

Module 1 Introduction

Unit 1 Evolution of Aviation Materials

Part I Lead-in

Task 1

(1) Fung Ru is the father of China's aviation, who is China's first aircraft designer, manufacturer and aviator.

(2) The first airplane was made of wood frame and fabric.

(3) C919 is a large passenger aircraft, which is China's first homegrown large jetliner. The main materials are aluminum alloy and high-strength carbon fibre composite materials.

Part II Reading

Task 2

1. (1) Aircraft structure materials have experienced five stages:

The first stage (1903–1919): wood, fabric;

The second stage (1920–1949): aluminum, steel;

The third stage (1950–1969): aluminum, titanium, steel;

The fourth stage (1970–early 21st century): aluminum, titanium, steel, composite material(mainly aluminum);

The fifth stage (early 21st century–): composite materials, aluminum, titanium, steel (mainly composite materials).

(2) The airplane structure utilizes advanced composite materials for their high strength-to-weight properties.

(3)“A generation material, a generation aircraft.” To some extent, the development of aviation material determines the development of aviation industry.

2. BHIAD JFECG

3. alloy, driving force, Titanium, fibreglass, strength

4. ACBBDD

5. (1) 一般来说, 高刚度、高强度和轻质量的材料最适合飞机应用。

(2) 第一架飞机的主要材料是木材和织物。

(3) 波音 777 飞机的尾翼和地板梁及襟翼等主要结构使用了碳纤维复合材料。

(4) 飞机结构采用先进的复合材料, 是因为它具有高比强度特性。

(5) 通过使用复合材料, 飞机部件的重量减少了 25%。

Task 3

1. 商业飞机; 碳纤维; 飞行控制; 直升机桨叶; 夹芯结构

2. FTTFT

Part III Listening

Task 4

1. CEABD
2. aircraft, material, strength, 1983, replaced

Part IV Translating Skills

Task 5

- | | | | |
|--------------|-------|-----------|------|
| (1) counter- | 逆时钟方向 | (2) non- | 无纺布 |
| (3) dis- | 移位 | (4) de- | 除冰导管 |
| (5) un- | 有缺陷的 | (6) anti- | 耐腐蚀 |
| (7) im- | 杂质 | (8) dis- | 断开 |

Unit 2 Properties of Aviation Materials

Part I Lead-in

Task 1

(1) A brittle material that experiences very little or no plastic deformation upon fracture while ductile materials undergo large plastic deformation before fracture.

(2) But after running a marathon at 18, she discovered that mental toughness matters is more important than physical strength in long-distance sports.

(3) The material used in membrane structure is a kind of film material with good strength and flexibility.

Part II Reading

Task 2

1. (1) The impact of certain external conditions on the component, such as load, temperature, or the strength of the current through the material.

(2) High strength, light weight and high temperature and corrosion resistance.

(3) Metal-based compounds, ceramics, carbon/carbon and various composite materials.

2. DHABJ CEFIG

3. properties, payloads, durable, eliminate, ceramics

4. CBDDC

5. (1) 此外，材料的机械性能并不是恒定的，经常会随着温度、载荷和其他条件而变化。

(2) 材料强度的增加使飞机能够实现更大的装载能力。

(3) 在保证材料足够强度和保持原有飞行性能的情况下，减轻材料的重量可以大大提高飞机的有效载荷能力。

(4) 为了适应航空航天产品日益增长的温度要求，出现了许多新材料，如金属基化合物、陶瓷、碳 / 碳和各种复合材料。

(5) 各种雷达波吸收材料的研制，直接提高了飞机的隐身性能。

Task 3

1. 抗拉强度；抗拉模量；铝合金；高强度标准碳；E 玻璃纤维

2. FFTTF

Part III Listening

Task 4

1. DCEAB

2. supplier, properties, fabricated, composite, critical

Part IV Translating Skills

Task 5

(1) 互扩散

(2) 衬底

(3) 变化

(4) 热塑性

(5) 预制

(6) 水热

(7) 超细

(8) 超导体

(9) 大分子

(10) 微组元

Module2 Common Types of Aviation Materials

Unit 3 Metal Materials

3.1 Ultra-high Strength Steels & Stainless Steels

Part I Lead-in

Task 1

- (1) The new model's frame increases the use of super-strength steel, reducing the total weight of the car by 20 kilograms.
- (2) Our company produces a complete range of stainless steel accessories with high quality.
- (3) The picture is a warning sign of corrosion.

Part II Reading

Task 2

- (1) Ultra-high strength steels are those with a yield strength greater than $1,300 \text{ N/mm}^2$ and a tensile strength greater than $1,400 \text{ N/mm}^2$, and are not normally used in a quenched and tempered state.
- (2) The disadvantage of ultra-high strength steel is that its fatigue performance is very sensitive to stress concentration, and thus the fatigue performance of parts will be greatly reduced, to as low as less than half that of the original materials.
- (3) Stainless steels can be divided into martensitic stainless steel, ferritic stainless steel, and austenitic stainless steel according to their microstructures after normalizing.

