

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.	课程名称 Course Title	光电信息材料与器件综合实验 I Comprehensive Experiments of Electronic and Photonic Materials and Devices I
2.	授课院系 Originating Department	材料科学与工程系 Department of Materials Science and Engineering
3.	课程编号 Course Code	MSE333
4.	课程学分 Credit Value	4
5.	课程类别 Course Type	专业核心课 Major Core Courses
6.	授课学期 Semester	秋季 Fall
7.	授课语言 Teaching Language	中英双语 English & Chinese
8.	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 & Contact (For team teaching, please list all instructors)	<p>叶飞, 教学教授, 材料系, 工学院北楼 201 yef3@sustech.edu.cn Ye Fei, Teaching Professor, Department of Materials Science and Engineering, Room 201, North Block, College of Engineering</p> <p>王海鸥, 实验师, 材料系, 慧园 2 栋 406 wangho@sustech.edu.cn, WANG Haiou, Experimentalist, Department of Materials Science and Engineer, Room 406, Block 2, Huiyuan</p> <p>章剑波, 实验师, 材料系, 慧园 2 栋 406 zhangjb@sustech.edu.cn, 0755-88018764 ZHANG Jianbo, Experimentalist, Department of Materials Science and Engineer, Room 406, Block 2, Huiyuan</p> <p>廖成竹, 教授级实验师, 材料系, 慧园 2 栋 406 Liaocz@sustech.edu.cn, 0755-88018761 LIAO Chengzhu, Senior Experimentalist, Department of Materials Science and Engineer, Room 406, Block 2, Huiyuan</p> <p>李慧丽, 实验师, 材料系, 慧园 2 栋 406 Lihl@sustech.edu.cn,</p>

	LI Huili, Experimentalist, Department of Materials Science and Engineer, Room 406, Block 2, Huiyuan 李艳艳, 实验师, 材料系, 慧园 2 栋 406 liyy@sustech.edu.cn, LI Yanyan, Experimentalist, Department of Materials Science and Engineer, Room 406, Block 2, Huiyuan				
9. 实验员/助教、所属学系、联系方式 Tutor/TA(s), Contact	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			128		128
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 MSE002 材料科学与工程基础实验 MSE001 Fundamentals of Materials Science and Engineering MSE002 Experiments for Fundamentals of Materials Science and Engineering				
13. 后续课程、其它学习规划 Courses for which this course is a pre-requisite	光电信息材料与器件综合实验 II Comprehensive Experiments of Electronic and Photonic Materials and Devices 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

《光电信息材料与器件综合实验》是光电信息材料与器件专业的必修实验课程。本课程涵盖了光电信息材料的合成、表征, 以及器件的加工与制备的基本方法和实验技能。课程的主要目的是培养学生的实践动手能力、科学创新的能力以及分析解决问题的综合能力; 使学生掌握与光电信息材料和器件相关的制备与加工、材料表征和器件性能测试的基本技能, 掌握材料实验研究的基本思路和方法, 体验材料研究的完整过程, 即“材料合成与制备-结构和性质表征-器件制备-性能测试”, 为学生在科研和工程实践中解决光电信息材料相关问题打下良好的基础。《光电信息材料与器件综合实验 I》是课程的第一部分, 其目的是训练学生掌握各种光电信息材料和器件的制备方法、加工手段、以及分析方法, 培养学生实践能力、创新意识和能力, 使其能够综合运用所学的知识解决实际问题。

Comprehensive Experiments of Photoelectric Information Materials and Devices is a compulsory experimental course for the specialty of photoelectric information materials and devices. This course covers the synthesis and characterization of photoelectric information materials, as well as the basic methods and experimental skills of device processing and preparation. The main purpose of the course is to cultivate students' practical ability, scientific innovation ability and comprehensive ability to analyse and solve problems, and to enable students to master the basic skills of

preparation and processing, material characterization and device performance test related to photoelectric information materials and devices. In addition, the students will master the basic ideas and methods of material experimental research, and experience the whole process of material research, that is "material synthesis and preparation - structure and property characterization - device preparation - performance test", so as to lay a good foundation for students to solve the problems related to photoelectric information materials in scientific research and engineering practice. Comprehensive experiments of photoelectric information materials and Devices I is the first part of the course. Its purpose is to train students to master the preparation methods, processing and analysis methods of various photoelectric information materials and devices, cultivate students' practical ability, innovative consciousness and ability, and enable them to comprehensively use their knowledge to solve practical problems.

16. 预达学习成果 Learning Outcomes

1. 具有较强的实验实践能力、创新思维能力、团队协作的能力。
 2. 掌握各种光电信息材料和器件的制备和加工方法、加工方法、性能测试方法以及实际应用原理。
 3. 掌握材料实验研究的基本思路和方法，体验材料研究的完整过程。
 4. 综合运用所学的实验研究方法去解决实际问题。
1. To cultivate strong experimental practice ability, innovative thinking ability and team cooperation ability.
 2. To master the preparation and processing methods, processing methods, performance testing methods and practical application principles of various photoelectric information materials and devices.
 3. To master the basic ideas and methods of material experimental research, and experience the complete process of material research, namely "synthesis preparation - processing - structural characterization - performance test".
 4. Comprehensively use the learned experimental research methods to solve practical problems.

