

## 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<br><b>Course Title</b>  | 半导体器件及封装基础<br>Fundamentals of Semiconductor Devices and Packaging   |
| 2.  | 授课院系<br><b>Originating Department</b>  | 深港微电子学院<br>School of Microelectronics   |
| 3.  | 课程编号<br><b>Course Code</b>   | SME319  |
| 4.  | 课程学分<br><b>Credit Value</b>  | 3   |
| 5.  | 课程类别<br><b>Course Type</b>   | 专业核心课 Major Core Courses  |
| 6.  | 授课学期<br><b>Semester</b>  | 春季 Spring   |
| 7.  | 授课语言<br><b>Teaching Language</b>   | 中英双语 English & Chinese  |
| 8.  | 授课教师、所属学系、联系方式<br>(如属团队授课, 请列明其他授课教师)<br><b>Instructor(s), Affiliation &amp; Contact</b><br>(For team teaching, please list all instructors) | 叶怀宇<br>深港微电子学院 副教授<br>Email: <a href="mailto:yehy@sustech.edu.cn">yehy@sustech.edu.cn</a><br>办公地点: 台州楼 104<br>Huaiyu YE<br>Associate Professor, School of Microelectronics<br><a href="mailto:yehy@sustech.edu.cn">yehy@sustech.edu.cn</a><br>Room 104, Taihou Hall |
| 9.  | 实验员/助教、所属学系、联系方式<br><b>Tutor/TA(s), Contact</b>  | 待公布 To be announced   |
| 10. | 选课人数限额(可不填)<br><b>Maximum Enrolment (Optional)</b>   |   |

|                             |          |           |               |                        |       |
|-----------------------------|----------|-----------|---------------|------------------------|-------|
| 11. 授课方式<br>Delivery Method | 讲授       | 习题/辅导/讨论  | 实验/实习         | 其它(请具体注明)              | 总学时   |
|                             | Lectures | Tutorials | Lab/Practical | Other (Please specify) | Total |
| 学时数<br>Credit Hours         | 42       | 6         | 0             |                        | 48    |

|   |                                 |
|---|---------------------------------|
| 12. 先修课程、其它学习要求<br>Pre-requisites or Other Academic Requirements    | PHY105B 大学物理(下) B、EE204 半导体器件导论 |
| 13. 后续课程、其它学习规划<br>Courses for which this course is a pre-requisite |                                 |
| 14. 其它要求修读本课程的学系<br>Cross-listing Dept.                             |                                 |

### 教学大纲及教学日历 SYLLABUS

#### 15. 教学目标 Course Objectives

本课程主要介绍基于硅基、化合物半导体、宽禁带半导体器件等的工艺、原理、技术及应用，包括晶体管、功率器件、发光器件、传感器件、碳化硅及氮化镓器件、超宽禁带器件、二维半导体材料器件等，并且介绍器件的封装及应用。通过本课程让本专业学生掌握先进半导体器件及封装的基本概念、原理、工艺与应用场景。

This course will be focused on the silicon, compound semiconductors, wide bandgap materials, starts from the device process, and then introduces the technologies and applications, including transistors, power electronics, light-emitting diodes, sensors, SiC and GaN devices, ultra-wide bandgap semiconductors, 2D semiconductors and etc. It then introduces the device packaging and applications. After completing the course, students should master the fundamental principles, process and application of advanced semiconductor devices and packaging.

#### 16. 预达学习成果 Learning Outcomes

通过本课程的学习，让学生在基于硅晶体管工艺的基础上，进一步了解功率器件、发光器件、传感器件、碳化硅及氮化镓器件、超宽禁带器件、二维半导体材料器件及封装，及各类器件的多元化应用，能够让微电子专业的学生更加深刻的了解半导体技术除了在数字领域外，还具有更为广阔的应用前景。具体包括，各类器件的材料、结构、工艺、封装、测试以及应用。

After completing the course, students will understand the devices, packaging and applications of power electronics, light-emitting diodes, sensors, SiC and GaN devices, ultra-wide bandgap semiconductors, 2D semiconductors and etc based on the knowledge of transistor process. It will broaden the knowledge of student on semiconductors, including materials, structure, process, packaging, testing and application.

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.)**

课程将讲授晶体管、功率器件、发光器件、传感器件、碳化硅及氮化镓器件、超宽禁带器件、二维半导体材料器件的工艺流程及应用，并介绍器件的封装及应用。

This course will include the following chapters related on the transistors, power electronics, light-emitting diodes, sensors, SiC and GaN devices, ultra-wide bandgap semiconductors, 2D semiconductors and etc. It then introduces the device packaging and applications.

主要内容包括：

(1-2 学时) 课程介绍 Introduction

(3-6 学时) 器件基本原理 Device physics

(7-10 学时) 图形化工艺及原理 Patterning process and principal

(11-14 学时) 薄膜工艺及原理 Thin film process and principal

(15-18 学时) 掺杂工艺及原理 Doping process and principal

(19-24 学时) 晶体管制造原理及工艺 Process and principal for transistors

(25-30 学时) CMOS 集成制造 CMOS integration

(31-34 学时) 发光器件及封装 Light-emitting diodes and packaging

(35-38 学时) 功率 IGBT 器件及封装 IGBT Power electronics and packaging

(39-42 学时) SiC 器件及 GaN 器件及封装 SiC and GaN devices and packaging

(43-44 学时) MEMS 传感器及微传动器 MEMS devices including sensors and actuators

(45-46 学时) 封装及集成工艺 Packaging process for integration

(47-48 学时) 二维半导体材料器件 2D semiconductors

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

参考资料 References:

Introduction to microelectronic fabrication, Richard C. Jaeger, Prentice Hall, ISBN: 9780201444940

Gallium Nitride And Silicon Carbide Power Devices ,B. Jayant Baliga, World Scientific Publishing Co Pte Ltd  
 ISBN: 9813109408

Fundamentals of Microsystems Packaging, Rao R. Tummala, McGraw-Hill Professional , ISBN-13: 9780071371698

**课程评估 ASSESSMENT**

| 19. 评估形式<br>Type of Assessment   | 评估时间<br>Time | 占考试总成绩百分比<br>% of final score | 违纪处罚<br>Penalty | 备注<br>Notes |
|--|--------------|-------------------------------|-----------------|-------------|
| 出勤 Attendance  |              | 10                            |                 |             |
| 课堂表现<br>Class Performance  |              | 30                            |                 |             |
| 小测验<br>Quiz  |              |                               |                 |             |
| 课程项目<br>Projects   |              |                               |                 |             |
| 平时作业<br>Assignments  |              |                               |                 |             |
| 期中考试<br>Mid-Term Test  |              |                               |                 |             |
| 期末考试<br>Final Exam   |              | 60                            |                 |             |
| 期末报告<br>Final Presentation   |              |                               |                 |             |
| 其它（可根据需要<br>改写以上评估方式）<br>Others (The above may be modified as necessary) |              |                               |                 |             |

University

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

