

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	固体废弃物处理处置与资源化 Solid Waste Treatment, Disposal and Recycling
2.	授课院系 Originating Department	环境科学与工程学院 School of Environmental Science and Engineering
3.	课程编号 Course Code	ESE302
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	春季 Spring
7.	授课语言 Teaching Language	中文 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)	张作泰 Zuotai Zhang 环境科学与工程学院 School of Environmental Science and Engineering 0755-88018019
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)	

11. 授课方式 Delivery Method	讲授	习题/辅导/讨论	实验/实习	其它(请具体注明)	总学时
	Lectures	Tutorials	Lab/Practical	Other (Please specify)	Total
学时数 Credit Hours	44	4	0		48

12. 先修课程、其它学习要求 Pre-requisites or Other Academic Requirements	先选课/Co-requisites: 物理化学/Physical Chemistry, 环境工程原理/Principles of Environmental Engineering
13. 后续课程、其它学习规划 Courses for which this course is a pre-requisite	无 N/A
14. 其它要求修读本课程的学系 Cross-listing Dept.	无 N/A

教学大纲及教学日历 SYLLABUS

15. 教学目标 Course Objectives

固体废弃物的综合利用已经得到了世界各国的高度重视，被认为解决资源短缺瓶颈的重要途径和手段。本课程针对固体废弃物循环利用过程中的基本问题，系统讲述固体废弃物循环利用过程中物质基本结构包括晶体结构、固溶体结构和熔体结构；资源处理处置技术；资源循环利用热力学；资源循环利用动力学；固态物质反应与烧结等。使学生能够全面系统地掌握资源循环利用的基础理论知识。

It is well known that the comprehensive utilization of solid waste has drawn the world's attention, which is considered as an important way to solve the shortage of resources. This present course focuses on the fundamental problems in the process of recycling solid waste, and systematically describes the structure of the material in the process of solid wastes reuse, including crystal structure, solid solution structure and melt structure; the disposal and recycling techniques of solid wastes; thermodynamics and dynamics of resource recycling; solid matter reaction and sintering. So that students can fully and systematically grasp the basic knowledge of resource recycling.

16. 预达学习成果 Learning Outcomes

为固体废弃物的处置与资源化奠定理论基础。

The target of this course is to lay the theoretical foundation for the disposal and recycling of solid waste.

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.)

主要内容框架:

(1) 资源循环利用概述

介绍资源的现状及未来趋势, 包括燃料矿产、金属矿产和非金属矿产资源; 化工原料、燃料、有色金属、黑色金属、非金属、稀有贵金属、稀土及放射性金属等矿产资源的现状, 提出进行资源的高效循环利用是实现可持续发展的必要前提。

目的与要求: 要求学生掌握目前世界范围内各种资源的利用现状、存储量及进行资源循环利用的必要性。

(1) Introduction

This section introduces the present status and developing trends of resources, these include fuel mineral, inorganic mineral resources; chemical raw materials, fuel, nonferrous metals, ferrous metals, non-metallic, rare precious metals, rare earth and radioactive metal and other mineral resources. Based on the background, and we proposed that an efficient recycling resources are a necessary prerequisite for achieving sustainable development.

Purpose and requirements: Students are required to understand the current status of the use of various resources around the world, the amount of storage and the need for recycling of resources.

(2) 物质基本结构

针对大宗工业固废资源的组分特点，主要介绍硅酸盐的晶体结构，晶体结构缺陷及类型，固溶体的分类及熔体的基本性质及结构，最后讲述这些结构对微观性能的基本影响规律。

目的与要求：要求学生掌握固废资源基本组分的结构及对宏观性能的影响规律。

(2) Structures

In view of the characteristics of component of solid wastes, the present section mainly introduces the crystal structure, the defects and types of solidification, the classification of solid solution. The basic properties and structure of the melt are then introduced. Finally, the influence of these structures on microcosmic performance is introduced.

Objective and requirements: Students are required to understand the basic components of solid waste structure and the impact of the macro performance of the solid wastes.

(3) 资源循环利用热力学

本章主要介绍资源循环利用的热力学基本概念，并举例各类不同资源综合利用途径进行热力学计算。

目的与要求：要求所有学生掌握资源综合利用的热力学概念及利用方法。

(3) Thermodynamics of resources recycling

This chapter mainly introduces the basic concept of thermodynamics of resource recycling, and examples of different types of comprehensive utilization of resources for thermodynamic calculation are discussed.

Purpose and requirements: All students are required to master the concept of thermodynamics in the processing of solid wastes.

