

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	物理化学实验 Physical Chemistry Experiments
2.	授课院系 Originating Department	材料科学与工程系 Department of Materials Science and Engineering
3.	课程编号 Course Code	MSE204
4.	课程学分 Credit Value	1
5.	课程类别 Course Type	专业基础课 Major Foundational Courses
6.	授课学期 Semester	春季 Spring
7.	授课语言 Teaching Language	英文 English
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)	章剑波, 实验员, 材料系, 荔园2栋502 zhangjb@sustech.edu.cn, 0755-88018764 ZHANG Jianbo, laboratory assistant, Department of Materials Science and Engineer, Room 502, Block 2, Lychee Hill zhangjb@sustech.edu.cn, 0755-88018764 李艳艳, 实验员, 材料系, 荔园2栋504 liyy@sustech.edu.cn, 0755-88018925 LI Yanyan, laboratory assistant, Department of Materials Science and Engineer, Room 504, Block 2, Lychee Hill liyy@sustech.edu.cn, 0755-88018925
9.	实验员/助教、所属学系、联系方式 Tutor/TA(s), Contact	无 NA
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
12. 先修课程、其它学习要求 Pre-requisites or Other Academic Requirements	MSE202 物理化学 Physical Chemistry				
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.	化学系、物理系、生物学、电子与电气工程系、环境系。 Department of Chemistry, Department of Physics, Department of Biology, Department of Electronics and Electrical Engineering, Department of Environment.				

教学大纲及教学日历 SYLLABUS

15. 教学目标 Course Objectives

物理化学实验是材料科学与工程系的一门独立基础实验课程，其目的不仅是传授物理化学知识，更重要的是培养学生的能力和优良的素质。通过物理化学实验学生应受到下列训练：掌握基本操作，正确使用仪器，取得正确的实验数据；正确记录、处理数据和表达实验结果的能力；认真观察现象进而分析判断，逻辑推理，作出结论的能力；正确设计实验（选择实验方法、实验条件、仪器和试剂等）解决实际问题的能力；通过查阅手册，工具书及其他信息源获得信息的能力。而培养学生实事求是的科学态度、勤俭节约的优良作风、相互协作的团队精神、勇于开拓的创新意识，贯穿整个实验教学。

Experimental Physical chemistry is an independent course in education of Department of Materials Science and Engineering. The objective of the course is not only to teach students the knowledge of Physical chemistry but also to develop their scientific ability and attitude. The students should be trained in the following aspects through the courses: to use the experimental apparatus correctly and obtain correct results; to record, process and express the experimental data correctly, to analyze the experiment phenomena observed and to deduce conclusions; to design experiment (including method, conditions, apparatus and reagents) and to solve practical problems; to collect information from handbooks, reference books and literatures. The most important thing throughout the Physical chemistry experiments education is to foster a practical and realistic scientific approach, an industrious and thrifty style of work, a spirit of cooperation and a courage to make innovations.

16. 预达学习成果 Learning Outcomes

1. 初步了解物理化学实验的研究思路，掌握物理化学的基本实验技能。
2. 能够针对实验目标，选择实验仪器，并获得相应的数据。
3. 具备严谨细致的实验作风，能够对实验数据进行分析 and 解决实际问题。
4. 能够理解并遵守实验安全、环境保护相关规范。
5. 能够在同组合作中，有效表达和交流，完成实验。
6. 通过英语教学，培养学生的专业英语能力，掌握课程核心词汇，能够阅读英语专业文献。

1. To preliminary understand the research ideas of physical chemistry experiments and to master the basic experimental skills of physical chemistry.
2. Be able to select experimental instruments according to experimental objectives and obtain corresponding data.
3. To cultivate rigorous and meticulous experimental style, be able to analyze experimental data and solve practical problems.
4. Be able to understand and comply with the relevant regulations of experimental safety and environmental protection.
5. Be able to effectively express and communicate and complete experiments in cooperation with other groups.
6. To cultivate the ability of using professional English, to master the core vocabulary of the course and read English professional literature through English teaching.

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.)

(一) 教学第一周（4学时）：Week 1 (4 hours)

实验一：课程介绍及燃烧热的测定 Introduction of Course and Heat of Combustion

主要内容：

1. 课程介绍；2. 掌握燃烧热的定义；3. 熟悉氧弹式量热计的原理并掌握其使用方法；4. 利用热力学第一定律计算萘和苯甲酸的燃烧热。

Contents:

1. Introduction of the course. 2. To learn the definition of heat of combustion. 3. To get familiar with the principle and experimental technique of a bomb calorimeter. 4. To calculate the heat of combustion of naphthalene and benzoic acid by first law of thermodynamics.

