北京工业大学

2003 年材料学学科硕士研究生入学复试试题（共 2 页）

考试科目：材料科学

准考证号：_____ 姓名_____ 性别___ 单位_____

身份证号_____

一、专业试题（请根据自己的专业背景选择如下四组之一解答，不得跨组解答）

第一组

1. 简要介绍金属材料目前在我国经济建设中的地位和作用，以及金属材料领域目前有哪些新的重点研究领域和新的重大研究成果。
2. 金属材料的成型加工主要有哪些工艺方法？这些方法各有何特点和适用范围，它们的成型原理各是什么？
3. 如何应用铁碳相图确定钢铁材料热处理工艺的加热温度范围（如：淬火、正火、不完全退火、球化退火、扩散退火、回火等），并说明其理由。
4. 金属材料的强化方法有几大类？它们的工艺方法和强化机理各是什么？有何共同点和不同点？

第二组

1. 什么是同质异构体，什么是晶体的各向异性，试举例说明。
2. 说明同种物质同一晶相的单晶、双晶与多晶在结构上的区别与联系。
3. 相图本身是怎样绘制的？相图在材料制备过程中有哪些作用？
4. 阐明陶瓷材料制备的一般原理与方法，简述传统陶瓷与特种陶瓷的主要区别。
5. 请简述陶瓷粉粒度的测定方法。
6. 你对材料化学组成、结构和性能之间的关系有哪些认识？

第三组

1. 水泥及水泥基材料的发展趋势与前景？
2. 水泥混凝土材料开裂原因及防治措施？
3. 氯离子对钢筋混凝土中钢筋锈蚀作用与机理？
4. 微量元素对熟料煅烧过程和质量的影响？
5. 水泥水化速率的调节方法和措施有那些？

第四组

1. 名词解释：

   位阻效应　　共扼效应　　电负性　　氢键
2. 阐述高聚物的聚合度，相对分子质量和相对分子质量分布。
3. （1）全同立构聚丙烯和无规立构聚丙烯哪一个的 Tg 高，写出它们结构式并说明理由。

   （2）聚丙烯酸甲酯和聚甲基丙烯酸甲酯哪一个熔点高，写出它们分子式并说明理由。
4. 聚合方法、聚合反应有几种，请解释。
5. 悬浮聚合和乳液聚合的区别是什么，悬浮剂和乳液剂有何区别。
6. 为功能高分子材料，叙述其运用及发展前景。

注：提交答卷邮箱：yuanxr@bjpu.edu.cn　　传真号码：010-67392383

请在答卷上写明本科毕业论文题目

二、专业英语试题（Translate following into Chinese）

Classification of materials

Solid materials have been conveniently grouped into three basic classifications: metals, ceramics and polymers. This scheme is based primarily on chemical makeup and atomic structure, and most materials fall into one distinct grouping or another, although there are some intermediates. In addition, there are three other groups of important engineering materials---composites, semiconductors, and biomaterials. Composites consist of combinations of two or more different materials, whereas semiconductors are utilized because of their unusual electrical characteristics; biomaterials are implanted into the human body. A brief explanation of the material types and representative characteristics is offered next.

Metallic materials are normally combinations of metallic elements. They have large numbers of non-localized electrons; that is, these electrons are not bound to particular atoms. Many properties of metals are directly attributable to these electrons. Metals are extremely good conductors of electricity and heat and are not transparent to visible light; a polished metal surface has lustrous appearance. Furthermore, metals are quite strong, yet deformable, which accounts for their extensive use in structural application.

Ceramics are compounds between metallic and nonmetallic elements; they are most frequently oxides, nitrides, and carbides. The wide range of materials that falls within this classification includes ceramics that are composed of clay minerals, cement, and glass. These materials are typically insulative to the passage of electricity and heat, and are more resistant to high temperatures and harsh environments than metals and polymers. With regard to mechanical behavior, ceramics are hard but very brittle.

Polymers include the familiar plastic and rubber materials. Many of them are organic compound that are chemically based on carbon, hydrogen, and other nonmetallic elements; furthermore, they have very large molecular structures. These materials typically have low densities and may be extremely flexible.

A number of composite materials have been engineered that consist of more than one materials type. Fiberglass is a familiar example, in which glass fibers are embedded within a polymeric material. A composite is designed to display a combination of the best characteristics of each of the component materials. Fiberglass acquires strength from the glass and flexibility from the polymer. Many of the recent material developments have involved composite materials.

Semiconductors have electrical properties that are intermediate between the electrical conductors and insulators. Furthermore, the electrical characteristics of these materials are extremely sensitive to the presence of minute concentrations of impurity atoms, which concentrations may be controlled over very small spatial regions. The semiconductors have made possible the advent of integrated circuitry that has totally revolutionized the electronics and computer industries (not to mention our lives) over the past two decades.

Biomaterials are employed in components implanted into the human body for replacement of diseased or damaged body parts. These materials must not produce toxic substance and must be compatible with body tissues (i.e., must not cause

adverse biological reactions). All of the above materials ---metals, ceramics, polymers, composites, and semiconductors----may be used as biomaterials.