

合成材料科技英语

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前 言

本书从塑料大全、工艺学、有关专著等十余本书籍中摘录精选，再经修改、整理、编辑而成，部分内容 by 作者撰写，共计 30 篇文选。内容涉及塑料定义、类型、主要树脂品种及其制造方法、性能与用途，塑料的成型加工、塑料机械、模具及塑料的试验方法，专业性强、适用性广泛。为了帮助读者学习，本书对每课详细列出单词、短语、注释乃至译文，并弥补了专业英语单词通常不注国际音标、难于拼读的弊病。

本书可作为高分子材料、塑料、涂料、绝缘材料等专业教材和参考书，供大学生、研究生、教师和科技人员使用，有助于提高高分子领域的阅读能力及翻译水平，增加高分子材料和塑料的专业知识，是了解合成材料英语世界的一扇窗口。

本书得到西北工业大学林德宽教授、西安交通大学刘桂云教授、西安绝缘材料厂卢传康高级工程师的热情支持，在此表示诚挚谢意。

限于作者水平，编译的深度和广度难免不足，错误、遗漏和欠妥之处难于杜绝，敬请读者不吝指正。

Contents

1. What Are Plastics?	
何谓塑料?	(1)
2. Types of Plastics	
塑料的类型	(10)
3. Ways of Producing Plastics Items	
塑料制品的生产方法	(18)
4. Reaction Mechanism of Phenolic Resins	
酚醛树脂的反应机理	(28)
5. Applications of Amino Resins	
氨基树脂的应用	(37)
6. Polyesters	
聚酯	(46)
7. Processing and Applications of Polycarbonate	
聚碳酸酯的加工与应用	(56)
8. Epoxy Resin Production	
环氧树脂的生产	(66)
9. Application of Silicone Resins	
有机硅树脂的应用	(77)
10. Manufacture of Polyamides	
聚酰胺的制造	(84)
11. Chemistry and Properties of Polyethylene	
聚乙烯的化学与性能	(93)

12. Processing of Polypropylene	
聚丙烯的加工	(104)
13. Polybutylene	
聚丁烯	(115)
14. Styrene Polymers	
苯乙烯聚合物	(126)
15. Polymerization of Vinyl Chloride	
氯乙烯的聚合	(135)
16. Fluoroplastics	
氟塑料	(144)
17. Acetal Homopolymer	
均聚甲醛	(155)
18. ABS	
丙烯腈 – 丁二烯 – 苯乙烯共聚物	(164)
19. Applications of Polyimide Films	
聚酰亚胺薄膜的应用	(175)
20. Properties of Acrylics	
丙烯酸类塑料的性能	(186)
21. Flexible Urethane Foams	
聚氨酯软泡沫塑料	(196)
22. Additive for Plastics	
塑料添加剂	(207)
23. Laminated Plastics	
层压塑料	(216)
24. Injection Molding and Injection Molding Machines	
注塑和注塑机	(225)

25. Impregnating Machines	
浸渍机	(237)
26. Molding of Phenol-Formaldehyde Compounds	
酚醛塑料的模塑	(246)
27. Types of Molds	
模具的类型	(255)
28. Sorption of Moisture by Resinous Insulation	
树脂型绝缘材料的吸湿性	(264)
29. Method of Density Test for Polyethylene	
聚乙烯密度的试验方法	(273)
30. Epoxide Resin Powder Coatings	
环氧树脂粉末涂料	(284)
References	(295)
Glossary	(297)

1. What Are Plastics?

A plastics material, in theory, is any material that will flow under the application of heat or pressure or both. Industry uses “plastic” or “plastics” to indicate finished items for the reason that their base material is moldable. By current definition plastics materials generally are considered to be restricted to synthetic materials that have been tailored to meet specific structural industrial needs with the exception of synthetic materials in the fiber or elastomer areas.

Plastics are divided into two families on the basis of how they react to heat. One family is called “thermoplastics”, and the other, “thermosetting”.

Thermoplastics softens under heat and takes its final shape upon cooling, reheating will soften the material which then can be remolded.

Thermosetting compounds harden as heat is applied. They are formed under heat and pressure, become hard and dense, and cannot be melted for reuse.

For example, if wax and iron were synthetic polymers, they would be thermoplastics because they could be melted and formed over and over. If concrete were a synthetic polymer, it would be thermosetting. Once concrete sets or cures to its final form, it cannot be melted and shaped again.

