Syllabus-Fundamentals of Materials Science II

<table>
<tr><td colspan="6">课程基本信息（Course Information）</td></tr>
<tr><td>*课程代码（Course Code）</td><td>MSE2606</td><td>*学时（Credit Hours）</td><td>48</td><td>*学分（Credits）</td><td>3</td></tr>
<tr><td rowspan="2">*课程名称（Course Name）</td><td colspan="5">（中文）材料科学基础</td></tr>
<tr><td colspan="5">（英文）Fundamentals of Materials Science II</td></tr>
<tr><td>课程性质 (Course Type)</td><td colspan="5">Compulsory Course</td></tr>
<tr><td>授课对象（Audience）</td><td colspan="5">Undergraduate students majored in materials science & engineering, metallurgical engineering, mechanical engineering and electrical engineering</td></tr>
<tr><td>授课语言 (Language of Instruction)</td><td colspan="5">English</td></tr>
<tr><td>*开课院系（School）</td><td colspan="5">Materials Science & Engineering</td></tr>
<tr><td>先修课程（Prerequisite）</td><td colspan="5">Fundamentals of Materials Science I, College Physics, College Chemistry, Thermodynamics of Materials, Solid State Physics</td></tr>
<tr><td>授课教师（Instructor）</td><td colspan="2">Guo Qiang，KM Reddy</td><td>课程网址 (Course Webpage)</td><td colspan="2">http:://ocw.sjtu.edu.cn/G2S/OCW/cn/CourseDetails.htm?Id=343</td></tr>
<tr><td>*课程简介（Description）</td><td colspan="5">（中文）《材料科学基础》是材料类和冶金类专业的核心基础课程。通过讲课、实验、课堂讨论和课外实践等各个教学环节，将金属学、陶瓷学和高分子物理的基础理论融合为一体，以研究材料共性规律，注重于材料的成分、组织结构、制备工艺和性能之间的内在联系，指导材料的设计和应用，并为学习后继专业课程、从事材料科学研究和工程技术工作打下坚实的理论基础。</td></tr>
<tr><td>*课程简介（Description）</td><td colspan="5">（英文）”Fundamentals of Materials Science” is one of the core curriculum for university/college students in the discipline of materials and metallurgy. The basic fundamentals of materials science is presented by lectures, experiments, class discussions, and extracurricular practice teaching, etc. In order to investigate the common laws for materials, the focus is on the internals relationships among the processing, structure, properties and performance for three different materials: metals, ceramic and polymer physics. The course provides guidance for materials design and application and lays a solid theoretical foundation for subsequent courses, materials science research and engineering technology. This is the second part of the course that covers diffusion, phase diagrams and phase transformations.</td></tr>
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课程教学大纲（course syllabus）	
*学习目标 (Learning Outcomes)	1、The fundamentals and frontiers of materials science & engineering（A3） 2、Systematic knowledge on the structure-property-processing-characterization tetrahedral.（A5.4） 3、The capability of discovering, analyzing and solving problems （B2）; The ability for sustained learning （B7） 4、Use of professional English for problem-solving and effective communication（B1）

*教学内容、进度安排及要求 (Class Schedule & Requirements)

Content	Duration (hours)	Type of teaching	Homework	Requirement	Type of evaluations
Introduction	1	Lecture		General knowledge	
Fick's diffusion laws	2	Lecture/discussion		Deep understanding	
Application of Fick's laws	2	Lecture/discussion	Homework	Understanding	
Kirkendall effect and Darken equation	2	Lecture/discussion	Homework	Deep understanding	
Solution to diffusion problems where diffusivity is a function of concentration	1	Lecture		Understanding	
Thermodynamics of diffusion	1	Lecture		Deep understanding	
Atomic mechanism of diffusion	3	Lecture/discussion	Homework	Deep understanding	
Reactive diffusion	1	Lecture		Deep understanding	
Diffusion in ionic solids and the molecular motion in polymers	2	Lecture/discussion	Homework	Deep understanding	
Thermodynamics of phase diagrams	3	Lecture/discussion	Homework	Deep understanding	
Fundamentals of phase diagrams	1	Lecture		Understanding	

	Single phase diagrams	1	Lecture/discussion	Homework	Deep understanding	
	Simple binary phase diagrams	5	Lecture/discussion	Homework	Deep understanding	Mid-term exam (closed book)
	SiO_2-Al_2O_3 phase digram	1	Lecture		Understanding	
	Fe-C phase diagram	3	Lecture/discussion	Homework	Deep understanding	
	Fundamentals of ternary diagrams	2	Lecture/discussion		Deep understanding	
	Immiscible ternary eutectic phase diagrams	2	Lecture/discussion	Homework	Deep understanding	
	Ternary euctectic phase diagrams with limited miscibility	2	Lecture/discussion	Homework	General knowledge	
	Other ternary phase diagrams	1	Lecture		General knowledge	
	Introduction of solid state phase transformations	3	Lecture		Understanding	
	Characteristics of solid state phase transformations	4	Lecture/discussion	Homework	Deep understanding	
	Nucleation & growth	4	Lecture/discussion	Homework	Deep understanding	
	Kinetics of phase transformations	1	Lecture		Understanding	

*考核方式 (Grading)	（成绩构成） The final grade includes class participation, homework, in-class quizzes, and exams: (1) Class participation: 10%。 (2) In-class quizzes and homework：20%; (3) Exams (closed book)：70%, where the mid-term exam comprises20%, and the final exam 50%.
*教材或参考资料 (Textbooks & Other Materials)	1) W. D. Callister, Jr., Fundamentals of Materials Science & Engineering, 5th Edition, John Wiley & Sons, Inc. New York, 2001. 2) 《材料科学基础(第三版)》，胡赓祥、蔡珣、戎咏华编著，上海交通大学出版社，2010

	3) R. E. Smallman，Modern Physical Metallurgy, 4th ed. Butterworths, London, 1985 4) A. G. Guy, Introduction to Material Science, McGraw-Hill, New York, 1972 5) D. R. Gaskell, Introduction to thermodynamics of materials, 5th Edition, Taylor & Francis, 2008 6) D.V. Regone，Thermodynamics of materials, Volume I, John Wiley & Sons, 1995 7) Porter & Easterling，Phase Transformations in Metals & Alloys 2nd Edition，CRC Press，1992 8) R. W. Hertzberg, Deformation & Fracture Mechanics of Engineering Materials, John Wiley & Sons, 1976 9) Hull & Bacon, Introduction to Dislocations, 5th Edition, Elsevier, 2011