上海交通大学研究生课程开设申请表

New Graduate Course Application Form, SJTU

<table>
<tr><th colspan="6">课程基本信息 Basic Information</th></tr>
<tr><td rowspan="2">*课程名称
Course Name</td><td colspan="5">（中文 Chinese）氢能技术与材料</td></tr>
<tr><td colspan="5">（英文 English）Hydrogen Technology and Materials</td></tr>
<tr><td>*学分
Credits</td><td>3</td><td>*学时
Teaching Hours</td><td colspan="3">48（1 学分≥16 课时）</td></tr>
<tr><td>*开课学期
Semester</td><td>秋季学期 Fall</td><td>*是否跨学期
Cross-semester?</td><td>否 No</td><td colspan="2">跨 Spanning over 个学期
Semesters（含夏季学期）。</td></tr>
<tr><td>*课程性质
Course Category</td><td>专业课 Specialized Course</td><td>*课程分类
Course Type</td><td colspan="3">全日制课程 For full-time students</td></tr>
<tr><td>*授课语言
Instruction Language</td><td>中文 Chinese</td><td>主要授课方式
Teaching Method</td><td colspan="3">课堂教学 In class teaching</td></tr>
<tr><td>*成绩类型
Grade</td><td>等第制 Letter grading</td><td>主要考核方式
Exam Method</td><td colspan="3">论文 Essay</td></tr>
<tr><td>*开课院系
School</td><td colspan="5">材料科学与工程学院</td></tr>
<tr><td>所属学科
Subject</td><td colspan="5">材料科学与工程</td></tr>
<tr><td rowspan="2">负责教师
Person in charge</td><td>姓名 Name</td><td>工号 ID</td><td>单位 School</td><td colspan="2">联系方式 E-mail</td></tr>
<tr><td>陈娟</td><td></td><td>材料科学与工程学院</td><td colspan="2">juanchen@sjtu.edu.cn</td></tr>
<tr><th colspan="6">课程扩展信息 Extended Information</th></tr>
<tr><td>*课程简介
(中文)
Course Description</td><td colspan="5">（分段概述课程定位、教学目标、主要内容、先修课程等；不少于 200 字。）

本课程着眼于氢能研究领域的当前热点方向，包括产氢、储氢、用氢、氢安全等全方位研究领域。本课程将深入系统全面地涵盖上述各方面所涉及到的电催化、光电催化、光电（热）转化、燃料电池、氢敏和氢脆等物理化学、材料科学理论，以及从原材料到系统的设计优化。本课程将从相关反应的物理化学以及材料科学基础概念和原理出发，结合材料计算学、材料实验学等从理论预测、基元材料设计到器件集成优化等的前沿动态和应用实例进行课程内容讲授。
本课程将理论知识点讲述与各分支学科领域的前沿发展相结合，强调问题为导向，指导并强化学生发现、分析和解决问题的能力。同时，本课程遵循新兴氢能相关的物理化学相关学科发展与创新规律，强调其中新原理、新知识、新成果、新应用的理解和运用。
通过本课程学习，希望学生能够掌握氢能源领域的整体发展概况、相关的技术与核心材料，能阐明氢能源技术的路径分支，各种技术方案的优缺点及应用范围与条件，了解当前最新的氢能技术，相关材料的需求及应用。希望本课程能为我国氢能产业培养一批基础扎实，富有创新力，并且具有民族自豪感、国际视野和竞争力的卓越人才。</td></tr>
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*课程简介
（English）
Course Description

（须与中文一致，翻译请力求信达雅。）

This course focuses on the current hot research fields of hydrogen energy, including hydrogen production, hydrogen storage, hydrogen utilization and hydrogen safety technologies. This course will thoroughly and comprehensively cover the physical chemistry and material science theories on electrocatalysis, photocatalysis, photoelectric (thermal) conversion, fuel cell, hydrogen sensitivity and hydrogen embrittlement, as well as the design optimization from raw materials to system. This course will start from the basic concepts and principles of physicochemistry and material science of related reactions, and combine the academic foreground and practical examples of theoretical prediction through material calculation, material experiment, elementary material design and device integration optimization.

This course combines the theoretical knowledge with the latest development of each branch discipline field, and strengthens the ability of students to discover, analyze and solve problems based on the problem orientation. At the same time, the course follows the laws of development and innovation of physical chemistry related to emerging hydrogen energy, emphasizing the understanding and utilizing of new principles, new knowledge, new achievements and new applications.

After the course, students are expected to master the overall development of hydrogen energy field, relevant technologies and core materials, clarify the path branches of hydrogen energy technology, advantages, disadvantages application scope and conditions of various technical schemes, and understand the latest hydrogen energy technology. It is hoped that a group of outstanding talents with solid professional knowledge, innovation, national pride and international vision and competitiveness for Chinese hydrogen industry will be cultivated by this course.

*教学大纲
(中文)
Syllabus

（建议列表形式，各列内容：章节、主要内容、课时数、教学方式）

章节	教学内容	授课学时	教学方式	授课教师
第一章 导论	导论	1	讲述与互动	陈娟+权威专家
第二章 氢气制备	制氢技术概述	1	讲述与互动	宋钫
	水分解制氢原理	4	讲述与互动	宋钫
	水分解催化材料—阴极还原	2	讲述与互动	宋钫
	水分解催化材料—阳极氧化	2	讲述与互动	宋钫
	光催化和光电极材料	2	讲述与互动	宋钫
	水分解装置及应用	1	讲述与互动	宋钫
	水分解制氢实验	1	实验课	实验课
第三章 氢气存储	氢储运的技术及相关材料概述、方式、应用状况及其原理	2	讲述与互动	邹建新
	高压氢气存储技术与储氢罐、阀门及管道材料	2	讲述与互动	邹建新
	低温液态氢存储技术与保温材料	2	讲述与互动	邹建新
	固态储氢技术及固态储氢材料	2	讲述与互动	邹建新
	氢气储运体系的现状、问题及未来展望	3	讲述与互动	邹建新
	固态镁基储氢材料水解 / 热解性能测试	1	实验课	邹建新
第四章 燃料电池	燃料电池的概述、类型、电化学基础和各组分及作用	2	讲述与互动	邬剑波
	燃料电池阴极电极反应与催化材料	2	讲述与互动	邬剑波
	燃料电池阳极电极反应与催化材料	2	讲述与互动	邬剑波
	燃料电池质子膜与双极板	2	讲述与互动	邬剑波

