

## 课程详述

### COURSE SPECIFICATION

以下课程信息可能根据实际授课需要或在课程检讨之后产生变动。如对课程有任何疑问，请联系授课教师。

The course information as follows may be subject to change, either during the session because of unforeseen circumstances, or following review of the course at the end of the session. Queries about the course should be directed to the course instructor.

1.	<b>课程名称 Course Title</b>	材料科学与工程基础实验 Experiments for Fundamental of Materials Science and Engineering
2.	<b>授课院系 Originating Department</b>	材料科学与工程系 Department of Materials Science and Engineering
3.	<b>课程编号 Course Code</b>	MSE002
4.	<b>课程学分 Credit Value</b>	1
5.	<b>课程类别 Course Type</b>	专业基础课 Major Foundational Courses
6.	<b>授课学期 Semester</b>	春季 Spring / 秋季 Fall
7.	<b>授课语言 Teaching Language</b>	英文 English
8.	<b>授课教师、所属学系、联系方式 (如属团队授课, 请列明其他授课教师) Instructor(s), Affiliation &amp; Contact (For team teaching, please list all instructors)</b>	<p>叶飞, 教学教授, 材料系, 荔园 2 栋 504 <a href="mailto:Yef3@sustech.edu.cn">Yef3@sustech.edu.cn</a> Ye Fei, Teaching Professor, Department of Materials Science and Engineer, Room 504, Block 2, Lychee Hill</p> <p>廖成竹, 工程师, 材料系, 荔园 2 栋 502 <a href="mailto:liaocz@sustech.edu.cn">liaocz@sustech.edu.cn</a>, 0755-88018761 LIAO Chengzhu, Engineer, Department of Materials Science and Engineer, Room 502, Block 2, Lychee Hill</p> <p>章剑波, 实验员, 材料系, 荔园 2 栋 502 <a href="mailto:zhangjb@sustech.edu.cn">zhangjb@sustech.edu.cn</a>, 0755-88018764 ZHANG Jianbo, laboratory assistant, Department of Materials Science and Engineer, Room 502, Block 2, Lychee Hill</p> <p>明静, 实验员, 材料系, 荔园 2 栋 502 MING Jing, laboratory assistant, Department of Materials Science and Engineer, Room 502, Block 2, Lychee Hill <a href="mailto:mingj@sustech.edu.cn">mingj@sustech.edu.cn</a>, 0755-88018944</p> <p>李艳艳, 实验员, 材料系, 荔园 2 栋 504 <a href="mailto:liy@sustech.edu.cn">liy@sustech.edu.cn</a>, 0755-88018925 LI Yanyan, laboratory assistant, Department of Materials Science and Engineer, Room 504, Block 2, Lychee Hill</p> <p>程化, 工程师, 材料系, 荔园 2 栋 504 <a href="mailto:chengh@sustech.edu.cn">chengh@sustech.edu.cn</a>, 0755-88018945 Hua Cheng, Department of Materials Science and Engineering.</p>

9. 实验员/助教、所属学系、联系方式 Tutor/TA(s), Contact	李慧丽, 实验员, 材料系, 荔园 2 栋 502 lihl@sustech.edu.cn, 0755-88018930 LI Huili, laboratory assistant, Department of Materials Science and Engineer, Room 502, Block 2, Lychee Hill				
	待公布 To be announced				
10. 选课人数限额(可不填) Maximum Enrolment (Optional)					
11. 授课方式 Delivery Method	讲授 Lectures	习题/辅导/讨论 Tutorials	实验/实习 Lab/Practical	其它(请具体注明) Other (Please specify)	总学时 Total
	学时数 Credit Hours	4	0	24	4 (safety test) 32
12. 先修课程、其它学习要求 Pre-requisites or Other Academic Requirements	MSE001 材料科学与工程基础 Fundamentals of Materials Science				
13. 后续课程、其它学习规划 Courses for which this course is a pre-requisite	物理化学实验 材料综合实验 I 材料综合实验 II Experiment for Physical Chemistry Comprehensive Experiment for Materials Science I Comprehensive Experiment for Materials Science II				
14. 其它要求修读本课程的学系 Cross-listing Dept.					