2. GJADI BCHFE

3. resistance, yield strength, density, stainless, toughness

4. BCBDC

5. (1) 根据合金元素含量多少, 可分为低合金、中合金和高合金超高强度钢。

(2) 尽管在飞机制造中钢的比重不断下降, 但它仍然广泛用于一些关键的承重结构部件。

(3) 超高强度钢的一大缺点就是疲劳性能对应力集中非常敏感。

(4) 这些构件的一个共同特点是体积虽小但作用巨大。

(5) 飞机向长寿命、高可靠性方向的发展, 对材料耐腐蚀性能的要求越来越高。

Task 3

1. 灰铸铁; 低收缩率; 比强度; 气门支架; 传动杆

2. TFFTFF

Part III Listening

Task 4

1. BADEC
2. applied, wide, stressed, strength, resistance

Part IV Translating Skills

Task 5

- | | | | |
|-----------|-------------|------------|---------|
| (1) 加强 | (2) 可忍受的 | (3) 加强 | (4) 不锈钢 |
| (5) 排列 | (6) 研磨机; 磨工 | (7) 结晶; 明确 | (8) 防水的 |
| (9) 唯物主义者 | (10) 安装 | | |

Unit 3 Metal Materials

3.2 Super Alloys & Aluminium Alloys

Part I Lead-in

Task 1

- (1) The sunroom made of aluminum alloy is very strong and comfortable.
- (2) Super alloys can be used at temperatures up to 1,100 °C .
- (3) Aluminum has a low density, which is 2.7 g/cm³.

Part II Reading

Task 2

1. (1) Super alloys can withstand certain stresses, oxidation and corrosion at temperatures between 600 °C and 1,100 °C .

(2) The characteristics of nickel, tungsten, tantalum and their alloys are their high melting points and good heat resistance.

(3) Aluminum and its alloys have the following characteristics: High specific strength. Excellent physical and chemical properties with a electrical conductivity. Good processability with their good plasticity.

2. DIFAC JBHEG

3. vacuum, indispensable, oxidation, processability, conductivity

4. CBACD

5. (1) 超合金，又称高温合金或者耐热合金。

(2) 在先进的航空和航天发动机中，超合金是制造航空航天发动机热端部件的关键材料，其用量占发动机总重量的 80%。

(3) 在工业生产中，钢铁材料被称为黑色金属，而其他的金属材料被称为有色金属。

(4) 铝、镁、钛等相对密度小、比强度高的材料，被广泛应用于航空、航天、汽车、船舶等行业。

(5) 铝合金是亚音速飞机的主要用材，飞机上的蒙皮、梁、肋、桁条、隔框和起落架都可以用铝合金制造。

Task 3

1. 国际合金命名系统；锻造合金；不可热处理的合金；易受影响的；飞机结构
2. TTFFF

Part III Listening

Task 4

1. DBEAC
2. metals, density, ratios, limitation, melting

Part IV Translating Skills

Task 5

- | | | | |
|---------|----------|--------|----------|
| (1) 马力 | (2) 框架 | (3) 车间 | (4) 搜索引擎 |
| (5) 时间舱 | (6) 固相 | (7) 高速 | (8) 高强度 |
| (9) 深孔 | (10) 大颗粒 | | |

Unit 3 Metal Materials

3.3 Magnesium Alloys & Titanium Alloys

Part I Lead-in

Task 1

(1) Titanium alloys can resist high temperature, which has been used for compressor, blades fans

(2) Titanium alloys are stronger and stiffer than aluminum alloys.

(3) Magnesium and its alloys have low density, high specific strength and modulus, strong shock resistance.

Part II Reading

Task 2

1. (1) The main advantages of magnesium alloys are their low density, high specific strength and modulus, strong shock resistance, and ability to withstand large impact loads. They also have excellent cutting and polishing properties.

(2) It enables aircraft to withstand the extreme heat generated during high-speed flight, ensuring the structural integrity of the aircraft. The use of titanium alloy in high-speed aircraft also reduces the overall weight of the aircraft, which improves performance and fuel efficiency.

(3) Magnesium alloys have limitations in their application due to their high chemical reactivity (poor corrosion resistance) and the need for complex smelting techniques. They are also difficult to cold-deform and have a high notch sensitivity, which imposes restrictions on their use.

2. CHAFJ BIGED

3. stability, resistance, smelt, harden, sensitivity

4. CDAAB

5. (1) 冷变形困难，缺口敏感性大，因而阻碍了其发展。

(2) 镁合金是结构材料中最轻的一种金属，因此镁合金在飞机、导弹、仪表、无线电等制造业中应用广泛。

(3) SR-71 是唯一能在 24000 m 的高空以 3.2 马赫以上的速度飞行实用型飞机。

(4) 它使用 93% 的钛合金作飞机的结构材料，等于给飞机穿了一身防高温的钛铠甲。

(5) 尽管钛具有其优点，但其特殊性质需要严格的条件和复杂的工艺，导致生产成本一直偏高。

Task 3

1. 圆形框；客舱；货舱；钛拼接配件；铝法兰管

2. FFTFF

Part III Listening

Task 4

1. CEBDA
2. 1950s, 45%, 60%, chemical, aircraft

Part IV Translating Skills

Task 5

Initialisms: MLG GPS GPWS TE MCDU AC VHF

Acronyms: ROM UNESCO SIM OPEC RAD ARDOS BASIC

Unit 4 Non-metallic Materials

4.1 Structural Ceramics

Part I Lead-in

Task 1

- (1) The word ceramic comes from the Greek word “keramikos”, which means “pottery”.
- (2) Ceramics are widely used in some corrosive or high-temperature environments. Ceramics are irreplaceable.
- (3) Ceramic matrix composite has the advantages of light weight and high hardness, which is an ideal material for high-performance turbine engines.

Part II Reading

Task 2

1. (1) Some common examples of structural ceramics used in industry include silicon carbide (SiC), silicon nitride (Si₃N₄), aluminum oxide (Al₂O₃), and zirconium dioxide (ZrO₂). These ceramics have excellent mechanical, thermal, and chemical properties, making them suitable for various structural applications. They are used in industries such as aerospace, defense, automotive, energy, and mining.