Composition of Compounds

Every compound is made up of the following ingredients:

1. The binder; most important — binds or holds the compound together.

2. The filler; imparts various physical properties such as electrical characteristics, resistance to high impact and heat.

3. Color matter; pigment or dye stuff — amount will vary depending on base resin; e. g. , phenolics are usually in dark colors; black, brown, green.

4. Lubricant; prevents sticking in machine and mold; decreases viscosity and in turn improves flow.

5. Accelerator & inhibitor; used in thermosets to either increase or decrease the rate of cure. Controls rate of chemical reaction.

6. Plasticizer; determines the characteristics of flow or viscosity.

Some resins require no lubricant. Clear compounds require no pigment. Many combinations of plastics compounds with different properties and characteristics make up the growing list of plastics materials available today.

Plastics have many desirable features including;

1. Weather resistance; many compounds resist weather changes due to low coefficients of expansion and contraction.

2. Chemical resistance; there are plastics formulations available which will resist most acids, solvents, and alkalis.

3. Corrosion resistance; plastics are replacing many materials because of their noncorrosive properties.

4. Dielectric property; plastics are used in electrical equipment due to their insulating properties.

5. Finish; virtually any finish can be obtained in a plastics part. The plastics material will reproduce a permanent finish from the finish of

the mold steel.

6. Weight to strength: while not as strong as steel, plastics have good strength characteristics and perform satisfactorily in many strength requirement applications.

7. Specific gravity: plastics are light: about one half the weight of aluminum and one sixth that of steel.

8. Abrasion resistance: there are plastics that will resist wear better than most metals in many applications.

9. Color: plastics parts can be produced in many colors. The color is a permanent part of the compound.

10. Configuration: plastics can be molded, extruded, formed, or machined into many intricate shapes economically.

In addition, plastics materials offer: (1) good heat insulation, (2) variety of hardnesses and flexibilities, (3) good acoustical properties, (4) transparency and (5) ability to combine with other materials.

New Words

- plastics [ˈplæstiks] *n.* 塑料, 塑料制品
- indicate [ˈindikeit] *vt.* 指示, 表示
- finish [ˈfiniʃ] *v.* 完成、修饰 *n.* 表面光洁度
- item [ˈaɪtəm] *n.* 项目, 物品; 产品
- finished item 成品
- moldable [ˈməuldəbl] *a.* 可模塑的
- definition [defɪˈnɪʃən] *n.* 定义
- tailor [ˈteɪlə] *vt.* 定制, 制作
- fiber [ˈfaɪbə] *n.* 纤维
- elastomer [iˈlæstəmə] *n.* 合成橡胶; 弹性体
- thermoplastics [θəːməuˈplæstiks] *n.* 热塑性塑料
- thermosetting [θəːməuˈsetɪŋ] *n.*; *a.* 热固性 (的)
- concrete [ˈkɒŋkri:t] *n.* 混凝土
- set [set] *v.* 凝结, 凝固, 固化
- composition [kɒmpəˈzɪʃən] *n.* 成分, 组成
- compound [ˈkɒmpaund] *n.* 混料; 复合物; 化合物
- ingredient [ɪnˈɡri:dʒənt] *n.* (混合物的) 成分, 组分
- binder [ˈbaɪndə] *n.* 粘合剂; 漆基; 基料
- filler [ˈfɪlə] *n.* 填料
- impart [ɪmˈpɑ:t] *vt.* 给予, 告诉, 通知
- stuff [stʌf] *n.* 材料, 原料
- lubricant [ˈlu:brikənt] *n.* 润滑剂
- accelerator [əkˈseləreɪtə] *n.* 促进剂
- inhibitor [ɪnˈhɪbɪtə] *n.* 阻聚剂