	燃料电池工况条件运行与失效	2	讲述与互动	邬剑波
	膜电极的制备与测试评估	1	实验课	邬剑波
第五章 氢安全	加氢站技术与材料	2	讲述与互动	陈娟+业界专家
	氢气安全管理概述及基础理论	2	讲述与互动	陈娟
	氢气检测技术与材料	3	讲述与互动	陈娟
	氢环境中的材料安全	3	讲述与互动	陈娟
	氢气检测材料性能测试	1	实验课	陈娟

*教学大纲（English）Syllabus

（须与中文一致，翻译请力求信达雅。）

Chapter	Content	Hours	Format	Instructor
Chapter 1 Introduction	Introduction to the course	1	Narration and interaction	Juan Chen+ Authoritative expert
Chapter 2 Hydrogen Production	Overview of Hydrogen Production Technologies	1	Narration and interaction	Fang Song
	Introduction to Water Splitting	4	Narration and interaction	Fang Song
	Hydrogen Evolution Catalysts at Cathode	2	Narration and interaction	Fang Song
	Oxygen Evolution Catalysts at Anode	2	Narration and interaction	Fang Song
	Photcatalysts and Photoelectrocatalysts	2	Narration and interaction	Fang Song
	Electrolyzer for Water Splitting	1	Narration and interaction	Fang Song
	Assembling and Testing of Electrolyzer for Water Splitting	1	Experimental lesson	Fang Song
Chapter 3 Hydrogen storage	Introduction to the hydrogen storage technology and related materials, methods, applications and mechanism	2	Narration and interaction	Jianxin Zou
	High pressure hydrogen storage and related storage tank, valve and pipeline materials	2	Narration and interaction	Jianxin Zou
	Low temperature liquid hydrogen storage and related heat insulation materials	2	Narration and interaction	Jianxin Zou
	Solid state hydrogen storage and related materials	2	Narration and interaction	Jianxin Zou
	Hydrogen storage and transportation: Current states, challenges and perspectives	3	Narration and interaction	Jianxin Zou
	Mg based solid hydrogen storage materials: Hydrolysis and thermal decomposition properties	1	Experimental lesson	Jianxin Zou
Chapter 4	Introduction to Fuel Cell	2	Narration and interaction	Jianbo Wu

	Fuel Cell	ORR Catalytic Materials at Cathode	2	Narration and interaction	Jianbo Wu
		HOR Catalytic Materials at Anode	2	Narration and interaction	Jianbo Wu
		Membrane and Bipolar plate	2	Narration and interaction	Jianbo Wu
		Operation and Failure Analysis of Fuel Cell	2	Narration and interaction	Jianbo Wu
		Fabrication and Evaluation of MEA	1	Experimental lesson	Jianbo Wu
	Chapter 5 Hydrogen safety	Technology and materials of hydrogenation station	2	Narration and interaction	Juan Chen + Industry expert
		Overview and basic theory of hydrogen safety management	2	Narration and interaction	Juan Chen
		Technology and materials for hydrogen detection	3	Narration and interaction	Juan Chen
		Material safety in hydrogen environment	3	Narration and interaction	Juan Chen
		Optical performance test of hydrogen detection material	1	Experimental lesson	Juan Chen

*课程要求（中文）Requirements	（课程考核方式、考核标准等；不少于 50 字） 课程成绩：总分 100 分 主要由以下 5 部分组成:期末 PPT 讲演 20 分+期末大论文 30 分+平时作业 20 分+考勤 20 分+实验 10 分
*课程要求（English）Requirements	（须与中文一致，翻译请力求信达雅。） Total score: 100 points (Final presentation 20% + Final thesis 30% + Homework 20% + Attendance 20 % + Experiment 10 %)
课程资源（中文）Resources	（教材、教参、网站资料等。） 1. Kazunari Sasaki, Hai-Wen Li, Akari Hayashi, Junichiro Yamabe, Teppei Ogura, Stephen M. Lyth: Hydrogen Energy Engineering, Springer, 2016. 2. Paulo Emilio Miranda. Science and Engineering of Hydrogen-Based Energy Technologies: Hydrogen Production and Practical Applications in Energy Generation. Academic Press. 2018. 3. Frano Barbir;Angelo Basile;T. Nejat Veziroglu, Compendium of Hydrogen Energy: Hydrogen Energy, Woodhead Publishing, 2015. 4. Bent Sorensen, Giuseppe Spazzafumo, Hydrogen and Fuel Cells: Emerging Technologies and Applications. Academic Press. 2018. 5. 毛宗强, 毛志明, 余皓. 制氢工艺与技术, 化学工业出版社. 2018. 6. 蔡颖, 许剑轶, 胡峰, 赵鑫. 储氢技术与材料. 化学工业出版社. 2018. 7. [日]氢能协会编. 宋永臣, 宁亚东, 金东旭译. 氢能技术，科学出版社，2009.
课程资源（English）	（须与中文一致，请力求信达雅。）

Resources	
备注 Note	