(2) The four steps in making ceramics are:

- 1) Preparing the ceramic powder;
- 2) Molding the clay;
- 3) Sintering (or drying);
- 4) Firing the clay.

In each step, specific actions and processes occur to transform the raw materials into finished ceramics. The quality and properties of the final product depend on the accuracy and skill employed in each step.

(3) Ceramic matrix composites are useful in aviation because they are light, hard, and resist high temperatures and corrosion. They can replace traditional materials in critical engine parts, like turbine seals and nozzles, to improve performance and durability. This can lead to better engine efficiency and aircraft performance.

2. DHAGI EJFCB

3. corrosion, chemically, verification, resistance, inorganic

4. CBADA

5. (1) 另外，陶瓷是有化学惰性的，因此在人体的高腐蚀性环境中被用作骨替代物。

(2) 它被用于火花塞、装甲板和髋关节植入物。

(3) 陶瓷基复合材料是航空工业领域中一种很有前途的新型结构材料，特别是在航空发动机制造中的应用。

(4) 陶瓷加工的第一步是制备陶瓷粉末，第二步是成型（湿黏土成型）。

(5) 然而, 在一些侵蚀性、腐蚀性或高温环境中, 它们是不可替代的。

Task 3

1. 陶瓷纤维; 碳化硅; 发动机部件; 金属纤维; 隔热罩
2. FFFTT

Part III Listening

Task 4

1. BECAD
2. greek, brittle, room, components, thermal

Part IV Translating Skills

Task 5

- | | | | |
|------------|----------|------------|-------------|
| (1) 3.9624 | (2) 50.8 | (3) 2.268 | (4) 9.144 |
| (5) 229.6 | (6) 51.6 | (7) 22,000 | (8) 0.735,8 |
| (9) 157.93 | (10) 96 | | |

Unit 4 Non-metallic Materials

4.2 Engineering Polymers

Part I Lead-in

Task 1

- (1) Engineered polymers include natural materials rubber and synthetic materials plastics.
- (2) Compared with metals, the mechanical strength of plastics is not particularly high.
- (3) The synthetic rubber material makes the robot more flexible and durable.

Part II Reading

Task 2

1. (1) A high specific strength; a wide range of colors; absorb and disperse mechanical vibration; good resistance to oil, solvents and chemical media; have good antioxidant and ozone resistance performance.

(2) Aircraft rubber materials have good resistance to oil, solvents and chemical media, Aircraft rubber materials can effectively absorb and disperse mechanical vibration and energy, reducing the transmission of vibration and thus have good vibration and sound insulation effects. Aircraft rubber materials have a high wear resistance and can maintain a long service life in harsh conditions. Aircraft rubber materials can also be used for a long time without damage in outdoor environments and have good antioxidant and ozone resistance performance.

(3) The synthetic rubber material is much better in terms of heat resistance, aging resistance and oil medium than natural rubber.

2. FJDAC IEBHG

3. specific, tailored, indispensable, disperse, insulation

4. CDBDD

5. (1) 天然橡胶是飞机轮胎制造过程中使用标准最高、用量最大的原材料。

(2) 航空橡胶材料具有良好的减振和隔离效果

(3) 世界各国已经开始使用合成橡胶

(4) 航空轮胎作为维系飞行安全的 A 类零部件，天然橡胶是其制造过程中所使用的要求最高、用量最大的原材料。

(5) 与金属相比，塑料的机械强度不是特别高，但由于其强度与重量比，低密度使其强度与金属相当。如果一种材料的强度与重量之比很高，它就具有较高的比强度。

Task 3

1. 施工时间；挤出时间；无黏性时间；固化时间；标准条件

2. FTFFT

Part III Listening

Task 4

1. CBAED
2. structures, compared, formed, polymers, heat

Part IV Translating Skills

Task 5

- (1) nine thousand, eight hundred and eighty-three
- (2) sixty-five thousand, three hundred and fifty-nine
- (3) two hundred and sixty-five thousand, four hundred and sixty-eight
- (4) sixty million, two hundred and sixty-three thousand, one hundred and fifty
- (5) sixty-eight billion, seven hundred and ninety million, three hundred and forty-eight thousand, one hundred and ninety-seven

4.3 Aircraft Coatings & Aircraft Fuel

Part I Lead-in

Task 1

- (1) He is coating the wooden board with colored protective paint.
- (2) Pigments not only color the film but also increase its strength, wear and corrosion resistance.
- (3) Aircraft fuel is the main energy source for modern aircraft engines.

Part II Reading

Task 2

1. (1) Aircraft skin; aircraft cabin; aircraft engines; aircraft components; insulation layer, fireproof layer, etc.
(2) Aviation kerosene.
(3) No, it isn't.
2. HJEIC BFGDA
3. anti-explosion, secondary, engines, reciprocating, functions
4. ABCAC
5. (1) 航空煤油是经直接炼制和二次加工从原油中提炼出来的, 一般产量不高, 只占原油的 10% 左右。
(2) 航空涂料除了传统的保护、装饰功能外, 其重要性更大程度是体现在特殊功能性上。
(3) 涂料是一种有机高分子胶体的混合溶液, 涂在零部件表面以形成膜。
(4) 高压气体通过燃烧产生推力。
(5) 航空燃料是现代飞机动力的主要能量来源。

