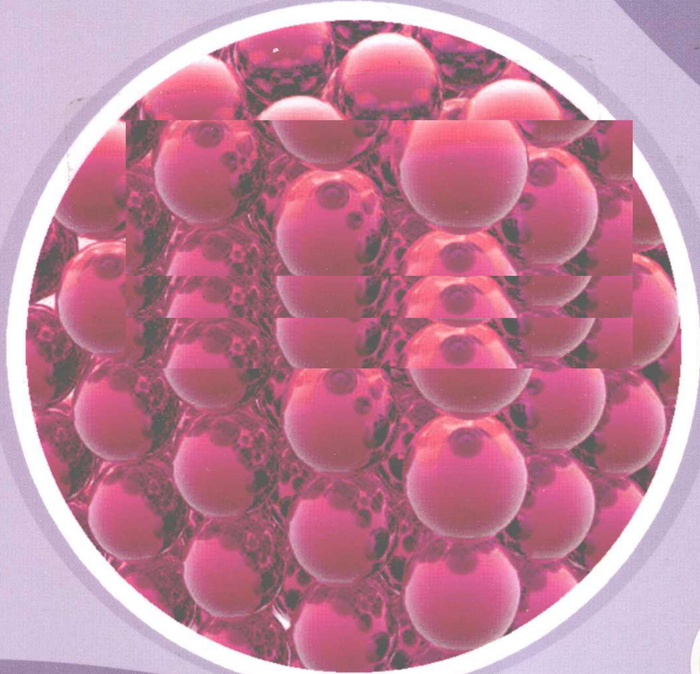
高等院校材料类专业教材

材料专业英语

CAILIAO ZHUANYE YINGYU

范积伟 主编



机械工业出版社
CHINA MACHINE PRESS

高等院校材料类专业教材

材料专业英语

主　编　范积伟
副主编　席艳君　王艳芝
参　编　张小立　赵慧君　曲良俊

机械工业出版社

本书课文和阅读材料全部选自近年来英、美等国材料科学专业教材和专业刊物，共55篇，涵盖了金属材料、陶瓷材料、高分子材料、复合材料、生物医学材料、纳米材料和工程应用等内容。所选文章题材多样，内容新颖，学科前沿知识丰富，融知识性和趣味性于一体。为了提高读者的科技英语翻译和写作水平，每一章都附有有关科技英语翻译及写作技巧的内容。读者可在掌握材料专业英语和翻译及写作技巧的同时进一步学习材料专业的有关知识。

本书可作为普通高等院校材料科学与工程类专业本科生、研究生的专业英语教材，也可供材料科学研究人员、工程技术人员学习和参考。

图书在版编目（CIP）数据

材料专业英语/范积伟主编. —北京：机械工业出版社，2010.4
高等院校材料类专业教材
ISBN 978-7-111-30261-2

Ⅰ.①材… Ⅱ.①范… Ⅲ.①材料科学—英语—高等学校—教材 Ⅳ.①H31

中国版本图书馆CIP数据核字（2010）第055190号

机械工业出版社（北京市百万庄大街22号 邮政编码 100037）
策划编辑：邝 鸥 何月秋 责任编辑：刘本明
版式设计：霍永明 责任校对：李 娜
封面设计：马精明 责任印制：乔 宇
北京瑞德印刷有限公司印刷（三河市胜利装订厂装订）
2010年5月第1版第1次印刷
184mm×260mm·15.75印张·387千字
0001—3000册
标准书号：ISBN 978-7-111-30261-2
定价：35.00元

凡购本书，如有缺页、倒页、脱页，由本社发行部调换

电话服务
社服务中心：(010)88361066
销 售 一 部：(010)68326294
销 售 二 部：(010)88379649
读者服务部：(010)68993821

网络服务
门户网：http://www.cmpbook.com
教材网：http://www.cmpedu.com
封面无防伪标均为盗版

前　　言

材料是人类物质文明的基础，新材料是社会不断发展进步的一大支柱，新材料的研究开发极大地促进了工业发展和社会进步。英语作为一种重要的全球化的交流工具，发挥着重要的作用。学好英语，尤其是专业英语，是学生、学者和工程技术人员获取科研信息、掌握学科发展动态、参加国际学术交流的基本前提。材料学科涉及广泛的研究领域，具有很强的学科交叉性，日新月异的新材料发展使得材料学科的专业英语学习尤为重要。为此，我们编写了本书，希望能对从事材料科学与工程的工程技术人员、研究生、本科生的专业英语水平的提高有所帮助。