### 教学大纲及教学日历 SYLLABUS

#### 15. 教学目标 Course Objectives

材料科学与工程基础实验是材料专业的入门实验课程。本实验课程的主要目的是培养学生材料学的基本实验操作技能, 处理数据和书写报告的能力。课程包括金属晶体结构的原子排列实验、金属合金腐蚀和钝化实验、聚合物冲击、拉伸、硬度和熔体流动实验、金属热处理、金属拉伸、硬度测试和二元相图实验。通过一系列的实验了解材料的晶体结构、力学性能、材料的加工处理以及相互关系, 为学生掌握材料的最基本实验技能打下扎实的基础。

‘Experiments for Fundamental of Materials Science’ is a major foundational course for Materials Science and Engineering. The purpose of this course is to cultivate the students’ basic operation skills in Materials Science and Engineering, as well as the ability to process data and write a lab report. This course includes six experiments: 1) Ball Model of Atom Arrangement in Crystal, 2) Passivation and Corrosion Behavior of Metal Alloys in Sulfuric Acid Solution, 3) Mechanical Behavior of Polymers, 4) Tensile Properties of Polymers and Metals, 5) Heat treatment and Hardness Test of Metals and 6) Binary Phase Diagrams of Sn-Bi/ Sn-Zn Alloys. Through these experiments, the students can understand the crystal structure, mechanical properties, material processing and their relationship. This course will lay a solid foundation for students to understand the most basic experimental skills of materials.

16. 预达学习成果 Learning Outcomes

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| <ol style="list-style-type: none"> <li>1. 掌握材料学实验安全注意事项和相应规章制度；</li> <li>2. 掌握金属晶体结构原子排列、位错和滑移机制，理解材料结构与性能的关系；</li> <li>3. 掌握常见材料分析仪器操作方法和测试原理，包括拉伸机、冲击试验机、硬度计和电化学工作站等；</li> <li>4. 掌握常见材料组织及结构特征，理解结构特征对材料力学性能的影响，能够利用材料结构、形变、晶体缺陷和回复再结晶知识，分析解决复杂工程问题；</li> <li>5. 掌握材料成分对材料电化学性质的影响规律；</li> <li>6. 掌握实验数据处理和分析的方法，具备规范的实验报告写作能力；</li> <li>7. 通过学生独立操作实验设备和分组合作等形式，培养学生独立实验的能力和团队合作的能力。</li> </ol>   |
| <ol style="list-style-type: none"> <li>1. To master the safety precautions and relevant rules and regulations of materials experiment.</li> <li>2. To learn the atomic arrangement, dislocation and slip mechanism of metal crystal structure and understand the relationship between structure and properties of materials.</li> <li>3. To master the principles and the operating techniques and of common material characterization instruments, including tensile machines, impact testing machines, hardness tester and electrochemical workstations, etc.</li> <li>4. To study the common structure of materials, understand the effect of microstructure on the tensile properties of materials; and to make use of the knowledge of material structure, deformation, crystal defects and recovery recrystallization to analyse and solve complex engineering problems.</li> <li>5. To master the influence of material composition on the electrochemical properties of materials</li> <li>6. To learn the methods for processing and analysing the experimental data, and then to write a formal report after each experiment.</li> <li>7. To train students' ability of the independence and teamwork cooperation in the experiments, through the independent operation of the experimental equipment and the group cooperation.</li> </ol> |

17. 课程内容及教学日历（如授课语言以英文为主，则课程内容介绍可以用英文；如团队教学或模块教学，教学日历须注明主讲人）

**Course Contents (in Parts/Chapters/Sections/Weeks. Please notify name of instructor for course section(s), if this is a team teaching or module course.)**

(一) 教学第二周（4学时）：Week 2 (4 credit hours)

主要内容：1.课程介绍；2.安全培训及考试

Content: Introduction, safety training and safety test

(二) 教学第四周（4学时）：Week 4 (4 credit hours)

实验一：金属晶体中的原子排列 Ball Model of Atom Arrangement in Crystal

主要内容：1. 搭建三种重要的金属晶体结构-HCP、FCC、BCC；2. 理解紧密堆积结构和辨别各种晶体结构的晶面；3. 了解晶面的滑移；4. 了解材料结构和性能的关系。

Contents: 1. Build up three important metal crystalline structures: HCP、FCC and BCC. 2. Understand close-packed plane and identify different crystal planes. 3. Understand slip system of each crystal. 4. Understand the structure-properties relationship of materials.

(三) 教学第六周（4学时）：Week 6 (4 credit hours)

实验二：金属的拉伸性能与加工硬化 Tensile Properties of Metals and Work Hardening

主要内容：1. 学习拉伸测试；2. 掌握金属拉伸应力和应变行为；3. 了解金属的冷轧过程。

Contents: 1. Learn tensile tests. 2. Master the tensile stress-strain behaviors of metals. 3. Understand the cold rolling of metals.