Task 3

1. 薄膜胶黏剂; 发泡胶黏剂; 夹芯结构; 二次胶接; 真空袋
2. FFTFT

Part III Listening

Task4

1. EADCB
2. protection, helicopter, adhesion, stability, harm

Part IV Translating Skills

Task 5

- (1) 汽车的产量比去年增加了 2 倍。
- (2) 与 2000 年相比, 煤炭产量增加了 4 倍。
- (3) 那架飞机飞行高度是那个风筝的 10 倍。
- (4) 铁几乎比铝重 2 倍。(铁的重量几乎是铝的 3 倍。)
- (5) 这条河是那条河的 3 倍深。(这条河比那条河深 2 倍。)

Unit 5 Composite Materials

5.1 Reinforcements

5.1.1 Common Fibre Reinforcements

Part I Lead-in

Task 1

(1) Aramid fibre has light weight, high strength and good toughness, which is the best choice for the manufacture of body armor.

(2) Most of the blades of wind turbines use GFRP, which has light weight, high strength and corrosion resistance.

(3) Carbon fibre composite can reduce the weight of the car by 40% to 60%.

Part II Reading

Task 2

1. (1) High temperature resistance, non-flammable, anti-corrosion, heat/sound/electrical insulation, high tensile strength.

(2) 3 to 10 times stiffer.

(3) Aramid fibres are hygroscopic. They also have a high coefficient of thermal expansion. One of the other disadvantages of aramid fibres is that they have a much lower compression strength than tension strength.

2. IDJBG HCFEA

3. diameter, reinforce, carbon fibre, aramid fibre, hygroscopic

4. BABCD

5. (1) 玻璃纤维通常用来增强塑料。

(2) 玻璃纤维是应用最广泛的纤维。

(3) 碳纤维是非常坚硬和坚固的纤维。

(4) BMS9-17 和 BMS9-8 是波音公司在 787 飞机上使用碳纤维的两个主要规格。

(5) 凯夫拉纤维是芳纶纤维的一种。

Task 3

1. 剪切载荷；机械性能；胶接修复；抗疲劳；高性能

2. FTFTT

Part III Listening

Task 4

1. DEBAC

2. weight, stiffness, damage, compression, 8

Part IV Translating Skills

Task 5

- (1) 这张床的大小是那张床的 $\frac{1}{3}$ 。
- (2) 氢原子的重量约为氧原子的 $\frac{1}{16}$ 。（氢原子比氧原子约轻 $\frac{15}{16}$ ）
- (3) 这座桥的长度是那座桥的 $\frac{1}{5}$ 。
- (4) 合金炉管的长度缩短了 $\frac{4}{5}$ 。
- (5) 电子设备的重量减少了 $\frac{3}{4}$ 。

Unit 5 Composite Materials

5.1 Reinforcements

5.1.2 Other Fibre Reinforcements

Part I Lead-in

Task 1

- (1) Boron fibres are mainly used in military aviation, such as the first F-15 stabilizers.
- (2) The turbine blades of gas turbine engines are made of high-temperature resistant ceramic fibres.
- (3) The BMS-276 material, which contains particle fibre, is used in 777 empennage and floor beams.

Part II Reading

Task 2

- (1) Because the thermal expansion of boron is close to aluminum and there is no galvanic corrosion potential.
- (2) Bullet resistant vests and other types of protective armor.
- (3) Pure silicon oxide.
2. JHGF EDCBA
3. ceramic fibres, Boron, Quartz fibres, Milled fibres, whiskers
4. CADAA
5. (1) 硼纤维非常坚硬，具有很高的拉伸和抗压强度。
(2) 光谱纤维用于防弹背心和其他类型的防护装甲。
(3) 金属纤维是非常细的线。
(4) 复合材料商用飞机结构中典型的增强材料是连续纤维。
(5) 晶须用于增强金属基和陶瓷基复合材料。

Task 3

1. 抗拉强度；轴向载荷；应用载荷；铺层方向；比刚度
2. FFTTF

Part III Listening

Task 4

1. CADBE
2. single, refered, says, woven, goods

Part IV Translating Skills

Task 5

- (1) one-tenth (2) three quarters (3) seven-eighths (4) one/a quarter
- (5) three-fifths (6) forty-three over ninety-seven (7) a (one) half
- (8) six and six-tenths

Unit 5 Composite Materials

5.1 Reinforcements

5.1.3 Fabric Types and Constructions

Part I Lead-in

Task 1

(1) Unidirectional tape, which is one direction of reinforcement, is one of available forms of prepreg.

(2) Fabrics usually contain warp filaments and weft filaments.

(3) There are many dry fabric materials on the shelf, such as Kevlar, fibreglass, and carbon fibre.

Part II Reading

Task 2

1. (1) An individual fibre is called a filament.

(2) Tape products have high strength in the fibre direction.

(3) The direction that the fabric comes off the roll is called the warp or rollout direction.

2. CIABG DFJEH

3. thick, filaments, transverse, fibre, roving

4. BCCAB

5. (1) 胶带只有一个方向的纤维，没有填充纤维。

(2) 与经纱方向横向的方向称为填充方向。

(3) 波音公司只在飞机部件上丝束和纱线织物。

(4) 胶带产品在纤维方向上具有高强度，而在纤维间几乎没有强度。

(5) 碳纤维胶带是以每平方米克数来标识的，称为等级。

Tasks 3

1. 经向；平纹编织；缎纹编织；通丝；气孔

2. FTFTT

Part III Listening

Task 4

1. BEDAC

2. fill, several, basket, two or more, staggered

Part IV Translating Skills

Task 5

(1) fourteen point one five percent

(2) nine point zero seven percent

(3) five percent

(4) ten percent

(5) twenty-two point five eight percent

(6) zero point zero nine percent

(7) twenty-six percent

(8) six point eight six percent

Unit 5 Composite Materials

5.2 Resin Types

5.2.1 Introduction of Resin Matrix

Part I Lead-in

Task 1

(1) Polyesters are used for manufacturing boats, sporting goods, and other non-aerospace products.