(4) 资源循环利用动力学

本部分主要介绍资源循环利用的动力学原理及应用，包括化学反应动力学、扩散、多相反应动力学等。

目的与要求：要求学生掌握动力学的概念及在资源综合利用过程中的应用。

(4) Dynamics of resources recycling

This part mainly introduces the dynamic principle and application in processing of resource recycling, including

chemical reaction, diffusion, heterogeneous reaction kinetics and so on.

Objective and requirement: Require students to master the concept of dynamics and the application in the process of comprehensive utilization of solid wastes.

(5) 固废的处理处置、资源化方法与技术

本部分主要系统介绍固体废物的化学浸出技术、热转化原理与技术、固废热处理技术等。

目的与要求：要求所有学生掌握固废资源化、处理处置的原理及技术。

(5) Solid waste treatment , disposal methods and technologies

This section mainly introduces the chemical leaching technology of solid waste, the principle and technology of thermal conversion, and the solid waste heat treatment technology.

Purpose and requirements: All students are required to master the principles and techniques of main solid waste recycling, treatment and disposal.

(6) 固态物质反应与烧结

本部分主要介绍资源循环利用过程中所涉及的固态物质反应与烧结，包括固体烧结动力学、液相烧结动力学、热压烧结、晶界迁移及长大规律、影响烧结因素等。

目的与要求：要求学生掌握资源循环利用过程中所涉及固态物质烧结的反应与烧结特点。

(6) Solid reaction and sintering

This part mainly introduces the solid matter reaction and sintering process involved in the process of resource recycling, including solid sintering kinetics, liquid sintering kinetics, hot pressing sintering, grain boundary migration and growth law, et.al.

Objectives and requirements: All students are required to master the reaction and sintering characteristics of solid material sintering involved in the process of resource recycling.

(7) 大宗工业固废处置技术

本部分主要介绍大宗工业固废处置与资源化技术，包括其循环利用预处理原理，再生资源炼制技术原理等。

目的与要求：要求所有学生掌握所介绍的大宗工业固废处置原理与技术，针对每个学生的研究背景，要求该学生深入掌握对应研究领域资源循环利用的原理。

(7) Disposal technologies of solid wastes

This part mainly introduces the disposal technology, including its recycling principle, the principle of renewable resources refining technology.

Purpose and requirements: All students are required to master the solid waste disposal principles and technology, for each student's research background, requires the students to master the corresponding research areas of the

principle of recycling resources.

(8) 资源循环利用实例分析

本部分选择 5~10 个具有代表性的资源循环利用的成功实例进行讲述。在可能的情况下，安排一堂课进行现场调研。

目的与要求：要求学生掌握资源循环利用商业成功实例情况，包括现场描述、技术描述、回收利用优缺点和局限性等。

(8) Examples of Resources Recycling

This section chooses 5-10 successful examples of representative resource recycling.

Objective and requirements: All students are required to master the successful examples, including on-site description, technical description, advantages and disadvantages of recycling and limitations.

序号 NO.	内容 Content	学时 Hours				汇总 Sub- total
		理论 Theoretic Teaching	实验 Experiment	实践 Exercise	上机操作 Computer Operation	
1	资源循环概述 Introduction	4				4
2	物质基本结构 Basic Structure of Materials	4				4
3	资源循环利用热力学 Thermodynamics of Resources recycling	8				8
4	资源循环利用动力学 Dynamics of Resources Recycling	8				8
5	固废的处理处置、资源化方法与技术 Solid waste treatment , disposal methods and technologies	6				6
6	固态物质反应与烧结 Solid waste Reaction and Sintering	6				6
7	大宗工业固废处置技术 Disposal technology of solid wastes	4				4
8	资源循环利用实例分析 Cases of Resources Recycling	4				4
9	讨论课 Discussion	4				4
总学时 Total		48				48

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

1. Paul Shewmon. Diffusion in Solids. Second Edition, TMS, 1989.
2. R.B. Bird, W.E. Stewart, and E.N. Lightfoot: Transport Phenomena, 2nd ed., John Wiley, 2002.
3. 饶东生, 硅酸盐物理化学, 冶金工业出版社, 1996.

4. Yong Jin and Fei Wei. Multi-phase chemical reaction Engineering and Technology, Tsinghua University press, 2011
5. 何晶晶, 固体废弃物处理与资源化技术, 高等教育出版社, 2011
6. 蒋建国, 固体废弃物处置与资源化, 化学工业出版社, 2007

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		5%		
小测验 Quiz				
课程项目 Projects				
平时作业 Assignments		20%		
期中考试 Mid-Term Test		20%		
期末考试 Final Exam		50%		
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