(四) 教学第八周（4学时）：Week 8 (4 credit hours)

实验三：聚合物链结构对拉伸性能的影响 The Influence of Chain Structure on the Tensile Properties of Polymers

主要内容：1. 学习使用大变形计；2. 了解结晶性聚合物的冷拉；3. 研究拉伸速率对聚合物拉伸性能的影响。

Contents: 1. Learn how to use big deform to conduct the tensile test. 2. Understand the cold drawing of polymers. 3. Investigate the influence of strain rates on the tensile properties of polymers.

(五) 教学第十周（4学时）：Week 10 (4 credit hours)

实验四：金属的硬度与热处理 Heat treatment and hardness tests of Metals

主要内容：1. 学习硬度测试技术；2. 了解冷加工对材料力学性能的影响；3. 了解金属热处理的几种技术；4. 了解镶嵌和磨抛制样技术。

Contents: 1. Learn hardness tests of metals. 2. Understand the influence of work hardening techniques on mechanical properties. 3. Understand various heat treatment techniques to modify the mechanical properties of materials. 4. Understand the specimen mounting, grinding and polishing procedure for hardness test.

(六) 教学第十二周 (4 学时) : Week 12 (4 credit hours)

实验五：聚合物的冲击实验及硬度、熔体流动指数测试 Impact, Hardness and Melt Flow Index Measurement of Polymers

主要内容：1. 掌握聚合物冲击实验；2. 学习聚合物的硬度测试；3. 了解热塑性高分子熔体流动指数的测试；4. 理解材料的结构和性能的对对应关系。

Contents: 1. Master the impact test of polymers. 2. Learn shore hardness test of polymers. 3. Understand the melt flow index of thermoplastics. 4. Understand the relationship between the microstructure of materials and their mechanical properties.

(七) 教学第十四周 (4 学时) : Week 14 (4 credit hours)

实验六：Sn-Bi/ Sn-Zn 合金二元平衡相图绘制 Binary Equilibrium Phase Diagrams of Sn-Bi/ Sn-Zn Alloys

主要内容：1. 了解固-液二元平衡相图的原理；2. 利用热电偶的热分析方法绘制 Sn-Bi/Sn-Zn 二元相图；3. 掌握热分析技术，并学会使用热电偶测量温度。

Contents: 1. Understand the basics of solid-liquid equilibrium phase diagram. 2. Draw the Sn-Bi/Sn-Zn phase diagrams using thermal analysis technique with thermocouple. 3. Master the technique of thermal analysis and study how to use thermocouple to determine temperature.

(八) 教学第十六周 (4 学时) : Week 16 (4 credit hours)

实验七：合金钝化和腐蚀行为 Passivation and Corrosion Behavior of Metal Alloys

主要内容：1. 掌握金属钝化和腐蚀原理；2. 学习线性扫描伏安法测定在酸性介质中金属的钝化和腐蚀；3. 比较 316 不锈钢和 Q235 低碳钢的腐蚀行为；4. 研究 Cl<sup>-</sup> 对合金钝化和腐蚀的影响。

Contents: 1. Master the principle of passivation and corrosion. 2. Learn and understand the linear sweep voltammetry (LSV) technique on evaluating the passivation and corrosion behavior of alloys in acid solution. 3. Compare the corrosion behavior of Q235 mild carbon steel (235CS) and 316 stainless steel (316SS) in acid solution. 4. Study the effect of Cl<sup>-</sup> concentration on the passivation and corrosion behavior of metal alloys.

18. 教材及其它参考资料 Textbook and Supplementary Readings

自编实验教材 Experimental Manual

课程评估 ASSESSMENT				
19. 评估形式 Type of Assessment	评估时间 Time	占考试总成绩百分比 % of final score	违纪处罚 Penalty	备注 Notes
出勤 Attendance		10		
课堂表现 Class Performance		40		
预习报告 Pre-report		10		
实验报告 Experiment Report		40		

20. 记分方式 GRADING SYSTEM

A. 十三级等级制 Letter Grading

B. 二级记分制（通过/不通过） Pass/Fail Grading

课程审批 REVIEW AND APPROVAL

21. 本课程设置已经过以下责任人/委员会审议通过

This Course has been approved by the following person or committee of authority