(2) Boeing aircraft are used phenolic resin for interior components because of its' fire resistant.

(3) The melting point of ordinary plastic bags is about 90-260 degrees Celsius.

Part II Reading

Task 2

1. (1) Good mechanical properties, good adhesive properties, good toughness properties and good resistance to environmental degradation.

(2) Thermosetting resins undergo chemical reaction during the cure, but will not melt and has different stages. Thermoplastic resins, which will melt at high temperature, will not undergo chemical reaction during part production.

(3) Polyimides and bismalamides (BMI).

2. CHFDB IGJEA

3. component, aero-engine, toughness, fire barrier, interior

4. CCDA

5. (1) 由于其成本便宜、功能多样，聚酯系统在各个行业中得到了广泛应用，包括船舶制造、体育用品生产等各个领域。

(2) 热塑性树脂在部分生产过程中不会发生化学反应。

(3) 热塑性塑料通常比热固性树脂更耐冲击损伤。

(4) 聚酯是一种低成本的树脂体系。

(5) 与传统的复合材料制造方法相比，使用 RTL 的优点是能够加热 RTL 并将其压成形状。

Task 3

1. 机械性能；苯乙烯排放；固化收缩；耐化学性；热性能

2. FFTFF

Part III Listening

Task4

1. CBEAD

2. matrix, fabric, no longer, freezer, avoid

Part IV Translating Skills

Task 5

- (1) 我既不喝酒，也不吸烟。
- (2) 实验失败了。
- (3) 该仪器的特点是结构紧凑、携带方便。
- (4) 水在 4 摄氏度以下不断地膨胀，而不是不断地收缩。
- (5) 吃苹果，还是吃桔子，由你决定。
- (6) 直升机几乎可以自由地飞到任何地方去。
- (7) 冲压模的尺寸必须正确。
- (8) 听他一说，房间里的每个人都大吃一惊。
- (9) 我们发现解决这个问题是困难的。
- (10) 她马上下来。

Unit 5 Composite Materials

5.2 Resin Types

5.2.2 Epoxies

Part I Lead-in

Task 1

- (1) A freezer, with temperature monitoring equipment, is necessary for long term storage.
- (2) The chewing gum will be tacky and softened at high temperature.
- (3) Some resin systems have a dye added to aid in seeing how well the material is mixed.

Part II Reading

Task 2

1. (1) The epoxy strength is directly related to the amount of cross linking between molecules.

(2) The glass transition temperature depends on the resin and curing agent mixture

(3) The A stage: no cross links exist between epoxy molecules.

The B stage: In the B-stage, some cross linking is present.

The C stage: Fully cured resins are called “C-staged”.

2. CIHFG JEDBA

3. curing agent, vacuum, adhesive, mixture, overheat

4. BCDBA

5. (1) 可在树脂中加入环氧树脂稀释剂以降低其黏度，并加入长链环氧增韧剂以提高树脂固化后的韧性。

(2) 当固化剂与环氧树脂混合时，环氧分子之间会形成交联。

(3) 热固性塑料在高温下不会熔化，但会发生玻璃转化并变软。

(4) 去除水分能使玻璃化转变温度恢复到原值。这通常是通过真空加热使零件干燥来实现的。

(5) 环氧树脂是放热性的。这意味着它们在固化过程中会释放热量。

Task 3

1. 复合材料；温度监测；短期储存；保温容器；防潮袋

2. TFFFF

Part III Listening

Task 4

1. CBEAD

2. 0.10-inch, 350, stored, honeycomb, core

Part IV Translating Skills

Task 5

- (1) 这台设备的效率很高。
- (2) 钢含碳量越高，硬度和强度就越大。
- (3) 必须注意机器的维修。
- (4) 一个正常人每天至少需要两夸脱水。

Unit 5 Composite Materials

5.3 Core Materials

Part I Lead-in

Task 1

- (1) The two main structural elements in sandwich construction are core and face sheet.
- (2) Initial cutting of core thickness is usually done with a band saw.
- (3) This company supplies background paintings on hexagonal fibre canvas.

Part II Reading

Task 2

1. (1) The core supports the face sheets against buckling, and resists out of plane shear loads.

(2) Honeycomb core can be made from aluminum, titanium, steel and aramid paper(Nomex, Kevlar N636). Fibreglass is used for higher strength applications. Carbon fibre reinforced core is available, but is seldom used.

(3) X-acto knives, band saws and sanding disks.

