

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	化学燃料电池技术 Chemical Fuel Cell Technology				
2.	授课院系 Originating Department	机械与能源工程系 Department of Mechanical and Energy Engineering				
3.	课程编号 Course Code	ME409				
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)	王海江 机械与能源工程系 慧园 5-405, wanghj@sustech.edu.cn Haijiang Wang, Department of Mechanical and Energy Engineering Wisdom Valley 5-405, wanghj@sustech.edu.cn				
9.	实验员/助教、所属学系、联系方式 Tutor/TA(s), Contact					
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	ME304 能源工程基础 ME304 Fundamentals of Energy 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

本课程系统地介绍质子交换膜燃料电池的基本原理、热力学、动力学、结构、材料、电堆与系统设计、燃料电池测试、模拟及诊断等有关内容。通过本课程学习，可以让学生掌握氢能与燃料电池的基本知识，了解国内外氢能与外燃料电池的发展趋势，拓宽学生的专业知识面，加深对新能源开发与利用的了解，提高学生分析和解决工程实际问题的能力，为学生将来在能源与环境领域从事科研和工程应用打好基础。 This course will systematically introduce PEM fuel cell's principles, thermodynamic, kinetics, configuration, materials, stack and system design, fuel cell testing, modelling and diagnosis etc. Through this course, students will learn the fundamental knowledge of hydrogen and fuel cell technology, understand the technology development of fuel cells in China and abroad, expand their knowledge base in energy technologies, deepen their understanding of the development and applications of new energy technologies, enhance their capabilities to analyze and solve practical problems, build a strong base for students to work on research or engineering in the field of energy and environments in the future.

16. 预达学习成果 Learning Outcomes

本课程采用多媒体教学与板书结合的授课方式，教学中通过对案例分析的方法来阐述某些枯燥难懂的基本原理，拟邀请 1~2 位氢能或燃料电池专家来课堂讲座，使学生更深刻的了解该课程的应用及重要性，能跟踪世界前沿的相关知识和技术。

Multimedia will be the major teaching tool and board writing will be used as a supplementary tool to help students fully understand some difficult points. Case study will be used to illustrate some of the difficult principles and topics, which will help students to grasp the knowledge in a more in-depth manner. One or two expert speakers in the areas of hydrogen and fuel cell technology will be invited to give seminars on specific topics to help students understand how the related theory and principles are useful.

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.)

理论部分:

1. 燃料电池简介 (2 课时)
2. 燃料电池的基本化学反应及热力学(1 课时)
3. 燃料电池电化学(1 课时)
4. 主要部件、材料性能和制作过程(4 课时)
5. 燃料电池操作条件(4 课时)
6. 电堆设计(4 课时)
7. 燃料电池模拟(4 课时)
8. 燃料电池诊断(2 课时)
9. 燃料电池系统设计(4 课时)
10. 燃料电池应用(2 课时)

11. 燃料电池耐久性(2 课时)
12. 燃料电池和氢能的未来(2 课时)

实验部分:

1. 电解水制氢(4 课时)
2. 双极板制作(4 课时)
3. 膜电极制作(8 课时)
4. 燃料电池测试(16 课时)

Theoretical part:

1. Introduction (2 hours)
2. Fuel cell basic chemistry and thermodynamics (1 hours)
3. Fuel cell electrochemistry (1 hours)
4. Main cell components, material properties, and processes (4 hours)
5. Fuel cell operating conditions (4 hours)
6. Stack design (4 hours)
7. Fuel cell modeling (4 hours)
8. Fuel cell diagnostics (2 hours)
9. Fuel cell system design (4 hours)
10. Fuel cell applications (2 hours)
11. Durability of polymer electrolyte fuel cells (2 hours)
12. Future of fuel cells and hydrogen (2 hours)

Experimental part:

1. Water electrolysis for Hydrogen production (4 hours)
2. Bipolar plate fabrication (4 hours)
3. Membrane-electrode-assembly fabrication (8 hours)
4. Fuel cell testing (16 hours)

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

1. Frano Barbir, *PEM Fuel Cells – Theory and Practice*, Elsevier, Second Edition, 2013.
2. James Larminie, Andrew Dicks. *Fuel Cell Systems Explained*, Second Edition, 2013.

课程评估 **ASSESSMENT**

19. 评估形式 评估时间 占考试总成绩百分比 违纪处罚 备注

Type of Assessment	Time	% of final score	Penalty	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				
期中考试 Mid-Term Test		40		
期末考试 Final Exam		50		
期末报告 Final 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