本书分为 8 章，每一章含 3 ~ 4 节，分别对应于材料科学的不同领域。前 7 章中，每一节均由一篇课文和一篇阅读材料组成。阅读材料提供了与课文对应的背景知识或者是课文的续篇，从而进一步拓展了课文的内容。全书共 29 节，课文及阅读材料共计 55 篇，涵盖了金属材料、陶瓷材料、高分子材料、复合材料、生物医学材料、纳米材料和工程应用等内容，涉及面广，学科全面。本书附录 A 为化学元素的中英文对照表。附录 B 为新版元素周期表。另外，英美科技文章中经常出现的非公制单位往往使读者感到困惑，为此，附录 C 给出了英美度量衡系统与公制系统之间的关系。附录 D 列出了本书的主要词汇。

本书具有以下几个特点：

1. 知识面广，趣味性强。涉及材料科学相关专业的各类知识，论述的概念清楚、准确、简练。

2. 内容丰富、新颖。55 篇文章全部选自近年来出版的原版英文教科书、科技报告、专业期刊和著作，内容新颖，学科前沿知识丰富，特别突出在纳米技术和生物医学材料方面的进展。

3. 词汇量大，词汇表实用。本书既可作为材料专业的英语教科书，又可用于自学。为了提高读者的科技英语翻译和写作水平，每一章都附有有关科技英语翻译及写作技巧的内容。

本书由范积伟担任主编，席艳君、王艳芝担任副主编。第 1、6、8 章由范积伟编写，第 2 章及科技翻译和写作技巧部分由席艳君编写，第 3 章由赵慧君编写，第 4 章由曲良俊编写，第 5 章由王艳芝编写，第 7 章由张小立编写，全书由范积伟统稿。本书在编写过程中，得到了中原工学院教务处、材料与化工学院领导及同仁的支持和帮助，在此表示衷心的感谢。

编　者

Contents

Chapter 1 Introduction to Materials Science and Engineering

1.1 What Is a Material?

From a practical **standpoint**, we know that all material objects are essential for a human being to build things. This definition includes solids, but also liquid (e. g., liquid crystals that create LCD displays), and even gases for more specific situations①. Really, every raw material used by industry could be included in this classification, but we use the word "material" in a restricted sense: We think about materials whose properties might not be an exact image of those that their elements possess. Thus, we especially concern ourselves with how elements are structured in macroscopic bodies, with how treatments are used during the elaboration of materials, or with the physicochemical aggregation of different elements—all activities that condition the properties of the materials we generate.

The selection, modification, and elaboration of materials to satisfy our needs merge in the foundations of human culture②. From the very beginnings of prehistory, humans have manipulated substances so that they would be more useful. To create more useful materials, our **forebears** wanted to understand and control the composition of materials, and they often succeeded in modifying a material's behavior and properties and in predicting the effects of such manipulations.

This task developed over time, beginning as a **handcraft** that employed empirical and speculative knowledge. The history of materials science and engineering had already begun in the Stone Age when stones, wood, clay, and leather began to be **manipulated**. In the Bronze Age, mankind discovered the value of temperature and used it to modify materials by thermal treatments or by adding other substances. Yet, in spite of technological improvements, materials science remained empirical until the end of the nineteen century. Materials science, as we now understand it, began with the appearance of **Mendeléev's** periodic table. Since that time, some properties of elements that are related to their position in the periodic table began to be explained scientifically③, and these results became incorporated in the annals of science. Since the end of the nineteen century, the introduction of chemistry and physics, calculus, and modern experimentation have brought the use and profits of materials to a mature status. Currently, thanks to more reliable knowledge of the structure of matter, we can design new materials atom by atom, to achieve the properties we want. At last we have materials that not only satisfy our requirements, but also permit us to create new ones that were **hitherto** unthinkable.