(二) 教学第三周（4学时）：Week 3 (4 hours)

实验二：纯液体饱和蒸汽压的测定 Saturated Vapor Pressure of Pure Liquid

主要内容：

1. 掌握纯液体饱和蒸汽压的定义和气液两相平衡的概念，了解基于热力学原理的克劳修斯-克拉贝龙方程式；2. 掌握用数字式真空计测定乙醇在不同温度下的饱和蒸汽压的实验技术；3. 用图解法求被测液体在实验温度范围内的平均摩尔汽化热与正常沸点。

Contents:

1. To comprehend the definition of saturated vapor pressure for pure liquids and the concept of equilibrium between gas and liquid; to get the knowledge of Clausius - Clapeyron equation based on the thermodynamic theory; 2. To master the technique of determining the saturated vapor pressure of alcohol at different temperature using vacuum gauge. 3. To learn the way to obtain the average molar enthalpy of vaporization of the examined liquid over a range of temperatures using graphical method as well as its normal boiling point under ambient pressure.

(三) 教学第五周（4学时）：Week 5 (4 hours)

实验三：双液系的气液-相图测定 Phase Diagram of a Binary Liquid-Vapor System

主要内容：

1. 绘制在标准大气压下环己烷-乙醇双液系的气-液平衡相图；2. 掌握测定双组分液体的沸点及正常沸点的方法；3. 掌握用折光率测定二元液体组成的方法。

Contents:

1. To draw the phase diagram of cyclohexane-ethanol binary liquid-vapor system under standard atmospheric pressure. 2. To learn the method of determining normal boiling point and the boiling point of a binary liquid system. 3. To learn the method of determining the composition of binary liquid systems by refractometry.

(四) 教学第七周（4学时）：Week 7 (4 hours)

实验四：旋光法测定蔗糖转化反应的速率常数 Rate Constant for the Conversion of Sucrose by a Polarimetric Method

主要内容：

1. 了解旋光仪的基本原理并掌握旋光仪的使用方法；2. 了解反应物浓度与旋光度之间的关系；3. 测定蔗糖转化反应的速率常数和半衰期，掌握反应动力学基本分析方法。

Contents:

1. To learn the basic principle and the correct use of a polarimeter. 2. To know the relationship between the reactant concentration and optical rotation. 3. To determine the rate constant and the half life for the conversion of sucrose, to master the analysis method of reaction kinetics.

(五) 教学第九周（4学时）：Week 9 (4 hours)

实验五：原电池电动势的测定 Electromotive Force of Galvanic Cells

主要内容：

1. 测定锌-铜原电池的电动势和锌、铜电极的电极电势；2. 学习一些电极的制备和处理方法；3. 掌握电位差计的测量原理和正确使用方法。

Contents:

1. To determine the electromotive force of a Zn-Cu galvanic cell and the electrode potentials of Cu and Zn. 2. To learn methods for preparation and treatment of some electrodes. 3. To know the principle of a potentiometer and its operation procedure.

(六) 教学第十一周 (4 学时): Week 11 (4 hours)

实验六: 溶液表面张力的测定 Surface Tension of Solution

主要内容:

1. 了解表面张力的性质, 表面自由能的意义以及表面张力和吸附的关系; 2. 掌握用最大泡压法测定表面张力的原理和技术; 3. 测定不同浓度乙醇-水溶液的表面张力。

Contents:

1. To know the characteristics of surface tension, the significance of surface free energy and the relationship between surface tension and adsorption. 2. To learn the principle and technique of the determination of surface tension by the bubble-pressure method. 3. To determine the surface tension of ethanol-water solutions with different concentration.

(七) 教学第十三周 (4 学时): Week 13 (4 hours)

实验七: 粘度法测定水溶液高聚物相对分子质量 Determination of Viscosity Average Molecular Weight of Polymers

主要内容:

1. 了解利用粘度法测定聚合物相对分子质量的基本理论; 2. 掌握乌氏粘度计的测定方法; 3. 测定聚乙烯吡咯烷酮的平均相对分子质量。

Contents:

1. Understand the basic theory on determination of the average molecule weight of polymers using viscometric method. 2. Measure viscosity using Ubbelohde viscometer. 3. Determine the average molecule weight of polyvinylpyrrolidone (PVP).

(八) 教学第十五周 (4 学时): Week 15 (4 hours)

实验操作考试 Experiment operation test.

主要内容: 根据课程内容, 设置六个实验题目, 学生采用抽签的方式抽取一个题目进行操作考试。

Contents:

According to the course content, six experimental subjects were set, and one of them was selected by drawing lots for the operation test.

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

Gao Zi, Experimental Physical Chemistry, Higher Education Press
复旦大学, 庄继华, 物理化学实验, 高等教育出版社



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		5		
课堂表现 Class Performance		40		
小测验 Quiz				

实验报告 Report	45		
平时作业 Assignments			
期中考试 Mid-Term Test			
期末考试 Final Exam	10		
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

