

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	人工光合成燃料技术 Artificial Light Synthesis Fuel Technology
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	ME382
4.	课程学分 Credit Value	3
5.	课程类别 Course Type	专业选修课 Major Elective 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)	李文甲, 助理教授 (副研究员), 机械与能源工程系 Email: liwj@sustech.edu.cn Wenjia Li, Associate Researcher, Department of Mechanical and Energy Engineering, Email: liwj@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	ME304 能源工程基础				
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.					

教学大纲及教学日历 SYLLABUS

15. 教学目标 Course Objectives

本课程旨在让学生了解和掌握人工光合成燃料技术的基本概念、原理及其应用，对人工光合成燃料技术有一定程度的认识，为后续相关学习打好基础。

This course aims to let students understand and master the basic concepts, principles and their applications of artificial light synthesis fuel technology, to have a certain degree of understanding of artificial light synthesis fuel technology, and to lay a good foundation for subsequent related studies.

1. 掌握人工光合成燃料技术的基本原理、分类、特点；

Master the basic principle, classification and characteristics of artificial light synthesis fuel technology.

2. 了解人工光合成燃料技术在能源等领域的应用；

Understanding the application of artificial light synthesis fuel technology in the fields of energy.

3. 了解人工光合成燃料技术的相关测试与分析方法。

Understand the relevant testing and analysis methods of artificial light synthesis fuel technology.

16. 预达学习成果 Learning Outcomes

通过本课程的学习，学生将了解人工光合成燃料技术的基本原理、应用领域等方面的知识，为其未来从事相关领域的科学研究或工程实践提供必要的理论和实践基础。具体的，学生将知悉和理解人工光合成燃料技术的基本原理和分类，了解人工光合成燃料技术在能源领域的应用等内容，了解人工光合成燃料技术的相关测试与分析方法。

Through this course, students will learn about the basic principles and application areas of artificial light synthetic fuel technology, which will provide them with the necessary theoretical and practical foundation for their future scientific research or engineering practice in related fields. Specifically, students will know and understand the basic principles and classification of synthetic artificial light fuel technology, and understand the application of synthetic artificial light fuel technology in the energy field. Students will also understand the testing and analysis methods related to synthetic fuel technologies.

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.)

- 1 绪论：光的本质和光科学，太阳能与人类，能源结构与人类社会可持续发展，太阳燃料简介（6 学时）
- 1 Introduction: the nature of light and light science, solar energy and human beings, energy structure and sustainable development of human society, introduction to solar fuels (6 hours).
- 2 光伏效应与太阳能电池：太阳电池的历史；太阳能光伏效应；太阳电池基础；各类太阳电池简介（6 学时）
- 2 Photovoltaic effect and solar cells: history of solar cells; solar photovoltaic effect; fundamentals of solar cells; introduction to various types of solar cells (6 hours)
- 3 电催化合成燃料：电解水制氢，电化学还原二氧化碳，电化学合成氨（8 学时）
- 3 Electrocatalytic synthesis of fuels: electrolysis of water to produce hydrogen; electrochemical reduction of carbon dioxide; electrochemical synthesis of ammonia (8 hours)
- 4 光催化合成燃料：自然光合作用，光催化基础概述，光催化分解水，光催化二氧化碳还原，太阳能光催化的其他应用（4 学时）
- 4 Photocatalytic synthesis of fuels: natural photosynthesis, overview of the fundamentals of photocatalysis, photocatalytic decomposition of water, photocatalytic CO₂ reduction, other applications of solar photocatalysis (4 hours)
- 5 光电催化合成燃料：光电催化的原理和特点，光电催化分解水体系的分类，光电催化分解水主要效率指标，提升光电催化性能的常用策略（4 学时）
- 5 Photocatalytic synthesis of fuels: principles and characteristics of photocatalysis, classification of photocatalytic decomposition of water systems, main efficiency indicators of photocatalytic decomposition of water, common strategies to enhance the performance of photocatalysis (4 hours)
- 6 光热合成燃料：太阳能光热转换原理，太阳能光热发电，太阳能热化学制燃料的基本原理，太阳能热化学制燃料的类型（8 学时）
- 6 Photothermal synthetic fuels: solar photothermal conversion principles, solar photothermal power generation, basic principles of solar thermochemical fuel production, types of solar thermochemical fuel production (8 hours)
- 7 太阳能全光谱利用与合成燃料：太阳能光谱基础，太阳能全光谱利用方法与技术，光伏光热互补的太阳能全光谱燃料合成技术（6 学时）
- 7 Solar Full Spectrum Utilization and Synthetic Fuels: Solar Spectrum Basics, Solar Full Spectrum Utilization Methods and Technologies, Solar Full Spectrum Fuel Synthesis Technologies for Photovoltaic Solar Thermal Complementation (6 hours)
- 8 光电光谱分析技术与应用：太阳光谱和光强测试，光电光谱分析技术简介；拉曼光谱技术与红外光谱技术简介；瞬态吸收光谱技术简介；紫外可见吸收光谱技术简介（6 学时）
- 8 Optical spectroscopy techniques and applications: solar spectroscopy and light intensity testing, introduction to photoelectric spectroscopy techniques; introduction to Raman and infrared spectroscopy techniques; introduction to transient absorption spectroscopy techniques; Introduction to UV-Vis absorption spectroscopy (6 hours)

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

- [1]李灿. 太阳能转化科学与技术[M]. 科学出版社, 2020.
- [2]藤岛昭. 光催化创造未来--环境和能源的绿色革命[M]. 上海交通大学出版社, 2015.
- [3]卡洛·阿尔贝特·比尼奥齐. 光催化[M]. 科学出版社, 2018.
- [4]何华. 光电光谱分析技术与应用[M]. 化学工业出版社, 2022.

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		20		
课堂表现 Class Performance				
小测验 Quiz		30		
课程项目 Projects				
平时作业 Assignments				
期中考试 Mid-Term Test				
期末考试 Final Exam				
期末报告 Final Presentation		50		
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