Thanks to this science, we can even **speculate** about using new, alternative materials to solve **socioeconomic** problems by avoiding the decimation of natural resources or trying to reach long ranges **sustained** economic development. Conversely, the solution of unsolved problems improves our theoretical knowledge as well as the scope of materials in science and engineering.

Materials scientists must analyze how the structure and composition of materials related to their properties, and the effect of the method of preparation of a material. Materials engineers examine the preparation, selection, and application of materials **in agreement with** known and desired properties. Engineers also incorporated technical and structural analysis and examine key concerns: **energetic**, economic, **ecological**, aging.

For materials science and engineering, changes in physicochemical properties in response to a **stimulus** are highly significant. These properties can be classified into groups according to the kind of stimulus: mechanical, thermal, electromagnetic (throughout the spectrum), chemical, and scattering. In brief, mechanical properties, such as deformation and fracture, among others, are responses to applied mechanical forces. Thermal properties, like thermal conductivity and heat capacity, are affected by heat fluxes or temperature changes. Electrical properties such as the dielectric constant or conductivity occur in response to electromagnetic fields. In a similar sense, optical properties, such as the **refractive index** or absorption, among others, respond to electromagnetic fields having high frequency. Chemical properties, like the chemical **affinity**, are responses to the existence of **reagents** in the environment, and the scattering properties are responses to the impact of particles depending on the material's structure.

(Selected from *An Introduction* to *Materials Science*,
by W. Gonzólez-Viñas, and H. L. Mancini, 2005)

Questions

1. What is a material? Please describe it by using your own words.
2. In history, at which stage had the materials science and engineering begun?
3. What do materials scientists need to analyze?
4. Please describe some properties of materials.
5. In general, what is the materials engineers' job?

New Words and Expressions

1. standpoint *n.* 立场，观点
2. forebear *n.* 祖先，祖宗
3. handcraft *n.* 手工，手艺
4. manipulate *v.* 操作，使用，利用
5. Mendeléev 门捷列夫（1834—1907），发现化学元素周期律的俄国科学家

6. hitherto *adv.* 迄今，至今
7. speculate *v.* 推测，思索
8. socioeconomic *adj.* 社会经济学的；*n.* 社会经济学
9. sustained *adj.* 持续不变的，相同的
10. in agreement with 符合……，和……一致
11. energetic *adj.* 积极的，精力充沛的
12. ecological *adj.* 生态学的，社会生态学的
13. stimulus *n.* 刺激，促进因素，刺激物
14. refractive index 折射率
15. affinity *n.* 亲合力，密切关系，相似（性）
16. reagent *n.* 试剂，反应力，反应物

Notes

① This definition includes solids, but also liquid (e. g., liquid crystals that create LCD displays), and even gases for more specific situations.

参考译文：这个定义包括固体也包括液体（例如液晶显示屏），在特定情况下甚至包括气体。

② The selection, modification, and elaboration of materials to satisfy our needs merge in the foundations of human culture.

参考译文：选择、改性和加工材料以满足我们的需求是人类文明的基础。

句中 the selection, modification, and elaboration of materials to satisfy our needs 构成主语。

③ Since that time, some properties of elements that are related to their position in the periodic table began to be explained scientifically,...

参考译文：从那时开始，元素的一些性质是与它们在元素周期表中的位置有关才得以有科学的解释，……

Reading Material

Materials and Materials Science

Materials have accompanied mankind **virtually** from the very beginning of its existence. Among the first materials utilized by man were certainly stone and wood, but bone, fibers, feathers, shells, animal skin, and clay also served specific purposes.

Materials were **predominantly** used for tools, weapons, **utensils**, shelter, and for self-expression, that is, for creating **decorations** or jewelry[①]. The increased usage and development of ever more **sophisticated** materials were paralleled by a rise of the **consciousness** of mankind. In other words, it seems to be that advanced civilizations generally invented and used more **elaborate** materials. This observation is probably still true in present days.

Materials have been considered of such importance that historians and other scholars have named certain ancient periods after the material which was predominantly utilized at that respective time[②]. Examples are the Stone Age, the Copper-Stone Age (**Chalocolithic** Period), the Bronze Age, and the Iron Age. The Stone Age, which is defined to have begun about 2.5 million years ago, is divided into the **Paleolithic** (Old Stone Age), the **Mesolithic** (Middle Stone Age), and the **Neolithic** (New Stone Age) phases. We will consider on the following pages mostly the Neolithic and Chalocolithic periods. Surprisingly, these classifications do not include a Ceramic Age, even though pottery played an important role during extended time periods.