2. CFDIA JBEHG

3. instead of, crush, viscous, Prior to, initial

4. DABCC

5. (1) 灌封剂可在室温下拼接芯段。

(2) 高密度芯比低密度芯更坚固、更坚硬。

(3) 发泡胶黏剂需要冷藏，以防止其固化超过 B 段。

(4) 芯层是夹层结构的两大主要结构要素之一，另一个元素是面板。

(5) 泡沫芯不具有蜂窝芯的比强度和刚度。

Task 3

1. 立方英尺；芯段；钉接；发泡胶；芯材拼接

2. TFFTF

Part III Listening

Task 4

1. DEBAC

2. comparison, directional, thickness, corrode, plies

Part IV Translating Skills

Task 5

(1) 这三个因素中一个都不应当忽视。

(2) 教室里空无一人。

(3) 并非每种疾病都用同样的方法治疗。

- (4) 我们学校几乎没有学生不会说英语。
- (5) 科学家们认为，计算机不可能在所有领域中都能代替人。
- (6) 并不是每个人都会喜欢它。
- (7) 巧妇难为无米之炊。
- (8) 在这些电路中没有发现任何缺陷。

Module 3 Selection of Aviation Materials

Unit 6 Airframe Materials

6.1 Aircraft Structure

Part I Lead-in

Task 1

(1) The longitudinal structural elements of the semimonocoque fuselage are beams and stringers.

(2) Various control surfaces are located on the wings including flaps, slats, spoilers, and the ailerons.

(3) Most aircraft wheels are mounted on shock-absorbing struts.

Part II Reading

Task 2

1. (1) The main difference between aerospace structures and materials and civil engineering structures and materials lies in their weight.

(2) The fuselage is the main structure or body of an airplane, which consists of cockpit, the passenger cabin and the cargo compartments. It provides space for cargo, controls, accessories, passengers, and other equipment.

(3) The empennage of aircraft is also known as the tail section, consists of tail cone, fixed surfaces and movable surfaces. The vertical stabilizer and horizontal stabilizer are the fixed surfaces. The movable surfaces are usually a rudder and elevators. The rudder is used for directional and yaw control, while the elevators are attached to the trailing edge of horizontal stabilizer and provide additional pitch control.

2. GJEIH FDABC

3. monocoque, undercarriage, empennage, aileron, Thermal

4. CBDAC

5. (1) 通常，具有高刚度、高强度和轻重量的材料最适合航空航天应用。

(2) 仅仅根据比强度和比刚度来选择材料是不够的。

(3) 出于性能原因，机身设计得尽可能小，但足够宽敞舒适。

(4) 将轮子和支柱放置在机翼或机身内的可伸缩起落架更可取，因为对气流的干扰较小。

(5) 大多数飞机机轮都安装在减震支柱上，减震支柱使用油垫或气垫来缓冲着陆时的冲击。

Task 3

1. 支柱；滚轮托盘；货运集装箱；抗剪腹板；机身蒙皮

2. FFTTF

Part III Listening

Task 4

1. CDBEA
2. speed, rudder, safety, to lighten, spoilers

Part IV Translating Skills

Task 5

- (1) 化学反应产生热和光。
- (2) 钢铁被用于各个行业。
- (3) 众所周知，金属，尤其是铁，是工程中的一种重要材料。
- (4) 能量被转化为热量。
- (5) 已经注意到采取防腐新措施。

Unit 6 Airframe Materials

6.2 Aircraft Materials

Part I Lead-in

Task 1

- (1) Cost includes initial material cost, manufacturing cost and maintenance cost.
- (2) The 2024 alloys have excellent fracture toughness and slow crack growth rate as well as good fatigue life.
- (3) The Boeing 787 aircraft use of more than 50% of the composite materials.

Part II Reading

Task 2

1. (1) There are two main kinds of materials used in aircraft structures: traditional metallic materials and advanced composites. Traditional metallic materials used in aircraft structures are aluminum, titanium and steel alloys.

(2) The 2024 alloys have excellent fracture toughness and slow crack growth rate as well as good fatigue life.

(3) Polymer matrix composites are usually for lower temperature (less than 300 °F) applications, and ceramic matrix composites are intended for applications in hot (higher than 1,500 °F) environments, such as jet engines.

2. JACBD EGIHF

3. prone, dominant, subjected, plate, performance

4. CCDDA

5. (1) 飞机结构中使用的传统金属材料是铝、钛和钢合金。

(2) 几十年来，铝合金一直在飞机结构中发挥着主导作用。

(3) 钛合金最早被用作飞机发动机合金，后来在飞机结构中得到了越来越广泛的应用。

(4) 虽然铝通常不适用于高于 350 华氏度的应用，但钛可以在高达 1000 华氏度的温度下连续使用。

(5) 纤维复合材料具有刚性、强度和轻质性，是最适合飞机结构的材料。

Task 3

1. 复合结构；夹层结构；实心层压板；襟副翼；后缘

2. FTTF

Part III Listening

Task 4

1. CEBAD

2. consists, wheel well, cockpit, cargo, CFRP

Part IV Translating Skills

Task 5

- | | | | |
|-----------|---------|---------|----------|
| (1) 新手 | (2) 轻金属 | (3) 强电流 | (4) 浅色 |
| (5) 拥挤的交通 | (6) 潮模砂 | (7) 粗导线 | (8) 高等法院 |

Unit 7 Aircraft Engine Materials

Part I Lead-in

Task 1

(1) The following diagram shows the internal construction of the compressor as well as the name of each component.

(2) The material of the combustion chamber must be resistant to high temperature.

(3) We can increase the engine thrust by raising the gas temperature.

Part II Reading

Task 2

1. (1) The fan and the compressor, which are so-called cold section, where the temperature is low to medium, titanium parts are often used.

(2) The outer casing experiences low temperatures, thus composites are suitable materials.

(3) The developmental tendencies in obtaining high performance of gas turbines are chiefly connected with an increase in the engine's capacity, its efficiency, lifetime, reliability and a decrease in the fuel consumption.

