

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.

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| 1. | 课程名称 Course Title | 先进半导体工艺实践 Advanced Semiconductor Fabrication Laboratory |
| 2. | 授课院系 Originating Department | School of Microelectronics 深港微电子学院 |
| 3. | 课程编号 Course Code | SME308 |
| 4. | 课程学分 Credit Value | 3 |
| 5. | 课程类别 Course Type | 专业选修课 Major Elective Courses |
| 6. | 授课学期 Semester | 春季及秋季 Spring and 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) | 于洪宇, 教授, 深港微电子学院, yuhy@sustech.edu.cn Hongyu Yu School of Microelectronics 755-88018508 yuhy@sustech.edu.cn |
| 9. | 实验员/助教、所属学系、联系方式 Tutor/TA(s), Contact | 刘欢, 教学实验师, 深港微电子学院, liuh3@sustech.edu.cn Huan Liu, Teaching Technician, School of Microelectronics, liuh3@sustech.edu.cn |
| 10. | 选课人数限额(可不填) Maximum Enrolment (Optional) | 24 |

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| 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 | 24 | | 48 | | 72 |
| 12. 先修课程、其它学习要求 Pre-requisites or Other Academic Requirements | SME204 微电子基础 II 或者 EE204 半导体器件导论 SME204 Fundamentals of Integrated Circuit II or EE204 Introduction to semiconductor devices or | | | | |
| 13. 后续课程、其它学习规划 Courses for which this course is a pre-requisite | | | | | |
| 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

本课程讲解先进半导体工艺及制造技术，及先进半导体工艺技术背后的科学工艺过程的物理图像以及测量方法。例如版图设计方法，光刻机，感应耦合离子刻蚀机，低压气象沉积设备等的使用方法，及离子注入，化学物理沉积、薄膜分析等技术。并通过实验操作，让学生掌握先进半导体工艺技术，实现理论与实践的融合。

This lecture focuses on the basic features of advanced semiconductor technology, including their distinctions and common underlying principle. Such as: Layout, how to use the lithography equipment, ICP, LPCVD etc. and the technology of ion implantation, epitaxy, chemical vapour deposition, plasma, film analysis etc. Through experimental operation, students can master various practical abilities of advanced semiconductor technology, and realize the integration of theory and practice.

16. 预达学习成果 Learning Outcomes

1. 学习使用 EDA 工具制作先进半导体工艺器件版图

Use EDA tools to make advanced semiconductor device layout.

2. 掌握先进半导体工艺测试技术及测试设备使用方法

Master the use of testing equipment for advanced semiconductor processes.

3. 掌握先进半导体工艺制成原理及设备的使用方法，例如：紫外线光刻机、金属溅射设备、快速热退火设备等

Master the advanced semiconductor processes and operational principle, such as: Photolithography、Sputter、RTP etc.

4. 掌握先进半导体工艺器件的测量方法及数据分析手段，例如：探针台等设备的使用

Master the methods of electrical measurement and analysis for semiconductor devices, such as: Probe station, etc.

5. 掌握先进半导体工艺器件制备的工艺流程

Master the processes of advanced semiconductor device.

6. 养成良好的实验习惯，具备良好的安全规范意识。

Develop good habits of experimental and a good sense of safety and regulation.

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：介绍先进半导体工艺流程及安全规范（理论课）、先进半导体工艺器件版图设计（实验课）

Week 1: Introduce advanced semiconductor process and Safety Training of Clean room, Advanced semiconductor device layout

第 2 周：先进半导体工艺制备技术及原理（理论课）、讲解半导体器件标识制作工艺原理，并完成先进半导体器件标识制作实验（实验课）

Week 2: Introduce advanced semiconductor process preparation and operational principle, complete laser marking experiment

第 3 周：先进半导体工艺制备技术及原理（理论课）、讲解薄膜沉积工艺制备设备使用方法，并完成先进半导体工艺器件薄膜沉积实验（实验课）

Week3: Introduce advanced semiconductor process preparation and operational principle, introduce the application method of film deposition process and complete the film deposition experiment.