The names of some metals have entered certain linguistic usages. For example, the **Greeks** distinguished the Golden Age (during which supposedly peace and happiness **prevailed**) from the Silver Age. Rather than being descriptive of the materials that were used, these distinctions had more **metaphorical** meanings. Specifically, gold has always been held in high **esteem** in the eyes of mankind. Medals for outstanding performances (sport events, etc.) are **conferred** in gold, silver, or bronze. Specific wedding anniversaries are classified using gold, silver, and iron.

Until very recently, the **mastery** of materials has been achieved mainly by **empirical** means or, at its best, by a form of **alchemy.** Only in the nineteenth and twentieth centuries did systematic research lead to an interdisciplinary field of study that was eventually named materials science.

(Edited from *Understanding Materials Science: History, Properties, Applications*, by R. E. Hummel, 2004)

Questions

1. What are the first materials that were utilized by ancient people?
2. How can we subdivide Stone Age?
3. Could you name some ancient periods?

New Words and Expressions

1. virtually *adv.* 事实上，实质上
2. predominant *adj.* 支配的，主要的，突出的
3. utensils *n.* 器具
4. decoration *n.* 装饰，装饰品
5. sophisticated *adj.* 高级的，完善的，久经世故的
6. consciousness *n.* 意识，知觉，觉悟
7. elaborate *adj.* 精心制作的，详细阐述的；*n.* 精心制作，详细描述
8. Chalocolithic *adj.* 铜石并用时代的
9. Paleolithic *adj.* 旧石器时代的
10. Mesolithic *adj.* 中石器时代的
11. Neolithic *adj.* 新石器时代的
12. Greek *n.* 希腊人，希腊语；*adj.* 希腊的，希腊语的
13. prevaile *v.* 流行，盛行，获胜，成功
14. metaphorical *adj.* 比喻性的

15. esteem *v.* 把……看作，尊重，认为；*n.* 尊敬，尊重
16. confer *v.* 授予，赠与，协商，交换意见
17. mastery *n.* 掌握
18. empirical *adj.* 实验的，经验的，经验主义的
19. alchemy *n.* 炼金术，魔力

Notes

① . . . , and for self-expression, that is, for creating decorations or jewelry.

参考译文：……并且为自我表现所用，即创造装饰品或珠宝。

句中 that is 是"即""就是"的意思。

② Materials have been considered of such important that historians and other scholars have named certain ancient periods after the material which was predominantly utilized at that respective time.

参考译文：材料被认为是如此重要，以至于历史学家和其他学者用在那个时期最主要使用的材料来命名该历史时期。

句中 such. . . that 意为"如此……以至于……"。

1.2 Classification of Materials

The phase of a material-which defines its **macroscopic** presentation-characterizes the material's properties and depends on external variables like temperature and pressure①. This phase can be modified when external parameters are changed. If we want to **assert** that a sample is of a certain type, we have to specify, **apart from** the material, the interval of environmental conditions in which its phase is stable. For example, we cannot say that aluminum is a conducting material without specifying the temperature at which it acts like a conductor; this is because at temperatures lower than 1.19K aluminum reveals a superconducting phase with quite a different **phenomenology** from the conducting one. Often this is not enough. **Metastable** states appear because of a material's **degradation**, hence allowing a sample of a material that is stable under certain conditions to **coexist** with another sample in another phase under the same conditions. As an example, carbon in normal conditions can naturally coexist in allotropic forms like diamond and graphite. It is not sufficient to indicate the environmental conditions; data about the sample's history are also required. In this example the pressures and temperatures applied to the carbon atoms and their duration are required for unambiguous determination of the phase of a sample. Without analyzing such problems, we list below some possible classifications.

The most general materials classification consists of dividing them into simple materials and **composites**. Composites are formed of more than one different type of material. After this simple classification, it is common to classify materials according to their different properties; hence, for example, as follows.

- Components:

— Simple elements; **monoatomic** and **polyatomic**.

— Compounds: **diatomic**, **polyatomic**, macromolecular (organic and inorganic).

