Unit 1 Materials Science and Engineering

Transportation,housing,clothing,communication,recreation and food production-virtually every segment of our everyday lives is influenced *to one degree or another* by material. Historically, the development and advancement of societies have been intimately tied to the members' abilities to produce and manipulate materials to fill their needs.
交通、住房、衣服、通讯、娱乐和食品生产－实际上我们日常生活的每个部分某种程度上受到材料的影响。（被动语态）古往今来，社会的发展和进步已经同人们制造和生产材料以满足他们的需要的能力紧密的联系起来了。

The earliest humans has access to only a very limited number of materials， those that occur naturally stone，wood， clay，skins，and so on. With time they discovered techniques for producing materials that had properties superior to those of natural ones: these new materials included pottery and various metals. Furthermore，it was discovered that the properties of a material could be altered by heat treatment and by the addition of other substance.
（非限制定语从句）早期的人类仅仅拥有少量的材料，这些材料是天然存在的石头、粘土，皮毛等等。随着时间的推移，他们发现了制备性能优于陶瓷和各种各样的金属的天然材料的方法.除此之外，人们发现通过热处理和添加其他物质可以改变材料的性质。

At this point, materials utilization was totally a selection process, that is, deciding from a given, rather limited set of materials the one that was the best suited for an application by virtue of its characteristic. It was not until relatively recent times that scientist came to understand the relationships between the structural elments of materials and their properties. （复杂长句）
重要的句型：it was…….that（强调句型），it 做形式主语，真正的主语是 that 后面的从句，not until 直到…come to…. 终于… 开始.
在这一点上，材料利用完全是一个选择过程，也就是说，从给定的、相当有限的材料中，根据材料的性质决定其最适合某种用途。直到最近，科学家才终于了解材料的结构要素与其性能之间的关系。

This knowledge，acquired in the past 60 years or so， has empowered them to fashion， to a large degree， the characteristic of materials. Thus, tens of thousands of different materials have evolved with rather specialized characteristics that meet the needs of our modern and complex society.
"大约 60 年前获得的"在这里做 knowledge 的后置定语，to a large degree 从某种程度上.. empower sb to do sth 授权某人做某事
在过去大约 60 年前获得的知识使他们有能力最大程度地改变材料的特征。这样，成千上万的具有十分特殊性质的材料就出现了，这些材料特殊的性质的可以满足我们现代和复杂社会的需要.

The development of many technologies that make our existence so comfortable has been intimately associated with the accessibility of suitable materials. Advancement in the understanding of a material type is often the forerunner to the stepwise progression of a technology.

be associated with ….同…联系起来
许多技术的发展已经同适当材料的可及性紧密的联系起来了，这些技术使得我们的生存更加舒适。对材料种类的认识的进步通常是一项技术的分阶段发展的先行者.

Materials science is an interdisciplinary study that combines chemistry, physics, metallurgy, engineering and very recently life sciences. One aspect of materials science involves studying and designing materials to make them useful and reliable in the service of humankind.
材料科学是一门交叉学科，它结合了化学、物理、冶金、工程和最新的生命科学。材料科学的一个方面包括研究和设计材料，使他们在为人类服务的过程中变得有用和可靠.

In materials science there is also an emphasis on developing and using knowledge to understand how the properties of materials can be controllably designed by varying the compositions, structures, and the way in which the bulk and surface phase materials are processed.
在材料科学中，也有一个值得注意的（强调）就是开发和使用知识来认识材料的性能如何才能实现可控制设计，借助改变组成，结构，和松散材料和表面材料的加工方式.

In contrast, materials engineering is , on the basis of those structure properties correlations, designing or engineering the structure of a materials to produce a predeterminded set of properties. In other words, materials engineering mainly deals with the use of materials in design and how materials are manufactured.
相反，基于那些结构和性质之间联系的材料工程是设计材料的结构以产生预先设定的性质。换句话说，材料工程主要是处理材料的使用过程中的设计和材料如何制造的问题.

In brief, the structure of a material usually relates to the arrangement of its internal components. Subatomic structure involves electrons within the individual atoms and interactions with their nuclei. On an atomic level, structure encompasses the organization of atoms or molecules relative to one another.
翻译：简单的说，材料的结构通常同内部成分的排列有关。亚原子结构包括每个原子内部的电子和这些电子同核子之间的相互作用。在原子水平上，结构包含原子的组织或者分子同其他分子之间的联系.

The next large structural realm, which contains large groups of atoms that are normally agglomerated together, is termed “microscopic” meaning that which is subject to direct observation using some type of microscope. Finally, structural elements that may be viewed with the naked eye are termed “macroscopic”.
下一个大的结构领域被称着“用显微镜可见的”，这个结构领域包含了大的原子基团，这些原子基团通常团聚在一起， “用显微镜可见的”意思就是用某种显微镜可以直接进行观察.最后，可以用肉眼观察的结构要素被称着“肉眼可见的”.（句子结构分析见后面科技英语特点部分）

Virtually all important properties of solid materials may be grouped into six different categories: mechanical, electrical, thermal, magnetic, optical, and deteriorative. For each there is a characteristic type of stimulus capable of provoking different responses.
事实上，固体材料所有重要的性质可以分为六个不同的种类：机械性能、电性能、若性能、

光学性能和变化性能。对每一个性质有一个特定的刺激能够引起不同的反应。

Thus, the interrelationship between processing, structure, properties, and performance is linear as follows:
Processing → structure → properties → performance
这样，加工、结构、性质和性能之间的相互联系如下面所示线性关系：
加工 → 结构 → 性质 → 性能

Why do we study materials? Many an applied scientist or engineer, whether mechanical, civil, chemical, or electrical, will at one time or another be exposed to a design problem involving materials. Examples might include a transmission gear, the superstructure for a building, an oil refinery component, or an integrated circuit chip. Of course, materials scientists and engineers are specialists who are totally involved in the investigation and design of materials.

Many times, a materials problem is one of selecting the right material from the many thousands that are available. There are several criteria on which the final decision is normally based. First of all, the in-service conditions must be characterized, for these will dictate the properties required of the material. On only rare occasions does a material possess the maximum or ideal combination of properties. Thus, it may be necessary to trade off one characteristic for another. The classic example involves strength and ductility; normally, a material having a high strength will have only a limited ductility. In such cases a reasonable compromise between two or more properties may be necessary.

A second selection consideration is any deterioration of material properties that may occur during service operation. For example, significant reductions in mechanical strength may result from exposure to elevated temperatures or corrosive environments.

Finally, probably the overriding consideration is that of economics: What will the finished product cost? A material may be found that has the ideal set of properties but is prohibitively expensive. Here again, some compromise is inevitable. The cost of a finished piece also includes any expense incurred during fabrication to produce the desired shape.

The more familiar an engineer or scientist is with the various characteristics and structure－property relationships, as well as processing techniques of materials, the more proficient and confident he or she will be to make judicious materials choices based on these criteria.