第 4 周：先进半导体工艺制备技术及原理（理论课）、讲解前段工艺清洗槽设备及紫外线光刻机、匀胶机、热板等设备工作原理及使用方法，并完成先进半导体工艺器件光刻实验（实验课）

Week4: Introduce advanced semiconductor process preparation and operational principle, introduce the equipment of photoetching machine etc. and complete the photoetching experiment.

第 5 周：先进半导体工艺制备技术及原理（理论课）、讲解湿法刻蚀工艺制备方法，并使用椭偏仪辅助计算刻蚀速率，完成湿法刻蚀工艺实验（实验课）

Week5: Introduce advanced semiconductor process preparation and operational principle, introduce the process of wet etching and complete the wet etching experiment.

第 6-7 周：先进半导体工艺制备技术及原理（理论课）、讲解先进半导体后段（金属）工艺及相关设备使用，完成硅片表面金属镀层实验（实验课）

Week6-7: Introduce advanced semiconductor process preparation and operational principle, introduce the equipment of ALD and Sputter, and complete the experiment of metal coating.

第 8 周：先进半导体工艺制备技术及原理（理论课）、讲解半导体多层光刻技术及相关设备使用方法，完成硅片表面多层光刻实验（实验课）

Week8: Introduce advanced semiconductor process preparation and operational principle, complete the photoetching experiment of metal.

第 9 周：先进半导体技术与应用（理论课）、讲解干法刻蚀工艺技术及 ICP 设备使用方法，并完成对硅片表面金属层的刻蚀实验（实验课）

Week9: Introduce advanced semiconductor technology and application, introduce the ICP equipment and complete the dry etching.

第 10 周：先进半导体技术与应用（理论课）、讲解快速热退火工艺技术及相关设备使用方法，完成高温热退火工艺实验

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| <p>(实验课)</p> <p>Week10: Introduce advanced semiconductor technology and application, introduce the RTP equipment and complete the rapid thermal processing.</p> <p>第 11 周: 先进半导体技术与应用 (理论课)、讲解晶圆切割工艺技术及 Dicing 设备使用方法, 完成晶圆切割工艺实验 (实验课)</p> <p>Week11: Introduce advanced semiconductor technology and application, introduce the Dicing equipment and complete the wafer saw.</p> <p>第 12 周: 先进半导体技术与应用 (理论课)、讲解蒸镀工艺技术及相关设备使用方法, 并完成金属蒸镀实验 (实验课)</p> <p>Week12: Introduce advanced semiconductor technology and application, introduce the evaporator equipment and complete the equipment of metal planting.</p> <p>第 13 周: 讲解先进半导体器件电性能测试原理、设备及使用方法, 并完成对器件的电性能测试实验 (实验课)</p> <p>Week 13: Introduce the testing methods of semiconductor device, electrical performance testing by probe stations</p> <p>第 14 周: 讲解对先进半导体器件表面工艺的测试方法及相关设备的使用、完成对先进半导体器件表面情况的检视实验 (实验课)</p> <p>Week 14: Introduce the testing methods of semiconductor device, visual check of capacitor by SEM</p> <p>第 15 周: 讲解对先进半导体工艺器件的环保要求, 例如 RoHS 指令、REACH 指令等, 完成通过分析物质成分表、第三方检测报告判断芯片或器件是否符合不同应用领域的环保要求的实践活动</p> <p>Week 15: introduce the environmental directive of integrated circuit, such as ROHS and REACH, analysis of MSDS, SGS Report etc</p> <p>第 16 周: 总结回顾集成电路工艺流程, 讲解集成电路工艺的品质管理要求、常见问题及解决方案, 完成分组问答等形式的课堂实践活动</p> <p>Week 16: introduce the safety standard of integrated circuit, learning quality management</p> |
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18. 教材及其它参考资料 Textbook and Supplementary Readings

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| 《微电子制造科学原理与工程技术》, Stephen A. Campbell, 电子工业出版社 |
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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 | | |
| 小测验 | | | | |

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| Quiz | | | | |
| 课程项目 Projects | | 30 | | |
| 平时作业 Assignments | | | | |
| 期中考试 Mid-Term Test | | | | |
| 期末考试 Final Exam | | | | |
| 期末报告 Final Presentation | | 20 | | |
| 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