2. DHJAE BIGFC

3. withstand, diffusion, Erosion, Blade, compressor

4. CBCDC

5. (1) 飞机发动机零件暴露在工作机械载荷、高温以及腐蚀和侵蚀介质中。

(2) 发动机各部分的部件具有不同的结构要求。

(3) 陶瓷基复合材料 (CMCs) 具有优异的热性能和改进的力学性能。

(4) 金属基复合材料 (MMCs) 由具有氧化物、氮化物或碳化物增强的铝或钛基组成。

(5) 热障涂层 (TBCs) 由具有导热性的薄陶瓷层组成。

Task 3

1. 排除故障; 隔振; 风扇转子; 线路断流板; 信号调节器

2. FTFTT

Part III Listening

Task 4

1. DCEAB

2. power plant, gearbox, combustion, high bypass ratio, protection

Part IV Translating Skills

Task 5

(1) 这台机器的结构简单, 但工作效率很高。

(2) 这种新型退火炉是节油型退火炉。

(3) 经验表明, 应用铸型涂料对消除铸件上的鼠尾缺陷一般不起作用。

Module 4 Manufacturing Processes of Aviation Materials

Unit 8 Forming and Deforming Processes

Part I Lead-in

Task 1

(1) Die casting is a manufacturing process that can produce geometrically complex metal parts through the use of reusable molds, called dies.

(2) A drilling operation can produce a blind hole, which extends to some depth inside the work-piece.

(3) 3D printed parts are typically infiltrated with a sealant to improve strength and surface finish.

Part II Reading

Task 2

1. (1) The forming processes generates little or no waste materials, which is why they are also called chip-free operations.

(2) By different processes involved, pressure processing can be divided into forging, rolling, extrusion, drawing, and stamping and the like

(3) Welding is a quick and efficient way of joining two separate solid work pieces together by atomic bonding force. Depending on whether pressure is applied during the welding process, it can be divided into pressure welding and fusion welding.

2. JDFAE CIHGB

3. components, properties, deformation, Welding, extrusion

4. DDCBC

5. (1) 由成形材料成形时的状态及工艺特点又分为液态材料的流动成形、固态材料的塑性成形、材料的连接成形、粉末压制成形及一些橡胶、塑料的特殊成形等。

(2) 然而，铸件的缺点是机械性能一般不如变形组织。

(3) 得益于现代铸造工艺，波音 767-400ER 驾驶舱仪表板上的零件数量从 296 个减少到 53 个，生产时间从 180 小时减少到 20 小时。

(4) 焊接是使两个分离的固态物质借助于原子间结合力连接在一起的快速有效的方法。

(5) 根据焊接过程是否施加压力，可以把焊接分为压力焊接和熔化焊接。

Task 3

1. 车削加工；铣削加工；刨削加工；磨削加工；钻削加工

2. FTTF

Part III Listening

Task 4

1. EBDCA
2. mechanical, change, improving, chemical, wear resistance

Part IV Translating Skills

Task 5

- (1) 论文中提出了关于这一课题的新数据。
- (2) 这是这里唯一能找到的有关该题目的参考书。
- (3) 尽管他有缺点，却是一个负责的人。
- (4) 他想找一个可靠的人帮忙做这项工作。
- (5) 据我所知，英语里并没有这样的词。

Unit 9 Manufacturing Processes of Composites

Part I Lead-in

Task 1

(1) Resin Transfer Molding, which is one of the best methods for the mass production of composite parts, continues to be an increasingly popular method of fabrication.

(2) Compression Molding is a traditional technique which is used to mold thermoset resin into the desired shape.

(3) The Vacuum Infusion Process (VIP) is a technique that uses vacuum pressure to drive resin into a laminate. This process greatly improves the fibre-to-resin ratio, and results in a stronger and lighter product.

Part II Reading

Task 2

1. (1) Room temperature cures, oven cures, and autoclave cures.

(2) Six stages:

Heating stage of composites autoclave;

Adhesive stage of composites autoclave;

Continuous heating stage of composites autoclave;

Thermal insulation and pressure stage;

Cooling Stage;

Processing stage.

(3) Gradually solidify the resin into a gel state.

2. BHDAL CGJFE

3. Autoclave, flexibility, releases, cure, Transfer

4. CDACC

5. (1) 选择合理的加热速率是第一步。

(2) 本阶段的成型压力为总压力的 $1/3 \sim 1/2$ ，排出部分树脂，保证零件最终树脂含量符合设计要求。

(3) 热固性树脂的固化反应为放热反应。

(4) 目的是使树脂在不断固化过程中各层之间充分压实。

(5) 如果冷却时间过长，会使生产周期变长，不利于产品质量。

Task 3

1. 修理织物；非金属蜂窝芯；电热毯固化；热压罐固化；胶膜

2. FFTFT

Part III Listening

Task 4

1. CDABE

2. pressure, mold, conform, rates, degradation

Part IV Translating Skills

Task 5

- (1) 如图所示，在过去的五年中，这个国家的人口迅速增长。
- (2) 从表中所给的统计数字可以看出，1985—1990年，中国人民的平均个人收入增长迅速。
- (3) 从图表中可以得出结论，在过去的五年中，中国的出生率有了很大的下降。

Module 5 Maintenance of Aviation Materials

Unit 10 Damage Classification

Part I Lead-in

Task 1

- (1) There is damage to radome honeycomb sandwich structure.
- (2) The following picture show the erosion damage to wingtip.
- (3) This picture shows corrosion of aluminum lightning protection mesh on an aircraft.

