

上海交通大学研究生课程开设申请表

New Graduate Course Application Form, SJTU

课程基本信息 Basic Information				
*课程名称 Course Name	(中文 Chinese) 氢科学基础及应用			
	(英文 English) Hydrogen Science: Fundamentals and Applications			
*学分 Credits	2	*学时 Teaching Hours	32 (1 学分≥16 课时)	
*开课学期 Semester	春季学期 Spring	*是否跨学期 Cross-semester?	否 No	跨 Spanning over 个学期 Semesters (含夏季学期)。
*课程性质 Course Category	专业课 Specialized Course	*课程分类 Course Type	全日制课程 For full-time students	
*授课语言 Instruction Language	英文 English	主要授课方式 Teaching Method	课堂教学 In class teaching	
*成绩类型 Grade	等第制 Letter grading	主要考核方式 Exam Method	论文 Essay	
*开课院系 School	材料科学与工程学院			
所属学科 Subject				
负责教师 Person in charge	姓名 Name	工号 ID	单位 School	联系方式 E-mail
	翁国明		材料科学与工程学院	guoming.weng@sjtu.edu.cn
课程扩展信息 Extended Information				
*课程简介 (中文) Course Description	(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。)			
	<p>《氢科学基础及应用》将立足于氢科学基础知识与理论，为已开设的《氢能技术与材料》课程提供理论支撑与补充。此外，这一新增课程会让学生了解“氢能源”以外的其他氢科学领域的基础知识与研究前沿。在已有《氢能技术与材料》课程的基础上，本课程将更加深入理论层面，系统地讲授氢的基本化学知识、物理化学性质与反应、不同领域的应用实例及机理、面临的关键问题和氢科学的展望等。本课程将理论知识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，遵循新兴氢科学相关的发展与创新规律，强调其中新原理、新知识、新成果、新应用的理解和运用。通过本课程的学习，(1) 学生能熟练掌握氢科学相关的发展概况、基础知识和技术应用的工作机理；(2) 学生能熟练掌握氢科学相关的物理化学反应过程中的基本理论知识；(3) 学生能清楚了解当前最新的氢科学应用领域及关键问题；(4) 学生能拓宽科学视野并激发其创新活力。</p>			
*课程简介 (English) Course Description	(须与中文一致，翻译请力求信达雅。)			
	<p>This course provides foundational knowledge of hydrogen science and serves as a supplemental course to <i>Hydrogen Technology and Materials</i>. Specifically, this course covers major fields of hydrogen science such as hydrogen energy, hydrogen biomedicine and hydrogen agriculture. As an extension of the aforementioned course, this course intends to help students develop a deep understanding on i) fundamentals of hydrogen; ii) properties of hydrogen; iii) physicochemical reactions of hydrogen production, utilization & storage; iv) basic principles & materials of hydrogen applications; v) key issues in hydrogen science and vi) opportunities & challenges in hydrogen science. This course combines the theories with the frontiers of research, aiming to further improve students' critical thinking ability and problem-solving skills. In addition, this course is designed with an emphasis on the theories, principles and findings related to most recent advances in the field of hydrogen science. In this course, students will i) learn about the current developments, basic principles and applications related to hydrogen science; ii) acquire knowledge about physicochemical reactions that occur during hydrogen production, utilization</p>			

& storage processes; iii) develop a knowledge base grounded in the specific applications and key issues of hydrogen science; iv) broaden their horizons with enriched knowledge and improved creative thinking skills.

(建议列表形式, 各列内容: 章节、主要内容、课时数、教学方式)

*教学大纲
(中文)
Syllabus

章节	教学内容	授课学时	教学方式	授课教师
第一章 氢的基础知识	氢元素、氢原子与氢气	0.5	讲课	翁国明
	氢原子的玻尔模型	0.5	讲课	翁国明
	氢的同位素、反氢原子与类氢原子	0.5	讲课	翁国明
	氢气的谱图	0.5	讲课	翁国明
第二章 氢气的性质	物理性质	2	讲课	翁国明
	化学性质	2	讲课	翁国明
	电化学性质	2	讲课	翁国明
	生物性质	2	讲课	翁国明
第三章 产氢、用氢和储氢中的物理化学反应	产氢的反应	2	讲课	翁国明
	用氢的反应	2	讲课	翁国明
	储氢的反应	2	讲课	翁国明
第四章 氢气的应用实例、基本原理及其相关材料	能源领域	3	讲课、口头报告与实地参观	翁国明
	生物医学及农业领域	3	讲课、口头报告与实地参观	孙学军、沈文飙、何前军和翁国明
	其他领域	2	讲课、口头报告与实地参观	孙学军、沈文飙、何前军和翁国明
第五章 氢科学的几个关键问题	氢的安全及危害性	2	讲课	翁国明
	金属氢脆	2	讲课	翁国明
	其他问题	2	讲课	翁国明
第六章 氢科学的机遇和挑战	氢科学的机遇和挑战	2	讲课、学生演讲与讨论	翁国明

