

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	新能源技术：氢能与燃料电池技术 Fuel Cell Technology
2.	课程编号 Course Code	MEE5402
3.	课程学分 Credit Value	3/48
4.	授课语言 Teaching Language	中、英双语 Chinese-English bilingual
5.	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 Haijiang Wang, Department of Mechanical and Energy Engineering Wisdom Valley 5-405
6.	是否面向本科生开放 Open to undergraduates or not	是 Yes
7.	先修课程、其它学习要求 Pre-requisites or Other Academic Requirements	本科生：ME304 能源工程基础 ME304 Fundamentals of Energy Engineering

教学大纲及教学日历 SYLLABUS

8.	教学目标 Course Objectives	<p>本课程首先向学生介绍不同类型的燃料电池技术，包括质子交换膜燃料电池、固体氧化物燃料电池、直接碳燃料电池、直接甲醇燃料电池、碱性燃料电池、熔融碳酸盐燃料电池、磷酸燃料电池、金属-空气电池、微生物燃料电池和酶催化燃料电池，接下来系统讲授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、诊断及寿命研究等有关内容。</p> <p>The course will first introduce different types of fuel cell technologies, including proton exchange membrane fuel cell, solid oxide fuel cell, direct carbon fuel cell, direct methanol fuel cell, alkaline fuel cell, molten carbonate fuel cell, phosphoric acid fuel cell, metal-air fuel cell, microbial fuel cell and enzyme fuel cell. After that the course will systematically teach students PEM fuel cell's principles, thermodynamic, kinetics, configuration, materials, stack and system design, fuel cell testing, modelling, diagnosis and durability studies etc.</p>
8.	预达学习成果 Learning Outcomes	通过本课程学习，学生将了解不同类型的燃料电池的原理、结构、技术现状及技术难点，掌握质子交换膜燃料电池的工作原理、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、诊断

	<p>及寿命研究等有关知识。</p> <p>Through this course, students will understand the principles, the structure, the current technologies and the technical challenges of different types of fuel cells. Students will further attain the knowledge of proton exchange membrane fuel cell including the operation principle, thermodynamics, kinetics, structure, materials, stack and system design, fuel cell testing, modelling, diagnosis and durability study etc.</p>
9.	<p>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）</p> <p>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.)</p>
	<ol style="list-style-type: none"> 1. 燃料电池简介 (2 课时) 2. 固体氧化物燃料电池 (3 课时) 3. 直接碳燃料电池 (2 课时) 4. 直接甲醇燃料电池 (3 课时) 5. 碱性燃料电池 (2 课时) 6. 熔融碳酸盐燃料电池 (1 课时) 7. 磷酸燃料电池 (1 课时) 8. 金属-空气电池 (2 课时) 9. 微生物燃料电池和酶催化燃料电池 (2 课时) 10. PEM 燃料电池的基本化学反应及热力学 (1 课时) 11. PEM 燃料电池电化学 (1 课时) 12. PEM 燃料电池主要部件、材料性能和制作过程 (4 课时) 13. PEM 燃料电池操作条件 (4 课时) 14. PEM 燃料电池电堆设计 (4 课时) 15. PEM 燃料电池模拟 (4 课时) 16. PEM 燃料电池诊断 (2 课时) 17. PEM 燃料电池系统设计 (4 课时) 18. PEM 燃料电池应用 (2 课时) 19. PEM 燃料电池耐久性 (2 课时) 20. 氢能 (2 课时) <ol style="list-style-type: none"> 1. Fuel cell introduction (2 hours) 2. Solid oxide fuel cell (3 hours) 3. Direct carbon fuel cell (2 hours) 4. Direct methanol fuel cell (3 hours) 5. Alkaline fuel cell (2 hours) 6. Molten carbonate fuel cell (1 hours) 7. Phosphoric acid fuel cell (1 hours)

	8. Metal-air fuel cell (2 hours) 9. Microbial fuel cell and enzyme fuel cell (2 hours) 10. PEM fuel cell basic chemistry and thermodynamics (1 hours) 11. PEM fuel cell electrochemistry (1 hours) 12. PEM fuel cell main cell components, material properties, and processes (4 hours) 13. PEM fuel cell operating conditions (4 hours) 14. PEM fuel cell stack design (4 hours) 15. PEM fuel cell modeling (4 hours) 16. PEM fuel cell diagnostics (2 hours) 17. PEM fuel cell system design (4 hours) 18. PEM fuel cell applications (2 hours) 19. Durability of PEM fuel cells (2 hours) 20. Hydrogen (2 hours)
11.	课程考核 Course Assessment
	(1) 考核形式 Form of examination: Assessment (2) 分数构成 grading policy: a.出勤 Attendance 10%; b.期中考试 Mid-term exam 30%; c.期末考试 Final report/presentation 40% d. 期末报告 final report 20%
12.	教材及其它参考资料 Textbook and Supplementary Readings
	1. Frano Barbir, <i>PEM Fuel Cells – Theory and Practice, Elsevier, Second Edition, 2013.</i> 2. James Larminie, Andrew Dicks. <i>Fuel Cell Systems Explained, Second Edition, 2013.</i>