— Mixtures. These correspond to composites and can be of different chemical compounds or of different phases of the same compound[②]. Blends can be either homogeneous or heterogeneous. The division of mixtures is made with reference to the following scales: atomic, microscopic, **mesoscopic**, macroscopic (various). For example, it is not enough to assert that a granite sample is **heterogeneous**; it is has to be stated that it is heterogeneous at the 1mm scale, which is homogeneous at 1km scale.

- Type of bond:

— Ionic (insulators, ceramics, metal-**monometal**). Bond energy 3-8eV/atom.

— Ionic-covalent.

— Covalent (polymers, ceramics, and so on).

— Metallic (metallic materials). Bond energy from 0.7 (Hg) to 8.8eV/atom (W).

— Van de Waals: fluctuating induced **dipole** (H_2, Cl_2, and so on) with bond energy of 0.1eV/atom, induced dipole-polar molecule (e.g., HCl) with bond energy of 0.1eV/atom, permanent dipole or hydrogen bond (e.g., H_2O, NH_3) with bond energy of 0.5eV/atom.

— **Pseudo bond** or physical bond (sticky materials).

- Electrical properties:

— Metallic or conducting, including principally metals and metallic alloys. In conductors the electrical resistance R is low but increases as the temperature rises.

— Semimetallic. In these, the electrical resistance R is appreciable, but there are 10^{-4} fewer electrons than in the metallic materials. Again, the resistance R grows as the temperature increases.

— Semiconducting. They have an appreciable electrical resistance R that diminishes if the temperature rises.

— Insulating or dielectrics. They have a high electrical resistance R.

— Superconducting. Their electrical resistance is $R \approx 0$.

- Arrangement of components:

— **Monocrystalline.**

— **Polycrystalline.**

— Glassy materials, which present short-range order.

— **Quasicrystalline.**

— **Semicrystalline.**

— **Partial** order. For example, the materials may have positional order (the mass centers of the components, have an ordered disposition) but not orientational order (the components, necessarily anisotropic here, do not have an ordered orientation).

— **Amorphous.**

— Composite (see the classification according to the components).

Because of the existence of many such nonequivalent classifications and of intermediate materials, the classifications above are of limited value[3]. We assume, usually, the following classification, but for our convenience and for **didactic** reasons sometimes we will use either one or another of the preceding classifications.

(Selected from *An Introduction to Materials Science*, by W. González-Viñas, and H. L. Mancini, 2005)

Questions

1. What is a compound?
2. What are the electrical properties of materials?
3. How many different bonding types are there?
4. What is the resistivity of an insulator?

New Words and Expressions

1. macroscopic *adj.* 宏观的，肉眼可见的
2. assert *v.* 断言，声称
3. apart from 远离，除……之外
4. phenomenology *n.* 现象学
5. metastable *adj.* 亚稳态的
6. degradation *n.* 退化，降级
7. coexist *v.* 共存
8. composite *n.* 复合材料，合成物；*adj.* 合成的，复合的
9. monoatomic *adj.* 单原子的
10. polyatomic *adj.* 多原子的
11. diatomic *adj.* 二原子的，二价的
12. mesoscopic *adj.* 介观的，准微观的
13. heterogeneous *adj.* 异质的，不同种类的
14. monometal *n.* 单金属
15. dipole *n.* 偶极子
16. pseudo bond 假键
17. monocrystalline *n.* 单晶，单晶质
18. polycrystalline *adj.* 多晶的；*n.* 多晶体
19. quasicrystalline *adj.* 准结晶的；*n.* 准结晶体
20. semicrystalline *adj.* 半晶质的；*n.* 半结晶体
21. partial *adj.* 部分的，局部的，偏爱的
22. amorphous *adj.* 无定形的，非晶（形）的
23. didactic *adj.* 说教的，教诲的

Notes

① The phase of a material-which defines its macroscopic presentation-characterizes the material's properties and depends on external variables like temperature and pressure.

参考译文：材料的相结构决定了该材料的宏观表现，表征了它的性能，同时也取决于像温度和压力这样的外部变量。

② These correspond to composites and can be of different chemical compounds or of different phases of the same compound.