(须与中文一致, 翻译请力求信达雅。)

*教学大纲
(English)
Syllabus

Chapter	Content	Hours	Format	Instructor
Chapter 1 Fundamentals of Hydrogen	The Hydrogen Element, The Hydrogen Atom and Hydrogen Gas	0.5	Lecturing	Guo-Ming Weng
	The Bohr Model of Hydrogen	0.5	Lecturing	Guo-Ming Weng
	Isotopes of Hydrogen, The Antihydrogen Atoms, The Hydrogen-like Atoms	0.5	Lecturing	Guo-Ming Weng
	The Spectra of Hydrogen Gas	0.5	Lecturing	Guo-Ming Weng
Chapter 2 Properties of Hydrogen	Physical Properties of Hydrogen	2	Lecturing	Guo-Ming Weng
	Chemical Properties of Hydrogen	2	Lecturing	Guo-Ming Weng
	Electrochemical Properties of Hydrogen	2	Lecturing	Guo-Ming Weng

		Biological Properties of Hydrogen	2	Lecturing	Guo-Ming Weng
	Chapter 3 Physicochemical Reactions of Hydrogen Production, Utilization & Storage	Reactions of Hydrogen Production	2	Lecturing	Guo-Ming Weng
		Reactions of Hydrogen Utilization	2	Lecturing	Guo-Ming Weng
		Reactions of Hydrogen Storage	2	Lecturing	Guo-Ming Weng
	Chapter 4 Basic Principles & Materials of Hydrogen Applications	Hydrogen Applications in Energy	3	Lecturing, Oral Reports & Field Trips	Guo-Ming Weng
		Hydrogen Applications in Biomedicine & Agriculture	3	Lecturing, Oral Reports & Field Trips	Xuejun Sun, Wenbiao Shen, Qianjun He & Guo-Ming Weng
		Hydrogen Applications in Other Fields	2	Lecturing, Oral Reports & Field Trips	Xuejun Sun, Wenbiao Shen, Qianjun He & Guo-Ming Weng
	Chapter 5 Key Issues in Hydrogen Science	Hydrogen Safety & Hazards	2	Lecturing	Guo-Ming Weng
		Hydrogen Embrittlement	2	Lecturing	Guo-Ming Weng
		Other Issues	2	Lecturing	Guo-Ming Weng
	Chapter 6 Opportunities & Challenges in Hydrogen Science	Opportunities & Challenges	2	Lecturing, Student Presentations & Panel Discussion	Guo-Ming Weng
*课程要求 (中文) Requirements	(课程考核方式、考核标准等; 不少于 50 字)				
*课程要求 (English) Requirements	(须与中文一致, 翻译请力求信达雅。)				
课程资源 (中文) Resources	(教材、教参、网站资料等。)				
	<ol style="list-style-type: none"> 1. John S. Rigden, Hydrogen: The Essential Element, Harvard University Press, 2003. 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. 				

	<p>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.</p> <p>8. [意]Gabriele Zini, Paolo Tartraini编. 李朝升译. 太阳能制氢的能量转换、储存及利用系统-氢经济时代的科学和技术, 机械工业出版社, 2015.</p> <p>9. 丁文江等著. 镁合金科学与技术, 科学出版社, 2007.</p> <p>10. Xuejun Sun, Shigeo Ohta, Atsunori Nakao, Hydrogen Molecular Biology and Medicine, Springer, 2015.</p> <p>11. 孙学军编. 氢分子生物学, 第二军医大学出版社, 2013.</p> <p>12. 康志敏等编. 氢健康趣谈, 上海交通大学出版社, 2020.</p> <p>13. Q. Jin, et al., Hydrogen Gas Acts as a Novel Bioactive Molecule in Enhancing Plant Tolerance to Paraquat-Induced Oxidative Stress via the Modulation of Heme Oxygenase-1 Signalling System, Plant Cell Environ. 36 (2013) 956–969.</p> <p>14. Y. Xie, et al., H₂ Enhances Arabidopsis Salt Tolerance by Manipulating ZAT10/12-Mediated Antioxidant Defence and Controlling Sodium Exclusion, PloS One 7 (2012) e49800.</p> <p>15. W.L. Wan, et al., Photosynthesis-Inspired H₂ Generation Using a Chlorophyll-Loaded Liposomal Nanoplatform to Detect and Scavenge Excess ROS, Nat. Commun. 11 (2020) 534.</p> <p>16. Y.H. Zhang, et al., Genetic Elucidation of Hydrogen Signaling in Plant Osmotic Tolerance and Stomatal Closure via Hydrogen Sulfide, Free Radic. Biol. Med. 161 (2020) 1-14.</p> <p>17. B. Zhao, et al., Photocatalysis-Mediated Drug-Free Sustainable Cancer Therapy Using Nanocatalyst, Nat. Commun. 12 (2021) 1345.</p>
课程资源 (English) Resources	<p>(须与中文一致, 请力求信达雅。)</p> <p>Same as above.</p>
备注 Note	