

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	电化学原理 Principles of Electrochemistry
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	ME372
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)	曾林, 副教授, 机械与能源工程系 Email: zengl3@sustech.edu.cn Lin Zeng, Associate Professor, Department of Mechanical and Energy Engineering, Email: zengl3@sustech.edu.cn
9.	实验员/助教、所属学系、联系方式 Tutor/TA(s), Contact	待公布 To be announced
10.	选课人数限额(可不填) Maximum Enrolment (Optional)	30

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	48				48
12. 先修课程、其它学习要求 Pre-requisites or Other Academic Requirements	物理化学 (MSE202) 和物理化学实验 (MSE204) Physical Chemistry, Physical Chemistry Experiments				
13. 后续课程、其它学习规划 Courses for which this course is a pre-requisite	ME384 电化学测量 ME384 Electrochemical Measurement				
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

通过本课程的学习, 学生应该了解和掌握电化学基本原理和基本理论, 为电化学测量、锂电池技术等课程打下良好的理论基础。具体掌握如下四方面的知识:

Through the study of this course, students should understand and master the basic principles and theories of electrochemistry, so as to lay a good theoretical foundation for electrochemistry measurement, lithium battery technology and other courses. Specifically, the following four aspects of knowledge should be mastered.

1. 掌握电化学反应热力学、电势基本概念以及电化学反应平衡条件;

Understand the basic concepts of thermodynamics of electrochemical reaction, potential and electrochemical reaction equilibrium conditions.

2. 掌握电极/溶液界面性质、双电层结构理论和研究方法;

Understand the electrode/solution interface properties, electric double layer structure theory and research methods.

3. 掌握电极过程动力学基本规律、特征和研究方法;

Understand the basic laws, characteristics, and research methods of electrochemistry kinetics under the electrode/electrolyte interface.

4. 学会利用电化学基本原理分析具体的电极反应过程。

Use the basic principles of electrochemistry to analyze the specific electrode reaction process.

16. 预达学习成果 Learning Outcomes

电化学原理是专业核心课程, 通过该课程的教学使学生了解电化学的基本原理及其应用, 主要内容包含电化学热力学、电极与溶液界面的结构和性质、电极过程动力学和重要的实用电化学过程等四大部分内容。通过该课程的学习, 让学生对电化学反应以及在能源转化中的应用有相对深刻的理解和认识, 提高学生的理论知识积累, 为后续电化学测量等课程的开展奠定基础。

The principle of electrochemistry is the core course. Through this course, students can understand the basic principle and application of electrochemistry. The main contents include electrochemical thermodynamics, the structure and properties

of the interface between electrode and solution, electrochemical kinetics and some practical electrochemical processes. Through this course, students have a relatively profound understanding of electrochemical reaction and its application in energy conversion, improve the theoretical knowledge of electrochemistry, and lay a foundation for the follow-up courses such as electrochemical measurement.

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.)

Week 1 电化学概论：研究对象、发展历史和应用

Week 1 Introduction to electrochemistry: research topic, development history and application

Week 2 电解质溶液的性质与描述方法：电导和电导率及摩尔电导率、迁移数、电解质溶液活度、离子的运动行为

Week 2 Properties and description methods of electrolyte solution: conductivity, conductivity and molar conductivity, migration number, activity of electrolyte solution, movement behavior of ions.

Week 3-5 电化学热力学：氧化还原体系的热力学平衡性质；电池、半电池、电极电势、Nernst 方程；电位-pH 图的构建与应用；电位分析概述

Week 3-5 Principles of electrochemical Thermodynamics: thermodynamic equilibrium properties of electrochemical system; the concept of battery, half-cell, electrode potential, Nernst equation; Construction and application of potential pH diagram; Overview of potential analysis.

Week 6-8 电极/溶液的界面结构与性质：电毛细现象；双电层与微分电容；双电层结构模型；零电荷电位；电极/溶液界面的吸附性质

Week 6-8 Structure and properties of electrode/solution interface: electrocapillary phenomenon; Electric double layer and differential capacitance; Electric double layer structure model; Zero charge potential; Adsorption properties of electrode / solution interface

Week 9-10 液相传质步骤动力学：基本特征；基本方程；极谱分析概述

Week 9-10 Kinetics of mass transfer in liquid phase: basic characteristics; Basic equation; Overview of polarographic analysis.

Week 11-12 电荷转移步骤动力学：基本特征；基本方程

Week 11-12 Kinetics of charge transfer steps: basic characteristics; Basic equation.

Week 13 气体电极过程：氢析出电极过程动力学；氧还原电极过程动力学

Week 13 Gas electrode electrochemistry: kinetics of hydrogen precipitation electrode process; Kinetics of oxygen reduction electrode process.

Week 14 金属电极过程：金属阳极过程动力学；金属电沉积过程动力学

Week 14 Metal electrode electrochemistry: Kinetics of metal electrodeposition process.

Week 15 半导体电化学基础：半导体电极的特性；光电化学概述

Week 15 Fundamentals of semiconductor electrochemistry: characteristics of semiconductor electrodes; Overview of photoelectrochemistry

Week 16 工业电化学应用：电解；电镀；化学电源；燃料电池

Week 16 Industrial electrochemical applications: electrolysis; electroplate; Chemical power supply; fuel cell

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

1. A. J. Bard. Electrochemical methods: Fundamentals and Applications, 2nd Ed. (电化学方法-原理和应用), 北京: 化学工业出版社, 2005
2. Carl H. Hamann, Andrew Hamnett, Wolf Vielstich, Electrochemistry 2nd Edition, ISBN-10: 9783527310692, Wiley-VCH; 2nd edition (April 9, 2007)
3. 查全性. 电极过程动力学导论 (第三版), 北京: 科学出版社, 2002, ISBN: 7-03-010013-1/O.1567
4. 李荻. 电化学原理 (第三版), 北京: 北京航空航天大学出版社, 2008, ISBN: 9787811244168

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	Every Lecture	10		
课堂表现 Class Performance				
小测验 Quiz				
课程项目 Projects				
平时作业 Assignments	Every two weeks	30		
期中考试 Mid-Term Test				
期末考试	16 th Week	60		

Final Exam				
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