Part II Reading

Task 2

1. (1) In this structural repair manual, the term “damage” is defined as a cross-sectional area change or a permanent distortion of a structural member.

(2) “Allowable Damage” is defined as damage that is permitted with no other flight restrictions.

(3) “Replacement of Damaged Parts” is defined as damage where the part must be replaced.

2. ECHJA IFDBG

3. damage, external, permanent, abrasion, corrosion

4. BDBCA

5.(1)在结构维修手册中,术语“损坏”被定义为结构构件的横截面积变化或永久变形。

(2)你必须确定结构杆件或结构材料发生的损坏类型。

(3)材料的部分断裂或完全断裂,导致横截面积发生显著变化。

(4)当两层或多层黏合材料分离时,就会发生剥离。

(5)“损坏零件的更换”是指该损坏必须更换零件。

Task 3

1. 热损伤;轴套;保护膜;液压油;绿色底漆

2. FFTFT

Part III Listening

Task 4

1. CEABD

2. defects, structural, Detecting, equipment, prompt

Part IV Translating Skills

Task 5

(1)经过一系列实验后,查明了一些重要现象。

(2)应注意保证脉冲信号本身不出现不规则现象和中断现象。

- (3) 第一批电子计算机于 1945 年投入使用。
- (4) 虽然有各种困难，但我们的任务已顺利完成。
- (5) 如果使用变压器，低压电就能转换成高压电。

Unit 11 Types of Inspections

Part I Lead-in

Task 1

(1) Tap testing is the most common technique used for the detection of delamination and/or disbond.

(2) Ultrasonic inspection is a very useful tool for detecting delamination, voids and other damage inside the composite.

(3) Pulse echo inspections are used to find delaminations, cracks, porosity, water, and disbonds of bonded components.

Part II Reading

Task 2

1. (1) Three. General Visual Inspection (GVI), Detailed Inspection (DET) and Special Detailed (Non-Destructive Testing) Inspection (SDI).

(2) Non-Destructive Testing (NDT) inspections are used to examine all subsurface damage and most small cracks. NDT is also used in areas where a visual inspection is not sufficient to find the dimensions of damage.

(3) Eddy Current, ultrasonic, resonance frequency, X-Ray, magnetic particle and penetrant.

2. CGFHI DJEBA

3. inspected, visual, interior, install, detected

4. DCBBA

5. (1) 这种级别的检查是在正常可用的照明条件下进行的，如日光、机库照明、手电筒或吊灯，可能需要拆除或打开检修面板或门。

(2) 可能需要复杂的清洁和大量的进入或拆卸程序。

(3) 无损检测 (NDT) 检查用于检查所有表面损伤和大多数小裂纹。

(4) 无损检测也用于目视检查不足以发现损伤尺寸的区域。

(5) 渗透检测利用液体的特性进入零件表面开口的缺陷。

Task 3

1. 耗材；起落架轴；溶剂的蒸汽；遮蔽胶带；砂纸

2. FTFTF

Part III Listening

Task 4

1. DBECA

2. visible, examined, tools, internal, techniques

Part IV Translating Skills

Task 5

(1) 太阳的体积约为地球的一百三十万倍。

- (2) 大多数物质热胀冷缩。
- (3) 直接电弧炉特别适用于生产高合金铸铁。
- (4) 将金属从矿石中分离出来的过程叫冶炼。
- (5) 这条长焊缝中似乎没有什么杂质。

Unit 12 Common Repair Procedures

Part I Lead-in

Task 1

(1) Prepreg and dry fabrics can be cut with hand tools, such as scissors, pizza cutters, and knives.

(2) The figure below describes the process of repair layup.

(3) Autoclave is a special pressure vessel that can withstand and control the temperature and pressure range.

Part II Reading

Task 2

1. (1) If you do, tiny dissimilar metal particles will become imbedded in the surface of the metal. This can cause corrosion and more damage to the part.

(2) Because damage that is not completely removed can reduce the fatigue strength of the part, which can result in cracking. In extreme cases, undetected fatigue cracking could compromise structural integrity.

(3) Clean up the damage by sanding manually or with power tools.

2. EGHAI BJCDF

3. removed, abrading, fumes, aluminum, primer

4. DACCBA

5. (1) 不要在铝金属表面使用碳钢刷或钢丝球。

(2) 打磨或使用化学药品将受损区域的油漆全部清除。

(3) 未完全清除的损伤会降低零件的疲劳强度。

(4) 不要让溶剂进入口腔、眼睛里或皮肤上。不要吸入溶剂产生的烟雾。

(5) 如有必要，可在该区域涂上装饰漆。

Task 3

1. 裂纹漆；永久修理；静态平衡；脱漆剂；干净的粗棉布

2. TFFFT

Part III Listening

Task 4

1. BDEAC

2. hand tools, difficult, wet layup, power, short circuit

Part IV Translating Skills

Task 5

(1) 迈克直挺挺地躺在沙发上，我一进去，他就站起来，热情地向我打招呼。

(2) 第二天早上七点钟，他们就把你叫醒了，让你穿上室内服在床上吃早饭，好让纽约各家报纸拍你坐在床上的样子，而此时你正睡眼惺忪。

(3) 为了更好地理解物理学并为以后的学习打下牢固的基础，遇到物理学符号、公式、定义和定律时，不管它们多么复杂，你都必须牢记。

(4) 欧洲有些国家，天气奇糟无比，人们要费心尽力才能找到风景如画的地方。但奇怪的是，恰恰是他们普遍最喜欢乡村生活，也最热爱自然风光，这让我百思不得其解。