plasticizer	['plæstisaɪzə]	<i>n.</i> 增塑剂
coefficient	[kəʊi'fɪʃənt]	<i>n.</i> 系数
expansion	[ɪks'pænfən]	<i>n.</i> 膨胀
contraction	[kən'trækʃən]	<i>n.</i> 收缩
formulation	[fɔ:mju'leɪʃən]	<i>n.</i> 配方; 公式
corrosion	[kə'rəʊzən]	<i>n.</i> 腐蚀
permanent	['pə:mənənt]	<i>a.</i> 永久的, 持久的
abrasion	[ə'breɪzən]	<i>n.</i> 磨损, 磨蚀
configuration	[kən figju'reɪʃən]	<i>n.</i> 外形, 轮廓
intricate	['ɪntrɪkɪt]	<i>a.</i> 复杂的
hardness	['hɑ:dnɪs]	<i>n.</i> 硬度
flexibility	[fleksə'bɪlɪtɪ]	<i>n.</i> 柔韧性, 柔软度
variety	[və'raɪətɪ]	<i>n.</i> 变化, 种类
acoustical	[ə'ku:stɪkəl]	<i>a.</i> 声学的
transparency	[træns'pɛərənsɪ]	<i>n.</i> 透明性, 透明度

Useful Expressions

for the reason that	因为, 由于
tailor...to...	使...适合(满足) ... (的要求, 需要, 条件等)
with the exception of	除...之外 (其余都)
on the basis of	根据, 以...为基础, 在...基础上
over and over	屡次, 一次又一次 (地)
be made up of	由...组成 (制成)
hold together	把...结合在一起, 保持...成一体
in turn	依次, 轮流
make up	组成, 构成

due to 由于，应归于

Notes to the Text

1. Industry uses “plastic” or “plastics” to indicate finished items for the reason that their base material is moldable.

本句是主从复合句。Industry…items 是主句，to…items 是不定式动词短语，在句中作宾语补语。for…moldable 是原因状语。that …moldable 是同位语从句表示修饰先行词 the reason 的具体内容，that 作从属连词。

2. By current definition plastic materials generally are considered to be restricted to synthetic materials that have been tailored to meet specific structural industrial needs with the exception of synthetic materials in the fiber of elastomer areas.

本句是主从复合句。plastic…to synthetic materials 是主句，to be …materials 是不定式短语，作主语补语。that…areas 是定语从句，that 作关系代词，修饰 synthetic materials，在从句中作主语。By…definition, with…areas 均作状语。

3. Thermoplastics softens under heat and takes its final shape upon cooling, reheating will soften the material which then can be remolded.

本句是并列主从复合句。Thermoplastics…cooling 是第一分句，reheating…material 是第二分句，which…remolded 是定语从句，which 作关系代词，修饰 the material，在从句中作主语。

4. For example, if wax and iron were synthetic polymers, they would be thermoplastics because they could be melted and formed over and over.

本句是主从复合句。if…polymers 是虚拟条件句，表示与现在

事实相反的假设，they...thermoplastics 是主句，because...over 是原因状语从句。虚拟句的现在时谓语形式，条件从句用过去式 were，主句和其它句用 would (could) + 动词原形，即 would (could) be (do)。

何 谓 塑 料？

从理论上讲，在受热、受压或受热压的双重作用时产生流动的物质，皆为塑料。在工业上，“塑料”系指成品而言，因其基础材料可以模塑。按现时的定义，塑料是指适应工业上的特殊结构需要经加工而成的非合成纤维类材料和非合成橡胶类材料。

塑料按其自身对热的反应变化情况，划归为两类，一类称作热塑性塑料，另一类称作热固性塑料。

热塑性塑料受热变软，冷却后定形，再受热又变软，还可模塑。

热固性塑料受热变硬，热压成形后，质地坚硬而致密，无法再次熔化利用。

例如，假定蜡和铁是合成聚合物。它们能反复熔化变形，所以是热塑性塑料。又假定混凝土是合成聚合物。它却是热固性塑料。混凝土一旦凝固定形，便无法再熔化变形。

塑料成分

构成塑料的成分如下：

1. 胶粘剂：担负粘合或结合混合料的作用，当最重要；
2. 填料：获取各种物理性能，如电气性能、抗强冲击性能、耐高温性能；
3. 着色剂：实为颜料或染料。它的用量视基础树脂而定，如酚醛塑料颜色偏暗，呈黑色、棕色和绿色；
4. 润滑剂：防止粘机器和模具，降低粘度以改善流动性；
5. 促进剂和阻聚剂：用于热固性塑料加快或减缓固化速率，

