

SME305课程大纲

- 1、2021秋季学期-2024春季学期 (1-6页码)
- 2、2024秋季学期起(7-11页码)

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	超大规模集成电路工艺原理 VLSI Fabrication Technology
2.	授课院系 Originating Department	深港微电子学院 School of Microelectronics
3.	课程编号 Course Code	SME305
4.	课程学分 Credit Value	3
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)	汪飞, 副教授, 深港微电子学院 办公室: 第二科研楼 506 室 Email: wangf@sustech.edu.cn 电话: 0755-8801-8509 WANG Fei, Assoc. Prof., School of Microelectronics Office: Room No. 506, Faculty Research Building 2 Email: wangf@sustech.edu.cn Telephone: 0755-8801-8509
9.	实验员/助教、所属学系、联系方式 Tutor/TA(s), Contact	无 NA / 待公布 To be announced / 已确定的实验员/助教联系方式 Please list all Tutor/TA(s) 蒋苓利, 教学实验师 JIANG lingli, Teaching Engineer Email: jiangll@sustech.edu.cn
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	32		32		64
12. 先修课程、其它学习要求 Pre-requisites or Other Academic Requirements					
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

本课程帮助学生了解建立先进半导体集成电路前段和末端工艺技术。通过讨论书中的基本原理，扩增参考文献等，加强对每一个方向问题的理解。在上课时让学生用学到的知识去解决现实试验中出现的种种问题。通过本节课知识点的理解学生将充分了解每一个制造工艺的优点和局限性。目的希望学生能够真正独立设计器件，并能够在实际生产试验中发现解决问题。

This course helps students establish a basic understanding of the front- and back-end processing in modern VLSI technology. The lectures discuss the fundamentals; the textbook and reference materials provide amplification, as well as direction for further exploration; and the problems and projects enhance topic understanding, and allow students to apply the knowledge gained from lectures and texts to solve practical problems. The knowledge acquired in this course will allow the student to understand the advantages and constrains of each fabrication technology. Students will be able to design practical fabrication strategies and trouble-shoot manufacturing problems for various types of semiconductor devices.

16. 预达学习成果 Learning Outcomes

通过本课，学生将理解微电子加工中的一些基本工艺；将了解一系列半导体工艺技术，如热处理（氧化、扩散、退火），离子注入，光刻，薄膜沉积（物理沉积法、化学沉积法），刻蚀（湿法刻蚀、干法刻蚀、离子刻蚀等）的工艺设备；将获得一定的超净间动手经验；将学会分析湿法腐蚀与干法腐蚀的优劣；将比较化学气相沉积与物理气相沉积的不同；将能评估一个工艺流程的复杂度。

After this course, the students should be able to,

1. Understand a few basic fundamental processing technologies in microelectronic fabrication technology;
2. Know the facilities for thermal processing (oxidation, diffusion, rapid- thermal annealing), ion implantation, lithography, thin film deposition (physical and chemical), and etching (wet, dry plasma and ion milling);
3. Gain some hand-on experience in the cleanroom;
4. Analyze the advantages and disadvantages of wet and dry etching;
5. Compare the Chemical vapor deposition and Physical vapor deposition;
6. Estimate the complexity of a process flow.

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.)

Theory Part		
	Topics	Reading
Lecture 1	Syllabus, Introduction	
Lecture 2	Wafer substrate, cleanroom	Chapters 1-4
Lecture 3	Pattern transfer: Lithography I	Chapter 5
Lecture 4	Pattern transfer: Lithography II	Chapter 5
Lecture 5	Etching I: Wet etching	Chapter 10
Lecture 6	Etching II: Dry etching	Chapter 10
	Quiz 1	
Lecture 7	Hot processing: Thermal oxidation I	Chapter 6
Lecture 8	Hot processing: Thermal oxidation II	Chapter 6
Lecture 9	Hot processing: Diffusion I	Chapter 7
Lecture 10	Hot processing: Diffusion II	Chapter 7
Lecture 11	Ion implantation I	Chapter 8
Lecture 12	Ion implantation II	Chapter 8
	Quiz 2	
Lecture 13	Thin films I	Chapter 9
Lecture 14	Thin films II	Chapter 9
Lecture 15	Isolation, contacts, and metallization	Chapter 11
Lecture 16	Process integration, MEMS process	
	Final Exam	

Experiment Part

	Topics	Stage
Lecture 1	Introduction for Athena	Single step process simulation
Lecture 2	Mesh and initialize simulation with Athena	Single step process simulation
Lecture 3	Implant simulation with Athena	Single step process simulation
Lecture 4	Diffuse simulation with Athena	Single step process simulation
Lecture 5	Deposit and etch simulation with Athena	Single step process simulation
Lecture 6	Epitaxy, polishing and oxidation simulation with Athena	Single step process simulation
Lecture 7	Extract simulation with Athena	Single step process simulation
Lecture 8	Structure simulation with Athena	Single step process simulation
Lecture 9	CMOS process simulation project- Part 1	Project simulation
Lecture 10	CMOS process simulation project- Part 2	Project simulation
Lecture 11	CMOS process simulation project- Part 3	Project simulation
Lecture 12	CMOS process simulation project- Part 4	Project simulation

Lecture 13	PECVD deposit for SiO ₂ and SiN	operation in clean room
Lecture 14	Photolithography	operation in clean room
Lecture 15	Etching for SiO ₂ , SiN and Si	operation in clean room
Lecture 16	Testing with step profiler	operation in clean room

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

指定教材: James D. Plummer, Michael Deal, Peter D. Griffin, Silicon VLSI Technology, 2th Ed. Prentice Hall, 2008.

推荐参考资料: Stephen A. Campbell, Fabrication Engineering at the Micro- and Nanoscale, 4rd Ed. Oxford University Press, 2012

MIT OpenCourseWare: MIT 6.152J - Micro/Nano Processing Technology

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		20		
小测验 Quiz		10		
课程项目 Projects		30		
平时作业 Assignments		5		
期中考试 Mid-Term Test		10		
期末考试 Final Exam		10		
期末报告 Final Presentation		15		
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

课程详述

COURSE SPECIFICATION

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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)	1. 汪飞，教授，深港微电子学院 办公室：工学院北楼 122 Email: wangf@sustech.edu.cn 电话：0755-8801-0187 1. WANG Fei, Prof., School of Microelectronics Office: N122, COE, Email: wangf@sustech.edu.cn Telephone: 0755-8801-0187
9.	实验员/助教、所属学系、联系方式 Tutor/TA(s), Contact	无 NA / 待公布 To be announced / 已确定的实验员/助教联系方式 Please list all Tutor/TA(s) 蒋苓利，教学实验师 JIANG lingli, Teaching Engineer Email: jiangll@sustech.edu.cn
10.	选课人数限额(可不填)	40 (实验课 25)

	Maximum (Optional)	Enrolment					
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		32		32		64
12.	先修课程、其它学习要求 Pre-requisites or Other Academic Requirements		SME204 微电子基础 II				
13.	后续课程、其它学习规划 Courses for which this course is a pre-requisite						
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