

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	光电器件工艺实践 Optoelectronic Devices Fabrication Laboratory				
2.	授课院系 Originating Department	电子与电气工程系 Department of Electrical and Electronic Engineering				
3.	课程编号 Course Code	EE322				
4.	课程学分 Credit Value	2				
5.	课程类别 Course Type	专业选修课 Major Elective Courses				
6.	授课学期 Semester	春季 Spring				
7.	授课语言 Teaching Language	中英双语 English & Chinese (教材、作业、考试、课件英语为主, 辅以中文解释) (Textbooks, Homework, Examinations and Lecture Notes: English. Detailed Explanations: 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)	陈树明 电子与电气工程系, 0755-88018522, chensm@sustech.edu.cn CHEN Shuming Department of Electrical and Electronic Engineering 0755-88018522 chensm@sustech.edu.cn				
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)	12				
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	16	0	32	0	48

<p>12. 先修课程、其它学习要求 Pre-requisites or Other Academic Requirements</p>	<p>EE204 半导体器件导论 EE204 Introduction to Semiconductor Devices</p>
<p>13. 后续课程、其它学习规划 Courses for which this course is a pre-requisite</p>	<p>EE403 显示与照明技术导论 EE403 Introduction to Display and Lighting Technologies</p>
<p>14. 其它要求修读本课程的学系 Cross-listing Dept.</p>	<p>无 NA</p>

教学大纲及教学日历 SYLLABUS

15. **教学目标 Course Objectives**

<ol style="list-style-type: none"> 1. 讲授洁净室、高真空、薄膜沉积（溅射、热蒸镀、电子束蒸镀、等离子体化学气相沉积、涂膜）、薄膜图形化（光刻、激光直写、丝网印刷、喷墨印刷）、刻蚀等基本制备工艺及透过率、反射率、吸收率、电阻率、膜厚、薄膜表面形貌等基本表征技术。 2. 讲授各种光电器件如有机发光二极管（OLED）、量子点发光二极管（QLED）、交流薄膜电致发光器件（ACTFEL）、太阳能电池（PV）、薄膜晶体管（TFT）的工作原理、制造工艺以及测试表征技术。 3. 学生需参与到实验中，并亲自制作、表征各种功能薄膜及光电器件。通过实验，掌握薄膜和器件的制备工艺及表征技术，加深理论知识的理解并锻炼学生动手能力、文献搜索、处理分析实验数据、口头演讲及科技写作的能力，为后续从事科学与工程的研究工作打下坚实基础。 <ol style="list-style-type: none"> 1. To introduce the clean room, high vacuum, thin film deposition (including sputtering, thermal evaporation, e-beam evaporation, plasma enhanced chemical vapor deposition, spin coating), thin film patterning (including photolithography, laser direct writing, screen printing, inkjet printing), etching and other fundamental fabrication processes. Thin film characterization techniques including transmission, reflection, absorption, resistivity, thickness, surface morphology are also covered. 2. To introduce the working mechanisms, the fabrication processes and the characterization techniques of various optoelectronic devices including organic light-emitting diodes (OLED), quantum dot light-emitting diodes (QLED), alternating current thin-film electroluminescent devices (ACTFEL), photovoltaic (solar) cells, thin-film transistors (TFT) and etc. 3. Laboratory course requires hands-on work in fabricating and characterizing various thin films (including metal, organic and ceramic) and devices (including OLED, QLED, ACTFEL, OPV and TFT). Process modules including sputtering, thermal evaporation, e-beam evaporation, plasma enhanced chemical vapor deposition, spin coating, photolithography, laser direct writing, screen printing, inkjet printing, etching and etc will be covered. Student will also learn to characterize the fabricated thin films and devices.
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16. **预达学习成果 Learning Outcomes**

<p>通过这门课程的学习，学生能够：</p> <ol style="list-style-type: none"> 1. 掌握各种功能薄膜的制备及表征工艺； 2. 掌握薄膜的图形化及刻蚀工艺； 3. 掌握各种光电器件（OLED、QLED、ACTFEL、OPV、TFT）的工作原理、制备工艺及表征技术； 4. 获得洁净间、高真空、薄膜、器件的制备和表征等亲身实践经历；

5. 运用所学知识，解释实验数据，挖掘数据背后隐藏的科学规律；
6. 设计新型光电器件，开展实验，制备及表征器件的性能；
7. 锻炼实验动手、文献搜索、数据处理、数据分析、团队沟通、口头演讲及科技写作的能力。

After completing this course, the students will be able to:

1. Understand the fabrication and characterization techniques of functional thin-films;
2. Understand the patterning and etching techniques of functional thin-films;
3. Understand the working principles, fabrication processes and characterization techniques of optoelectronic devices including OLED, QLED, ACTFEL, OPV, TFT and etc.;
4. Get the hands-on experience in clean room, high vacuum, thin-film and device fabrication and characterization;
5. Apply the learned knowledge to explain the experimental data and disclose the scientific rules hidden behind the data;
6. Design novel optoelectronic devices and conduct experiments to fabricate and characterize the devices;
7. Enhance the abilities of hands-on, literature searching, data processing, data analysis, team communication, oral presentation and scientific writing.