控制其化学反应的速度；

6. 增塑剂：确定流动或粘度的特性。

有些树脂无需添加润滑剂，透明塑料不用掺入颜料。塑料在性能上各有所长，千差万别，它们不断地变换组合，使得今天的塑料品种层出不穷，方兴未艾。

塑料具有许多优良的特性，其中包括：

1. 耐候性：许多塑料品种由于膨胀率和收缩率均低，不受制于气候的影响。

2. 耐化学性：现有的塑料制品不受多数酸、溶剂和碱的侵蚀。

3. 耐腐蚀性：塑料耐腐蚀，已逐步取代许多材料。

4. 介电性：塑料绝缘性能上乘，适用于电气设备。

5. 表面光洁度：塑料部件实际上都能获得不同程度的表面光洁度，可永久性地再现钢模的表面光洁度。

6. 重量比强度：塑料虽不如钢硬，却具有良好的强度特性，应用于高强度的领域里，效果颇佳。

7. 比重：塑料质地轻，重量约为铝的 $1/2$ 或钢的 $1/6$ 。

8. 耐磨性：塑料较之大多数金属更耐磨，应用广泛。

9. 颜色：塑料制品色彩缤纷。色彩永远是塑料制品的一个部分。

10. 外形：塑料能够采用模塑、挤塑、成型或机械加工的方法制成多种复杂的形状，经济实惠。

此外，塑料还具有：

1. 良好的隔热性；

2. 不同的硬度和韧性；

3. 良好的声学性；

4. 透明；

5. 与其它材料结合的能力。

2. Types of Plastics

There are two main groups of plastics: thermosetting materials and thermoplastic materials.

Thermosetting materials can be heated and shaped only once. Thereafter, they become rigid and can be broken, but they cannot be softened again by heat without being decomposed. Urea-formaldehyde or UF, a resin obtained from urea ($\text{NH}_2\text{CO}\cdot\text{NH}_2$) and formaldehyde (CH_2O), and the similar melamineformaldehyde or MF, from melamine ($\text{C}_3\text{H}_6\text{N}_6$) and formaldehyde, are two of the most widely used thermosets. Their toughness and high electrical and thermal resistance make them ideal for electric light switches and plugs, and for the handles of irons, kettles, pans, etc., while they are also used to impregnate laminated paper sheets, from which heat-and-scratch-resistant surfaces are made. Where dark colours are acceptable, the cheaper phenolic material, phenolformaldehyde or PF, is often used.

Thermoplastic materials can be shaped and reshaped as many times as required. If the temperature is not too high, they soften again without decomposition. Polyethylene produced by the polymerization of ethylene ($\text{CH}_2 = \text{CH}_2$) is still the most widely used thermoplastic. It is cheap to produce, tough and light (Specific Gravity 0.92 to 0.96). Low-density polythene is used for making transparent sheet or film, cable and flex covering and flexible bottles, while more rigid bottles and containers are made from high-density polythene. The more recently developed polypro-

polyene from propylene ($\text{CH}_3 - \text{CH} = \text{CH}_2$) has replaced polythene for many applications, since it is more resilient, less inclined to stress-cracking and is not weakened by flexing. However, it is more costly than several other similar plastics and tends to be brittle at very low temperatures. It is used to make a variety of products, including hinges, vehicle-engine radiator fans and moulded chair seats. Polystyrene, obtained by reacting benzene with ethylene, is an extremely cheap, light, rigid material, which is brittle and is often toughened by the addition of rubber. It is used especially for making toys and small rigid containers, where low cost may be more important than durability. Expanded polystyrene is an extremely light rigid foam (Specific Gravity about 0.015) produced in block or by moulding for insulating and packaging. Polyvinylchloride or PVC, from vinyl chloride ($\text{CH}_2 = \text{CHCl}$) can be produced in many forms to make, for example, rigid refrigerator linings, rigid and flexible pipes, furniture coverings and floor tiles. Unsupported PVC and PVC-coated fabrics are used to make bags, cases and clothing. PVC is a relatively heavy plastics (Specific Gravity 1.2 to 1.5). Nylon, a generic name for the polyamide thermoplastics, has different properties depending on the relative lengths of the $-\text{CH}_2-$ groups in the polymer. Nylon was the first synthetic plastics fibre to be introduced into the clothing industry, but it is also used wherever its great tensile strength or thermal resistance is needed, for example, to make ropes, bristles and gearwheels. Polytetrafluoroethylene or PTFE is made from fluoroethylene, a compound of carbon and fluorine. Although it is difficult and costly to process, it is extremely resistant to chemicals and weathering, has very high temperature resistance and has low frictional properties. Apart from industrial uses, it provides the coating for nonstick cooking utensils.