

## 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.	<b>课程名称 Course Title</b>	封装材料与技术 Packaging Materials and Technology
2.	<b>授课院系 Originating Department</b>	材料科学与工程系 Department of Materials Science and Engineering
3.	<b>课程编号 Course Code</b>	MSE410
4.	<b>课程学分 Credit Value</b>	3
5.	<b>课程类别 Course Type</b>	专业核心课 Major Core Courses
6.	<b>授课学期 Semester</b>	秋季 Fall
7.	<b>授课语言 Teaching Language</b>	中英双语 English & Chinese
8.	<b>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 &amp; Contact (For team teaching, please list all instructors)</b>	于严焱, 材料科学与工程系, 电子邮箱: yuyh@sustech.edu.cn Yanhao Yu, Department of Materials Science and Engineering, Email: yuyh@sustech.edu.cn
9.	<b>实验员/助教、所属学系、联系方式 Tutor/TA(s), Contact</b>	待公布 To be announced
10.	<b>选课人数限额(可不填) Maximum Enrolment (Optional)</b>	

11. 授课方式 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 Credit Hours	48				48
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 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					
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

封装材料与技术是芯片、LED、太阳能电池、储能电池等多种电子和能源系统稳定运行的关键。本课程讲授封装系统中的材料科学基础知识，内容包括封装介绍、热力学与动力学基础、断裂力学基础、陶瓷封装材料、高分子封装材料、微电子封装、有机发光二极管封装、生物医疗器件封装、太阳能电池封装、储能电池封装、光电化学器件封装等。通过本课程的学习，学生将具备封装相关的材料、物理、化学、力学基础知识，了解目前封装主要材料设计和工艺路线，把握新兴电子和能源系统的封装需求和发展方向，为未来在封装领域研究和工作打好基础。

Packaging materials and technology ensures the operational stability of electronic and energy systems such as semiconductor chips, light emitting diode, solar cells, energy storage batteries, making it an essential component for electronic and energy devices. This course emphasizes the materials science fundamentals in packaging systems. The content includes basic concepts of packaging materials, thermodynamics and kinetics, fracture mechanics, ceramic packaging materials, polymer packaging materials, microelectronic packaging, OLED packaging, packaging for biomedical devices, solar cell packaging, battery packaging, photoelectrochemical device packaging, and et. al. After taking this course, the students will acquire the materials, physics, chemistry, mechanics knowledge about packaging. They will know the main material and technological designs in current packaging industry. They will get familiar with the packaging needs and trends in emerging electronic and energy systems and be prepared for the future research and work in packaging area.

#### 16. 预达学习成果 Learning Outcomes

1. 学习封装材料与技术基础理论，掌握传质、传热、表面扩散、表面亲疏水、界面键合、界面断裂等基础知识。
2. 学习掌握封装评测技术，包括散热检测、水汽透过率测量、氧气透过率测量、断裂能测量等。
3. 学习掌握有机发光二极管、生物医疗器件、太阳能电池等新兴电子系统对封装材料的性能需求。
4. 能够应用材料热力学、表界面化学等知识，设计具有快速散热、高水氧阻隔、强界面粘附性能的封装系统。
5. 能够应用封装评测技术，进行封装材料可靠性和失效分析。
6. 通过英语教学，培养学生的专业英语能力，掌握课程核心词汇，能够阅读英语专业文献。

1. To understand the basic thermodynamic concepts in electronic packaging, such as mass transfer, heat transfer, surface diffusion, surface hydrophobicity, interface bonding, interfacial adhesion, et al.
2. To learn the evaluation and analysis techniques in electronic packaging, such as heat detection, measurement of water and oxygen vapor transport rates, measurement of fracture energy, et al.

3. To get familiar with the packaging needs and trends in emerging electronics, such as organic light emitting diodes, biomedical devices, solar cells et al.
4. Utilizing the thermodynamic and surface chemistry knowledge to design a packaging system with fast heat dissipation, high water and oxygen vapor barrier performance, and strong interfacial adhesion.
5. Utilizing the measurement techniques to evaluate the reliability and analyze the reasons upon disfunction in electronic packaging.
6. To cultivate the professional English ability, including mastering the core vocabulary in electronic packaging and reading English literature.

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.)**

- 第一章 封装简介（2学时）
- 第二章 热力学与动力学基础（8学时）
- 第三章 断裂力学基础（6学时）
- 第四章 陶瓷封装材料（4学时）
- 第五章 高分子封装材料（4学时）
- 第六章 微电子封装（4学时）
- 第七章 有机发光二极管封装（4学时）
- 第八章 生物医疗器件封装（4学时）
- 第九章 太阳能电池封装（4学时）
- 第十章 储能电池封装（4学时）
- 第十一章 光电化学器件封装（4学时）

- Lecture 1. Introduction of packaging materials (2 credit hours)
- Lecture 2. Thermodynamics and kinetics (8 credit hours)
- Lecture 3. Fracture mechanics (6 credit hours)
- Lecture 4. Ceramic packaging (4 credit hours)
- Lecture 5. Polymer packaging (4 credit hours)
- Lecture 6. Microelectronic packaging (4 credit hours)
- Lecture 7. OLED packaging (4 credit hours)
- Lecture 8. Biomedical device packaging (4 credit hours)
- Lecture 9. Solar cell packaging (4 credit hours)
- Lecture 10. Energy storage battery packaging (4 credit hours)
- Lecture 11. Photoelectrochemical device packaging (4 credit hours)

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

**1. Textbook**

Electronic Packaging and Interconnection Handbook, 4th Edition, Charles A. Harper, 2004, McGraw-Hill Education

**2. Supplementary Readings**

- (1) Materials for Advanced Packaging. Book, 2nd Edition, Daniel Lu and C.P. Wong, 2017, Springer
- (2) 电子元器件可靠性设计, 王蕴辉、孙再吉, 2007, 科学出版社

**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				
小测验 Quiz				
课程项目 Projects				
平时作业 Assignments		10		
期中考试 Mid-Term Test		40		
期末考试 Final Exam				
期末报告 Final Presentation		40		
其它（可根据需要 改写以上评估方 式） Others (The above may be modified as necessary)				

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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

教学负责人签字：  
 日期：