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.)

- 第 1 周（讲授）：1.课程介绍；2.真空技术，洁净室环境的获得
- 第 2 周（实验）：1.实验室安全培训；2.设备基本操作培训
- 第 3 周（讲授）：1.薄膜沉积技术（热蒸镀、电子束蒸镀、溅射、等离子体化学气相沉积）；2.薄膜表征技术
- 第 4 周（实验）：1.金属和有机薄膜的沉积；2.薄膜的透过率、反射率、方块电阻、厚度等参数测量
- 第 5 周（讲授）：1.薄膜图形化技术(光刻、激光直写、丝网印刷、喷墨印刷)；2.刻蚀技术
- 第 6 周（实验）：薄膜图形化及刻蚀实验
- 第 7 周（讲授）：有机发光二极管（OLED）的原理、制备及表征
- 第 8 周（实验）：有机发光二极管（OLED）的制备及表征实验
- 第 9 周（讲授）：量子点发光二极管（QLED）的原理、制备及表征
- 第 10 周（实验）：量子点发光二极管（QLED）的制备及表征实验
- 第 11 周（讲授）：交流薄膜电致发光器件（ACTFEL）的原理、制备及表征
- 第 12 周（实验）：交流薄膜电致发光器件（ACTFEL）的制备及表征实验
- 第 13 周（讲授）：光生伏打电池（OPV）的原理、制备及表征
- 第 14 周（实验）：光生伏打电池（OPV）的制备及表征实验
- 第 15 周（讲授）：薄膜晶体管（TFT）的原理、制备及表征
- 第 16 周（实验）：薄膜晶体管（TFT）的制备及表征实验

第 17 周（讲授）：课程总结及学生课题演讲

Week 1 (Lecture): 1. Course Introduction; 2. Vacuum Technology and Clean Room

Week 2 (Lab): 1. Lab Safety Training; 2. Equipment Operation Training

Week 3 (Lecture): Thin Film Deposition (Sputtering, Thermal Evaporation, E-Beam Evaporation, Plasma Enhanced Chemical Vapor Deposition) and Characterization

Week 4 (Lab): Metal and Organic Thin Film Deposition and Characterization (Transmission, Reflection, Sheet Resistance, Thickness) Laboratory

Week 5 (Lecture): Thin Film Patterning (Photolithography, Laser Direct Writing, Screen Printing, Inkjet Printing) and Etching

Week 6 (Lab): Thin Film Patterning and Etching Laboratory

Week 7 (Lecture): Organic Light-Emitting Diodes (OLED): Principles, Fabrication and Characterization

Week 8 (Lab): Organic Light-Emitting Diodes (OLED) Fabrication and Characterization Laboratory

Week 9 (Lecture): Quantum Dot Light-Emitting Diodes (QLED): Principles, Fabrication and Characterization

Week 10 (Lab): Quantum Dot Light-Emitting Diodes (QLED) Fabrication and Characterization Laboratory

Week 11 (Lecture): Alternating Current Thin-Film Electroluminescent (ACFEL) Devices: Principles, Fabrication and Characterization

Week 12 (Lab): ACFEL Devices Fabrication and Characterization Laboratory

Week 12 (Lecture): Photovoltaic Cells (OPV): Principles, Fabrication and Characterization

Week 14 (Lab): Photovoltaic Cells (OPV) Fabrication and Characterization Laboratory

Week 15 (Lecture): Thin Film Transistors (TFT): Principles, Fabrication and Characterization

Week 16 (Lab): Thin Film Transistors (TFT) Fabrication and Characterization Laboratory

Week 17 (Lecture): Course Summary and Student Project Presentation

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

1. 光电器件工艺实践自编教材（陈树明）
2. 薄膜技术与薄膜材料（田民波著，清华大学出版社 ISBN: 9787302274834）
1. Optoelectronic Devices Fabrication Laboratory by Shuming Chen, under preparation
2. Thin Film Technologies and Materials by Mingbo Tian (ISBN: 9787302274834)

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				
课堂表现 Class Performance	偶数周 Even week	14	无 NA	实验表现及出勤, 7*2%=14% Lab performance and attendance, 7*2%=14%
小测验 Quiz				
课程项目 Projects				

平时作业 Assignments	奇数周 Odd week	56	无 NA	实验报告, 7* 8%=56% Lab reports. Each report takes up 8% score.
期中考试 Mid-Term Test				
期末考试 Final Exam				
期末报告 Final Presentation	第 17 周 Week 17	30	无 NA	期末报告和口头演讲 Final report and oral 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

