inject	10. впрыскивать, вводить
11. to decompose	11. разлагать(ся), распадаться

12. decomposition — 12. разложение, распад, расщепление
13. to process — 13. обрабатывать, перерабатывать
14. blowing agent — 14. вспучиватель, порообразователь
15. conventional — 15. обычный
16. vigorous — 16. сильный, энергичный; бурный (о химической реакции)

II.Translate the following word combinations into Russian:

vigorous agitation, rubber – latex – foam, foaming operation, volatile liquids, liquid polymer formulations, expanding gas, within the matrix of polymer, cell-forming gas, characteristic property, gaseous decomposition product.

III.Match the words in A with their synonyms in B

A	B
1) intensive	a) product
2) mixing	b) vigorous
3) to make	c) agitation
4) use	d) to process
5) to liberate	e) froth
6) base on	f) to obtain
7) article	g) commercial
8) to melt	h) to produce
9) to get	i) to rely on
10) to treat	j) to fuse
11) industrial	k) to evolve
12) foam	l) application

IV.Complete the following sentences using the words from the list below:

heat, to liberate, to afford, vigorous, carbon dioxide, to inject.

1. Mechanical forming involves … agitation of an emulsion or suspension.
2. The method … less control over density.
3. Materials that change their physical state during foaming operation … into liquid polymer formulations.
4. The cell forming gas can be produced by ….
5. Chemical blowing agents decompose under the influence of ….
6. Their most characteristic property is the temperature at which they … gas.

V.Translate the following sentences into Russian. Define the types of the subordinate clauses:

1. Mechanical methods for production of foams are not widely used now because they do not provide efficient control over density and structure of the product.
2. In physical foaming materials that change their physical state during foaming operation are injected into liquid polymer before curing.
3. When heat is applied gases evolve to form cells.
4. Chemical blowing agents are inorganic or organic materials that decompose under the influence of heat.
5. The most characteristic property of chemical blowing agents is the temperature at which they liberate gas.

VI.Read the text below to find out various foaming methods

TEXT 4A

FOAMING METHODS

Polymers may be foamed by mechanical, physical or chemical methods.

Mechanical foaming involves vigorous agitation of an emulsion, suspension or solution of the resin to produce a froth that is then gelled, fused and cured. This method is used for the production of rubber – latex – foam but it is not widely used now because it affords less control over density and structure than other methods.

In physical foaming materials that change their physical state during foaming operations (e.g. compressed gases, volatile liquids or soluble solids) are injected into liquid polymer formulations before curing. An example is cellular polystyrene which is obtained by dissolving in the polymer and under pressure normally gaseous agents such as methyl chloride and propylene.

In chemical foaming the expanding gas is generated within the matrix of the polymer. The cell-forming gas can be produced as a polymerization by-product by carbon dioxide. Most fastest-growing chemical foaming methods rely on heat-sensitive additives – chemical blowing agents as sources of the expanding gas. Chemical blowing agents are inorganic or organic materials that decompose under the influence of heat to give at least one gaseous decomposition product. Their most characteristic property is the temperature at which they liberate gas. The decomposition temperature determines the usefulness of a foaming agent in a given plastic material. The application of chemical blowing agents to processes using conventional and plastic equipment is the main advantage of commercial use of these materials.

Notes:

1. advantage	– преимущество
2. cell-forming gas	– газ, образующий ячейки
3. most fastest growing methods	– наиболее быстро развивающиеся методы
4. heat-sensitive additives	– добавки, чувствительные к нагреву

VII.Find answers to the following questions in the text:

1. What methods may polymers be foamed by?
2. What does mechanical foaming involve?
3. What is this method used for?
4. What is done with materials in physical foaming?
5. Is the expanding gas generated within the matrix of the polymer in chemical foaming?
6. What do chemical foaming methods rely on?
7. What kind of materials are chemical blowing agents?
8. What is the most important characteristic property of chemical blowing agents?
9. What determines the usefulness of the foaming agent in a given plastic material?
10. What is the main advantage of the commercial use of the chemical blowing agents?

VIII.Think and say about:

1. the main foaming methods
2. mechanical foaming
3. physical foaming
4. chemical foaming

IX.Read the text; try to get it as a whole.

TEXT 4B

FOAM MANUFACTURING TECHNIQUES

In recent years the polymer processing industry has become increasingly interested in the production of extruded foams and injection-moulded structural foams. This is because in many cases lower density can be achieved which makes the technique economically attractive.

The processes of extrusion or injection moulding have much in common. In both cases hot plastic or liquid material is forced through an aperture: in the case of extrusion the material emerges through a die which gives it a desired shape, e.g. a tube or a rod. In the case of injection moulding the material is forced into a cooled mould which gives it a desired form. Similar apparatus is used to extrude or inject the material.

In injection moulding or extrusion it is known that the thermoplastic mass must be mixed with stabilizers or lubricants. They are used in order to exclude decomposition resulting from blockage of materials and concentration of heat.

Production of expanded materials by extrusion is more difficult than by moulding processes because pressure cannot be applied to the foam to limit the expansion. The extruder die has to be equipped with complex cooling systems so that the foam can be extruded at lower temperatures than are normally used for the polymer. Handling the extrudate requires control of the physical expansion taking place and of the cooling of the foam which is an excellent thermal insulator. Consistent cooling needs a cooling medium at a carefully controlled temperature and requires that the foaming takes place smoothly with no “bumping”. Nucleating agents are added in carefully controlled amounts and the polymer must be dried to a low and consistent moisture content.

Chemical processes for extruding expanded materials are based on either chemical or physical blowing agents. Chemical blowing agents are commonly used to produce high-density foams. They function by decomposing at a critical temperature and releasing a gas, for example, nitrogen, carbon monoxide or carbon dioxide. The bubbles thus initiated may be dissolved into a hot melt under high pressure and will grow when the pressure is reduced as the molten polymer flows through an extrusion die.

Physical blowing agents are gases such as nitrogen, n-pentane and others. They are introduced either as a component of the polymer or under pressure into the molten polymer in the barrel of the extruder.

X.Answer the following questions:

1. Why has the polymer processing industry become interested in the production of extruded and injection-moulded foams?
2. What do extrusion and injection-moulding have in common?
3. What are stabilizers used for in these two processes?
4. Why is it more difficult to produce expanded materials by extrusion than by moulding processes?

5. What does the extruder have to be equipped with in this case?
6. What are nucleating agents used for?
7. What are commercial processes for extruding expanded materials based on?
8. What are chemical blowing agents used for?
9. In what way are physical blowing agents introduced into the polymer?

XI.Find information concerning the following statements in the text:

1) the need in the production of extruded foams and injection-moulded structural foams;
2) much in common between the process of extrusion and injection-moulding;
3) the role of cooling in the process of extrusion;
4) types of agents commonly used for extruding expanded materials;
5) functions of these agents.

CONTENTS

ПЛАСТМАССЫ И ПОЛИМЕРЫ

Учебные задания к практическим занятиям
на английском языке для студентов II курса
специальности «Полимерные материалы»

Составитель
СКАКУНОВА Аполлинария Алексеевна

Ответственный за выпуск – зав. кафедрой доцент Е.П. Марычева

Подписано в печать 04.04.07.
Формат 60х84/16. Усл. печ. л. 2,09. Тираж 100 экз.
Заказ
Издательство
Владимирского государственного университета.
600000, Владимир, ул. Горького, 87.