参考译文：这对应于复合材料，可以是不同的化合物或同一化合物的不同相。

③ Because of the existence of many such nonequivalent classifications and of intermediate materials, the classifications above are of limited value.

参考译文：因为存在许多这样的不等分类和存在于分类之间的材料，上述分类只有有限的价值。

Reading Material

Electronic Materials Age

Stone Age-Bronze Age-Iron Age-what's next? Some individuals have called the present era the space age or atomic age. However, space exploration and nuclear reactors, to mention only two major examples, have only little impact on our everyday life. Instead, electrical and electronic devices (such as radio, television, telephone, **refrigerator**, computers, electric light, CD players, electromotors, etc.) **permeate** our daily life to a large extent. Life without electronics would be nearly unthinkable in many parts of the world. The present era could, therefore, be called the age of electricity. However, electricity needs a medium in which to **manifest** itself and to be placed in service①. For this reason, and because previous eras have been names after the material that had the largest impact on the lives of mankind, the present time may best be characterized by the name **Electronic Materials Age.**

We are almost constantly in contact with electronic materials, such as conductors, insulators, semiconductors, (ferro) magnetic materials, optically **transparent** matter, and **opaque** substances. The useful properties of these materials are governed and are characterized by electrons. In fact, the terms electronic materials and electronic properties should be understood in the widest possible sense, meaning to include all phenomena in which electrons participate in an active (dynamic) role. This is certainly the case for electrical, magnetic, optical, and even many thermal phenomena. In contrast to this, mechanical properties can be mainly interpreted by taking the interactions of atoms into account②.

We have already known that electrons can be considered to part of an atom which, in an elementary description, orbit the atomic core. Some of these electrons, particularly those in the outermost **orbit** (i. e., the valence electrons), are often only loosely bound to their **nuclei**. Therefore, they disassociate with relative ease from their core and then combine to form "sea" of electrons.

These free electrons govern many of the electronic properties of materials, particularly in conductors. In other cases, such as in insulators, the electrons are bound somewhat stronger to their nuclei, and thus, under the influence of an alternating external electromagnetic force, may oscillate about their core. This constitutes and electric dipole can be discussed in the electronic properties of dielectric materials.

Now, to our knowledge, nobody has so far seen an electron, even by using the most sophisticated equipment. We experience merely the actions of electrons, for example, on a television screen or in an electron microscope. In each of these instances, the electrons seem to manifest themselves in quite a different way, that is, in the first case as a particle and in the latter case as an electron wave. Accordingly, we shall use the term "wave" and "particle" as convenient means to describe the different aspects of the properties of electrons. This is called the "**duality**" of the manifestations of electrons. A more complete description of the wave-particle duality of electrons and a **quantum**-mechanical treatment of electron wave can be found, for example, in the book, Electronic Properties of Materials.

At the end, we may **ponder** the question of when the electron, as we know and understand today, was actually discovered. The particle nature of electrons was suggested in 1897 by the British physicist J. J. Thomson who experimented with "cathode rays" at Cavendish Laboratory of Cambridge University. These **cathode rays** were known to consist of an invisible radiation that emanated from a negative electrode (called a cathode) which was sealed through the walls of an **evacuated** glass tube that also contained at the opposite wall a second, positively charged electrode. It was likewise known at the end of nineteenth century that cathode rays travelled in straight lines and produced a glow when they struck glass or some other materials. J. J. Thomson noticed that the path of these rays could be deflected by magnetic or electric fields, and that cathode rays traveled slower than light and transported negative electricity. In order to settle the **lingering** question of whether cathode rays were "vibrations of the ether" or instead "streams of particles," he **promulgated** a bold **hypothesis**, suggesting that cathode rays were "charged corpuscles which are miniscule constituents of the atoms." This proposition—that an atom should consist of more than on particle—was startling for most people at the time. Indeed, atoms were considered since **antiquity** to be indivisible, that is, the most fundamental building blocks of matter. The charge of these "corpuscles" was found to be the same as that carried by hydrogen ions during **electrolysis** (about 10^{-19}C). Further, the mass of these **corpuscles** turned out to be 1/2,000th the mass of the hydrogen atom.

