

上海交通大学研究生专业课程信息收集表

Information Form for SJTU Graduate Profession Courses

课程基本信息 Basic Information				
*课程名称 Course Name	(中文 Chinese) 材料强度学			
	(英文 English) Strength of Materials			
*学分 Credits	3	*学时 Teaching Hours	48	
*开课学期 Semester	秋季学期 Fall	*是否跨学期 Cross-semester?	否 No	
*课程类型 Course Type	专业基础课 Program Core Course	*课程分类 Course Type	全日制课程 For full-time students	
*课程性质 Course Category	专业课 Specialized Course	课程层次 Targeting Students	硕士课程 Master Level	
*授课语言 Instruction Language	中文 Chinese	主要授课方式 Teaching Method	课堂教学 In class teaching	
*成绩类型 Grade	等第制 Letter grading	主要考核方式 Exam Method	其它 Other	
*开课院系 School	材料科学与工程学院			
所属学科 Subject	材料学			
负责教师 Person in charge	姓名 Name	工号 ID	单位 School	联系方式 E-mail
	张帆		材料学院	mtsmmc@sjtu.edu.cn
课程扩展信息 Extended Information				
*课程简介 (中文) Course Description	<p>教学内容: 本课程系统、深入地介绍工程材料变形和断裂的基本理论及强韧化原理。主要分为两篇：第一篇为变形与强化，介绍弹性变形、位错理论、塑性变形、强化原理；第二篇为材料的断裂及韧化，介绍断裂基础、断裂力学、断裂物理、韧化原理</p> <p>教学目标: 通过本课程的学习，使研究生达到如下三个目标：(1) 全面掌握有关材料变形和断裂的基本理论以及物理实质；(2) 充分了解材料强度的影响因素、强度-成分-组织之间的关系、以及材料失效分析的基本原理；(3) 获得选材、用材及开发新材料的初步能力。</p>			
*课程简介 (English) Course Description	<p>Contents: 《Strength of Materials》 discusses the basic theories of deformation and fracture as well as the main principals of strengthening and toughening for engineering materials. This course is divided into two parts. Part 1 is Deformation and Strengthening of Materials, includes elastic deformation, basics of dislocation theories, plastic deformation and principals of strengthening. Part 2 is Fracture and Toughening of Materials, includes Basics of Fracture, Fracture Mechanics, Physics of Fracture and Principles of Toughening.</p> <p>Targets: By studying the course, the students should achieve the goals as follows: (1) To have a grasp of the basic theories and physic essences of material's deformation and fracture; (2) To know well the influencing factors of material strength, the relationships among the strength, chemical composition and microstructure, the basic means improving material strength, and the basic analysis methods of material failures; (3) To obtain a preliminary ability to selecting, using the traditional materials and developing novel materials.</p>			

*教学大纲
(中文)
Syllabus

- 绪论 (1h)
- 第一篇 材料的变形与强化 (23h)**
- 1、弹性变形 (3h)**
- 1.1 弹性热力学分析
- 1.2 弹性本构关系
- 1.3 弹性模量
- 1.4 橡胶弹性
- 1.5 粘弹性
- 2、位错理论基础 (6h)**
- 2.1 位错弹性力学
- 2.2 位错动力学
- 2.3 实际晶体中的位错
- 3、晶体的塑性变形 (6h)**
- 3.1 塑性本构关系
- 3.2 塑性变形机理
- 3.3 屈服
- 3.4 塑性流变
- 4、强化原理 (8h)**
- 4.1 缺陷与强度
- 4.2 加工硬化
- 4.3 晶界强化
- 4.4 固溶强化
- 4.5 颗粒强化
- 4.6 复合强化
- 4.7 其他强化
- 第二篇 材料的断裂与韧化 (24h)**
- 5、断裂基础 (3h)**
- 5.1 断裂概论
- 5.2 断裂过程
- 5.3 缺口强度
- 5.4 环境强度
- 6、断裂力学 (9h)**
- 6.1 线弹性断裂力学
- 6.2 弹塑性断裂力学
- 6.3 动态断裂力学
- 6.4 损伤力学简介
- 7、断裂物理 (9h)**
- 7.1 脆性断裂理论
- 7.2 延性断裂理论
- 7.3 韧脆判据
- 7.4 裂纹与位错的交互作用
- 7.5 裂纹的稳态扩展
- 7.6 裂纹的位错模拟
- 7.7 断裂的原子过程
- 7.8 断裂与分形
- 8、韧化原理 (3h)**
- 8.1 概述
- 8.2 强度设计的韧化原理
- 8.3 断裂设计的韧化原理

