

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	金属材料的粉末冶金及其 3D 打印 Powder metallurgy and 3D printing of metallic materials
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	MSE330-16
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	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)	严明、材料科学与工程系、yanm@sustech.edu.cn、0755-88018967 Dr Ming Yan, Department of Materials Science and Engineering, yanm@sustech.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)	NA

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	0	0	0	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	NA				
14. 其它要求修读本课程的学系 Cross-listing Dept.	NA				

教学大纲及教学日历 SYLLABUS

15. 教学目标 Course Objectives

The objective of this course is to present undergraduate students the fundamentals and cutting-edge development of powder metallurgy of metallic materials such as Ti and Ti alloys, Cu and Cu alloys, steels, Al and Al alloys, and metallic glasses; and their 3D printing as well, which will be on either based on laser printing system or electron beam printing system.

对本科生人才培养的作用:

- (1). 粉末冶金及 3D 打印是非常重要的近终成形技术, 在制备多种工业用金属材料方面有大量应用;
- (2). 课程基于金属学原理, 结合材料制备、相关产业发展情况, 对于本科生充分了解科研前沿动态以及工业生产将大有裨益。

16. 预达学习成果 Learning Outcomes

Learning outcomes are expected as follows:

- (1) To grasp the fundamentals of powder metallurgy;
- (2) To get familiar with various techniques based on principals of powder metallurgy;
- (3) To grasp the fundamentals of the 3D printing of metallic materials;
- (4) To get familiar with the development of the 3D printing of metallic materials; and
- (5) To get familiar with the progress of the powder metallurgy and 3D printing as well as the latest development of the related industries.

本课程将使学生在以下方面得以提高:

- (1) 掌握粉末冶金原理;
- (2) 了解粉末冶金技术;
- (3) 掌握金属材料 3D 打印原理;
- (4) 了解金属材料 3D 打印;

(5) 了解金属材料粉末冶金、3D 打印行业动态。

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) Introduction to the whole course (2 credit hours)
- (2) Definition and status quo of 3D printing (2 credit hours);
- (3) Fundamentals of laser and laser facility (2 credit hours);
- (4) Interaction between laser and materials, and Laser safety (2 credit hours);
- (5) Laser, electron beam and electrical arc based 3D printing/additive manufacturing (2 credit hours);
- (6) 3D printing of titanium and titanium alloys (2 credit hours);
- (7) 3d printing of Mg alloys, Co alloys and shape memory alloys (2 credit hours);
- (8) 3d printing of Ni based alloys, and high entropy alloys (2 credit hours);
- (9) Special report: 3D printing of superalloys and flyable microturbine engine (2 credit hours);
- (10) 3d printing of steels and Al alloys (2 credit hours);
- (11) Special report: 3D printing of breathable mould steels and 7xxx Al alloys (2 credit hours);
- (12) 3D printing of noble metals and metallic glasses (2 credit hours)
- (13) 3D printing of ceramic materials and polymers (2 credit hours)
- (14) Midterm review of the course (2 credit hours);
- (15) Midterm presentation (2 credit hours);
- (16) Fundamentals of powder metallurgy and conventional powder metallurgy (2 credit hours);
- (17) Metal powder production and safety (2 credit hours);
- (18) External pressure assisted sintering (2 credit hours);
- (19) Special report on the sintering of metallic glasses (2 credit hours)
- (20) Microwave sintering and ultrasonic sintering (2 credit hours);
- (21) Liquid phase sintering, metal injection molding and reaction sintering (2 credit hours);
- (22) Secondary review on the sintering part (2 credit hours);
- (23) Final term presentation (2 credit hours).
- (24) Final Review of the course (2 credit hours);

- (1) 课程简述 (2 学时)
- (2) 3D 打印概况 (2 学时);
- (3) 激光器基础 (2 学时);
- (4) 激光与材料的相互作用, 激光器安全 (2 学时);
- (5) 基于激光、电子束及电弧的 3D 打印技术 (2 学时);
- (6) 钛及钛合金的 3D 打印 (2 学时);
- (7) 镁、钴合金与形状记忆合金的 3D 打印 (2 学时);
- (8) 镍及高熵合金的 3D 打印 (2 学时);
- (9) 特别报道: 3D 打印高温合金及微型涡喷 (2 学时);
- (10) 钢及铝合金的 3D 打印 (2 学时)
- (11) 特别报道: 3D 打印透气模具钢及 7 系铝合金 (2 学时);
- (12) 贵金属及非晶态合金的 3D 打印 (2 学时);
- (13) 陶瓷及高分子材料的 3D 打印 (2 学时)
- (14) 期中课程回顾 (2 学时);
- (15) 学生期中报告 (2 学时);
- (16) 粉末冶金基本原理及传统粉末冶金 (2 学时);
- (17) 金属粉体制备及其安全 (2 学时);
- (18) 外部压力下的粉末冶金 (2 学时)
- (19) 特别报道: 金属玻璃的粉末冶金 (2 学时);
- (20) 微波烧结及超声烧结 (2 学时);
- (21) 液相烧结、金属注塑成型及反应烧结 (2 学时);
- (22) 烧结部分课程回顾 (2 学时);

- (23) 学生期末报告 (2 学时) ;
(24) 课程回顾 (2 学时) 。

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

- (1) Leander F., III Pease, William G. West, 'Fundamentals of Powder Metallurgy', Metal Powder Industry, ISBN-13: 978-1878954862, ISBN-10: 1878954865
- (2) Randall M. German, 'Powder Metallurgy & Particulate Materials Processing', Metal Powder Industry, ISBN-13: 978-0976205715, ISBN-10: 0976205718
- (3) Randall M. German, 'Sintering Theory and Practice', Wiley-Interscience; ISBN-13: 978-0471057864, ISBN-10: 047105786X
- (4) Chee Kai Chua, Kah Fai Leong, '3D Printing and Additive Manufacturing : Principles and Applications', World Scientific Publishing Company, ISBN-10: 9814571407.
- (5) William.M. Steen, Springer Verlag, 'Laser Material Processing', ISBN: 9781852336981

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		-		
小测验 Quiz		-		
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		-		

其它（可根据需要
改写以上评估方
式）
**Others (The
above may be
modified as
necessary)**

	NA		
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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

