

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	3D 打印及激光先进制造 3D printing and laser-based advanced manufacturing
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	MSE413
4.	课程学分 Credit Value	3
5.	课程类别 Course Type	专业选修课 Major-Elective Course
6.	授课学期 Semester	秋季学期 Fall Semester
7.	授课语言 Teaching Language	英语 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)	严明、材料科学与工程系、yanm@sustc.edu.cn、0755-88018967 Dr Ming Yan, Department of Materials Science and Engineering, yanm@sustc.edu.cn , 0755 88018967
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	48				48
12. 先修课程、其它学习要求 Pre-requisites or Other Academic Requirements					
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

本课程为了达到让本科生（大三及大四学生）掌握 3D 打印的技术原理、特点与应用范畴，以及掌握激光科学及激光器各种工业应用的目的，将重点讲授激光器的工作原理、种类，以及激光器在 3D 打印，材料连接、材料分离/切割、材料微制造、材料表面改性、以及新材料制备等方面的重要应用。最终为学生今后从事与 3D 打印、激光器开发以及激光加工等相关研发或者生产经营活动奠定良好理论基础。

The objective of this course is to present 3rd year and 4th year grade undergraduate students the cutting-edge development of 3D printing and its current status. Since the development of science and technology of laser and laser system is key to the advance of 3D printing, this course will also teach students the working principles and types of laser and laser system, as well as the applications and fundamental aspects of laser system in five important areas, namely materials joining, cutting, micro-fabrication, surface engineering and fabrication of new materials. It is expected that the course can assist the students significantly in their career development if they pursue research & design, and/or work in a subject area that is related to 3d printing as well as laser-based advanced processing.

16. 预达学习成果 Learning Outcomes

a) 掌握 3D 打印的定义及其应用、研发现状；(b) 掌握激光 3D 打印设备在制造先端金属材料中的应用及其局限；(c) 掌握激光器工作原理、及激光器工作系统的组成；(d) 掌握激光及激光器在材料连接、材料分离、材料表面工程、材料微制造、以及新材料制备中的应用。

(a) To know the definition, current R&D status and application status of 3D printing; (b) to know the application of laser-based 3D printing for manufacturing advanced metallic materials and its current limitations; (c) to know the working principles and machine set-up of laser and laser system; (d) to know the applications of laser and laser system in materials joining, cutting, surface engineering, micro-fabrication and fabrication of new materials.

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.)

Chapter 1: 绪论 (2 课时)

Chapter 2: 3D 打印定义及现状 (2 课时) (Chapter 1: 3D printing: Its definition and current status ; 2 credit hours)

Chapter 3: 基于激光及电子束的增材制造 (2 课时) (Chapter 2: laser-based and electron beam based additive manufacturing; 2 credit hours)

Chapter 4: SLA\DLP\Polyjet\FDM 3D 打印软件、以及在线服务 (2 课时) (Chapter 3: SLA, DLP, PolyJet and FDM ; 2 credit hours) (Chapter 4: DIY of FDM 3D printer; 2 credit hours)

Chapter 5: 钛及钛合金的 3D 打印 (2 课时) (Chapter 5: Printable materials-Ti and Ti alloys; 2 credit hours)

Chapter 6: Mg 合金、Co 合金及形状记忆合金的 3D 打印 (2 课时) (Chapter 6: Printable materials-Mg alloys, Co alloys and shape memory alloys; 2 credit hours)

Chapter 7: 镍基高温合金、钢的 3D 打印 (2 课时) (Chapter 7: Printable materials-Mg alloys, Co alloys and shape memory alloys; 2 credit hours)

Chapter 8: Al 合金, 高熵合金的 3D 打印 (2 课时) (Chapter 8: Printable materials-Al alloys, and high entropy alloys; 2 credit hours)

Chapter 9: 贵金属、金属玻璃的 3D 打印 (2 课时) (Chapter 9: Printable materials-Noble metals and metallic glasses; 2 credit hours)

Chapter 10: 3D 打印粉体制备 (2 课时) (Chapter 10: Printable materials-Polymers; 2 credit hours)

Chapter 11: 陶瓷材料及高分子材料的 3D 打印 (2 课时) (Chapter 11: Printable materials-Ceramic materials and colored glaze; 2 credit hours)

Chapter 12: 3D 打印部分课程回顾 (2 课时) (Chapter 12: Midterm review; 2 credit hours)

Chapter 13: 3D 打印部分口头报告 (2 课时) (Chapter 13: Midterm presentation; 2 credit hours)

Chapter 14: 激光器简介 (2 课时) (Chapter 14: Working principles of laser and laser system, ; 2 credit hours)

Chapter 15: 激光-物质相互作用及激光安全 (2 课时) (Chapter 15: laser safety; 2 credit hours)

Chapter 16: 激光焊接 (2 课时) (Chapter 16: Interaction between laser and materials; 2 credit hours)

Chapter 17: 激光切割、激光钻孔 (2 课时) (Chapter 17: Laser in materials joining; 2 credit hours)

Chapter 18: 激光打标、激光清洗、激光微制造 (2 课时) (Chapter 18: Laser in materials cutting; 2 credit hours)

Chapter 19: 激光表面工程&表面改性, 激光表面工程概论 (Chapter 19: Laser in hole making; 2 credit hours)

hours)
Chapter 20 激光新材料制造 (2 课时) (Chapter 20: Laser in surface engineering; 2 credit hours)
Chapter 21: 激光测距、激光医疗与激光通讯 (2 课时) (Chapter 21: Laser in micro-fabrication; 2 credit hours)
Chapter 22: 激光部分课程回顾 (2 课时) (Chapter 22: Laser in fabrication of new materials; 2 credit hours)
Chapter 23: 激光部分报告 (2 课时) (Chapter 23: Review of the course; 2 credit hours)
Chapter 24: 课程回顾 (2 课时) (Chapter 24: Final term presentation; 2 credit hours)

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

教材 (Teaching materials):
(1). 3D Printing and Additive Manufacturing : Principles and Applications, 2014 年第 4 版, Chee Kai Chua, Kah Fai Leong, World Scientific Publishing Company, ISBN-10: 9814571407.
(2). Laser Material Processing, 第 3 版或更新, William.M. Steen, Springer Verlag, ISBN: 9781852336981.
(3). 21 世纪的先进制造——激光技术与工程, 2007 版或更新, 左铁钊, 科学出版社, ISBN978-7-03-018330-9.
(4). 3D 打印: 打印未来, 2013 版, 中国机械工程学会, 科普出版社, ISBN: 9787504663771.

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		10		
课堂表现 Class Performance		0		
小测验 Quiz		0		
课程项目 Projects				
平时作业 Assignments		60		
期中考试 Mid-Term Test		15		
期末考试 Final Exam		15		
期末报告 Final Presentation		0		
其它 (可根据需要 改写以上评估方				

式)
Others (The
above may be
modified as
necessary)

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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

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