<p>*教学大纲 (English) Syllabus</p>	<p>Preface(1h) Part 1 Deformation and Strengthening of Materials 1、 Elastic Deformation 1.1 Thermodynamics Analysis of Elasticity 1.2 Elastic Constitutive Relation 1.3 Modulus of Elasticity 1.4 Rubber Elasticity 1.5 Viscoelasticity 2、 Basics of Dislocation Theory (6h) 2.1 Elastic Mechanics of Dislocation 2.2 Dynamics of Dislocation 2.3 Dislocations in Real Crystals 3、 Plastic Deformation in Crystals (6h) 3.1 Elastic Constitutive Relation 3.2 Mechanisms of Plastic Deformation 3.3 Yielding 3.4 Plastic Flow 4、 Principals of Strengthening (8h) 4.1 Defects and Strength 4.2 Work Hardening 4.3 Boundary Strengthening 4.4 Solid -Solution Strengthening 4.5 Particle Strengthening 4.6 Combination of Strengthening 4.7 Other Strengthening Part 2 Fracture and Toughening of Materials (24h) 5、 Basics of Fracture (3h) 5.1 Outline of Fracture 5.2 Fracture Process 5.3 Notch Strength 5.4 Environment Strength 6、 Fracture Mechanics (9h) 6.1 Linear Elastic Fracture Mechanics 6.2 Elastic-Plastic Fracture Mechanics 6.3 Dynamic Fracture Mechanics 6.4 Introductions to Damage Mechanics 7、 Physics of Fracture 7.1 Theories of Brittle Fracture 7.2 Theories of Ductile Fracture 7.3 Criterion for transition between Ductile fracture and Brittle Fracture 7.4 Interaction between crack tip and dislocation 7.5 Steady Propagating of Crack 7.6 Dislocation Simulation of Crack 7.7 Atomic Theories of Fracture 7.8 Fracture and Fractal 8、 Principles of Toughening (3h) 8.1 Overall 8.2 Toughening Mechanisms based on Strength Design 8.3 Toughening Mechanisms based on Fracture Design</p>
<p>*课程要求 (中文) Requirements</p>	<p>成绩为：平时成绩 30% + 期末成绩 70% 平时成绩由课堂出勤率、课堂讨论、每章作业完成情况考核 期末成绩由笔试或期末小论文的成绩考核</p>
<p>*课程要求 (English) Requirements</p>	<p>Total Points = usual performance30%+final grade70%. Usual performance consists of attendance rate, class discussion and homework of each chapter. Final grade is determined by final examination or small paper.</p>

<p>*课程资源 (中文) Resources</p>	<p>1、李庆生,【材料强度学】,山西科学出版社,1990 2、Thomas H Courtney,【Mechanical Behavior of Materials】,机械工业出版社,2004 3、石德珂,【位错与材料强度】,西安交通大学出版社,1988 4、哈宽富,【金属力学性质的微观理论】,科学出版社,1983 5、肖纪美,【金属的韧性与韧化】,上海科学技术出版社,1980</p>
<p>*课程资源 (English) Resources</p>	<p>1、Li Qingsheng, <i>Strength of Materials</i>, Science Press of Shanxi Province, China, 1990 2、Thomas H Courtney, <i>Mechanical Behavior of Materials</i>, China Machine Press, 2004 3、Shi Deke, <i>Dislocations and Strength of Materials</i>, Xian Jiao Tong University Press, 1988 4、Ha Kuanfu, <i>The Mechanisms and Theories on Mechanical Behavior of Metals</i>, Science Press, China, 1983 5、Xiao Jimei, <i>Toughness and Toughening of Metals</i>, Shanghai Sci. and Tech. Press, 1980</p>
<p>备注 Note</p>	