A second hypothesis brought forward by J. J. Thomson, suggesting that the "corpuscles of cathode rays are the only constituents of atoms," was eventually proven to be incorrect. Specifically, E. Rutherford, one of Thomson's former students, by using a different kind of particle beam, concluded that the atom resembled a tiny solar system in which a few electrons orbited around a "massive" positively charged centre. Today, one knows that the electron is lightest stable elementary particle of matter and that it carries the basic charge of electricity.

In 1924, de Broglie, who believed in a unified creation of universe, introduced the idea that electrons should also possess wave properties③. In other words, he suggested, based on the hypothesis of a general reciprocity of physical laws, that electrons, similarly as light, should display a wave-particle duality. In 1926, Schrodiger cast this idea in a mathematical form. Eventually, in 1927, Davisson and Germer and independently in 1928, G. P. Thomson (the son of J. J. Thomson), discovered electron diffraction by a crystal which experimentally proved the wave nature of electrons.

(Edited from *Understanding Materials Science: History, Properties, Applications*, by R. E. Hummel, 2004)

Questions

1. What age can we call the present era?
2. What are the electronic materials?
3. List some electrical and electronic devices in your home.
4. Why electrons are so important in electronic materials?
5. So far, could we see any electron?

New Words and Expressions

1. refrigerator *n.* 电冰箱，制冷器，冷藏库
2. permeate *v.* 充满，渗透，透过，弥漫
3. manifest *v.* 出现，表明，证明；*adj.* 显然的，明白的；*n.* 旅客名单，载货单
4. transparent *adj.* 透明的，显然的，明晰的
5. opaque *adj.* 不透明的，不传导的
6. orbit *n.* 轨道，势力范围；*v.* 绕……轨道而行，沿轨道飞行，进入轨道
7. nuclei nucleus 的复数形式
8. duality *n.* 二元性，对偶性
9. quantum *n.* 量子，量子论，量
10. ponder *v.* 沉思，考虑
11. cathode ray 阴极射线
12. evacuate *v.* 疏散，撤出，排泄
13. linger *v.* 拖延，逗留，游移
14. promulgate *v.* 发布，公布，传播
15. hypothesis *n.* 假设
16. antiquity *n.* 古代，古物
17. electrolysis *v.* 电解，电蚀
18. corpuscle *n.* 微粒，粒子，血球

Notes

① However, electricity needs a medium in which to manifest itself and to be placed in service.
参考译文：然而，电需要一种方式来证明它本身的存在而且在被使用。

② In contrast to this, mechanical properties can be mainly interpreted by taking the interactions of atoms into account.

参考译文：与此相反，力学性质可以被认为主要是原子间的相互作用。

③ In 1924, de Broglie, who believed in a unified creation of universe, introduced the idea that electrons should also possess wave properties.

参考译文：1924 年坚信宇宙统一论的德布洛伊提出了电子应该也具有波动性这一观点。

1.3 Fundamental Properties of Different Kind of Materials

Although the properties of the materials in each category can sometimes vary, properties broadly accepted as defining the categories are the following①:

- Metallic materials:
  — They are build up of metallic elements or of compounds of metallic elements.
  — They have many unlocalized electrons in the so called condition band.
  — They are good thermal and electrical conductors. They are opaque to visible light.
  — They are usually strong and plastic.
- Ceramic materials:
  — They are chemical compounds of the type metal + nonmetal②.
  — They are generally good electrical and thermal insulators.
  — They are stronger than metallic and polymeric materials at high temperatures and in chemically **aggressive** environments.
  — They are hard and brittle.
- Polymeric materials:
  — They are compounds, generally organic, in the form of long chains.
  — They have low density.
  — They are flexible or elastic or both.
- Semiconductor materials:
  — They have properties intermediate between conductors and insulators.
  — They have properties that are extremely sensitive to impurities and to temperature.
- Composites:
  — They are composed of more than one type of material.
  — They are designed to obtain better properties or combinations of properties. For example, glass fiber is as resistant as glass filament and as flexible as the polymer that forms it. Another example is adobe. Adobe, a mixture of clay and straw (up to 30%), has been employed in making bricks and in making bricks and in primitive buildings. Composites also serve as new materials in the aerospace industry. Together, these are two technological ends of composites③.
  — They are designed by taking into account typical targets of materials engineering. As an example, the aims of the aerospace industry are first to reduce operating costs (i. e., to