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 1 周（8 学时）：
绪论及差动放大电路

主要内容：

1. 绪论主要内容：课程介绍及安全教育。
2. 差动放大电路讲解与实操
3. 了解差动放大电路的基本原理和应用；
4. 掌握差动放大电路的组装及调节方法。

(二) 教学第 2、3、4 周（24 学时）：
实验 2：有机光子晶体的制备与表征

主要内容：

1. 了解光子晶体材料的一般特点。
2. 了解有机光子晶体的不同制备原理和方法。
3. 掌握一维、二维纳米结构有机光子晶体的制备。
4. 学会设计、制作有机光子晶体器件，并进行性能测试。

(三) 教学第 5、6、7 周（24 学时）
实验 3：半导体材料的能级结构调控与表征

主要内容：

1. 了解半导体薄膜材料的主要制备方法。
2. 了解半导体薄膜材料禁带宽度与薄膜厚度的关系。
3. 掌握使用紫外可见光谱法计算半导体禁带宽度的原理和方法。
4. 使用溶胶凝胶法合成不同厚度氧化锌薄膜，并使用紫外可见分光光度计表征其禁带宽度。

(四) 教学第 8 周 (8 学时):

实验 4: 平面电极的制备与性能测试

主要内容:

1. 了解平面电极的分类与工作原理。
2. 掌握平面电极的主要制备方法。
3. 使用丝网印刷法制备平面电极。
4. 测试平面电极性能。

(五) 教学第 9、10、11 周 (24 学时):

实验 5: 光电器件的微纳加工与制备

主要内容:

1. 了解光电器件的分类与内部结构和工作原理。
2. 掌握光电器件材料的合成方法以及器件制备方法。
3. 了解并掌握光电器件芯片的微纳加工方法。
4. 进行材料结构的表征及器件性能测试。

(六) 教学第 12、13、14 周 (24 学时):

实验 6: 气敏传感器的制备与性能测试

主要内容:

1. 了解水热合成气敏材料氧化铟微球的基本原理和方法。
2. 掌握掺杂态氧化铟微球的表征方法。
3. 掌握气敏传感器的制备及性能测试方法。

(七) 教学 15 周 (8 学时)

实验 7: 光电能源转化器件的制备与应用

主要内容:

1. 了解光电能源转化器件的基本工作原理。
2. 掌握薄膜材料的基本制备方法。
3. 制作光电能源转换器件并测试其光电转化效率。

(八) 教学 16 周 (8 学时)

期末考试

Week 1 (8 credit hours)

Introduction and differential amplifier circuit

Contents:

1. Course introduction and safety education.
2. Introduction of differential amplifier circuit.
3. Understand the basic principle and application of differential amplifier circuit;
4. Master the assembly and adjustment methods of differential amplifying circuit.

Week 2、3、4 (24 credit hours)

Lab 2 Preparation and Characterization of Organic Photonic Crystals

Contents:

1. To understand the general characteristics of photonic crystal materials.
2. To understand the different preparation principles and methods of organic photonic crystals.
3. To master the preparation of one-dimensional and two-dimensional nanostructured organic photonic crystals.
4. To learn to design and manufacture organic photonic crystal devices, and conduct performance tests.

Week5、6、7 (24 credit hours)

Lab3 Regulation of band gap of semiconductor materials

Contents:

1. To understand the synthesis methods of semiconductive film.
2. To understand the relationship of thickness of semiconductor and band gap.
3. To master the principle and method of calculating the band gap of semiconductor by UV-Vis spectra.
4. To fabricate ZnO thin film by sol-gel method and calculate its band gap by UV-Vis spectra.

Week 8 (8 credit hours)

Lab4 preparation and characterization of planar electrodes

Contents:

1. To understand the classification and working principle of planar electrodes.
2. To master the synthesis methods of planar electrodes.
3. To prepare the planar electrodes by screen printing method.
4. To test the performances of prepared planar electrodes.

Week 9、10、11 (24 credit hours)

Lab 5 Micro-nano fabrication and fabrication of optoelectronic devices

Contents:

1. To understand the classification, internal structure and working principle of optoelectronic devices.
2. To master the synthesis methods of optoelectronic device materials and device preparation methods.
3. To understand and master the micro-nano processing methods of optoelectronic device chips.
4. To characterize the material structure and test the device performance.

Week 12、13、14 (24 credit hours)

Lab 6 Preparation and performance tests of gas sensors

Contents:

1. To grasp the basic principle and preparation method of indium oxide microspheres by hydrothermal method.
2. To master the characterization method of doped indium oxide microspheres.
3. To assembly a gas sensor and test its performance.

Week 15 (8 Credit hours)

Lab 7 Preparation and characterization of photovoltaic devices

Contents:

1. To understand the working principle of photovoltaic devices.
2. To master the methods of film materials' preparation.
3. To prepare photovoltaic devices and test the photoelectric conversion efficiency of the devices.

Week 16 (8 Credit hours)

Final examination

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

自编实验讲义 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		
实验报告 Lab Report		40		
课程项目 Projects				
平时作业 Assignments				
期中考试 Mid-Term Test				
期末考试 Final Exam		10		
期末报告 Final Presentation				
其它（可根据需要 改写以上评估方式） Others (The above may be modified as necessary)				

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