

## 研究生课程教学大纲 (Syllabus)

课程代码 Course Code	MT26008	*学时 Teaching Hours	48	*学分 Credits	3
*课程名称 Course Name	(中文) 高等材料热力学 (English) Advanced Thermodynamics of Materials				
*授课语言 Instruction Language	中文 Chinese				
*开课院系 School	材料科学与工程学院				
*先修课程 Prerequisite	材料热力学、物理化学				
授课教师 Instructors	姓名 Name	职称 Title	单位 Department	联系方式 E-mail	
	金学军	教授	材料科学与工程	jin@sjtu.edu.cn	
	李伟	副教授	材料科学与工程	weilee@sjtu.edu.cn	
*课程简介 (中文) Course Description	<p>以热力学和统计热力学的原理和方法研究材料问题，称谓材料热力学。它与动力学、晶体学以及固体物理和固体化学组成材料科学的基础。材料工程包括材料的设计、制造、成型和检验，它是应用材料科学的原理进行材料设计和加工的综合学科，与材料科学和工程已成为一个整体。</p> <p>热力学在这个领域的应用，对发展材料的品种、提高材料的质量，日益显示其积极的作用。应用材料热力学原理可以阐明和预测相图、相变以及材料的其他物理现象。材料热力学既掌握热力学的基本知识，又能将这些原理和方法结合材料实践加以应用。重点掌握热力学的基本概念、原理和方法，理解相图的构成规则和诠释相图。</p> <p>高等材料热力学是在学生已经掌握本科水平的材料热力学或者材料物理化学的基础上，进一步梳理课程内容，在教学内容和教学深度上做到本硕博良好衔接。学习内容上要求掌握更高等水平，掌握相变、相图、界面、统计、不可逆过程等热力学原理。熟悉并初步掌握热力学基本原理在材料设计和加工中的应用，学以致用。</p>				
*课程简介 (English) Course Description	<p>Thermodynamics and statistical thermodynamics are used to study the material problem and the thermodynamics of appellation material. It is based on dynamics, crystallography, solid state physics and solid chemistry. Materials engineering includes materials design, manufacturing, molding and inspection. It is a comprehensive discipline that applies material science principles to design and process materials and combined with material science and engineering as a complete part.</p> <p>The application of thermodynamics in this field plays an active role in developing varieties of materials and improving the quality of materials. The application of material thermodynamics principle can clarify and predict phase diagrams, phase transitions and other physical phenomena of materials. Material thermodynamics not only grasps the basic</p>				

	<p>knowledge of thermodynamics, but also applies these principles and methods to material practice. We should grasp the basic concepts, principles and methods of thermodynamics, understand the rules of phase diagram and interpret phase diagrams.</p> <p>The advanced thermodynamics is based on the material thermodynamics and physical chemistry courses which have been mastered in the undergraduate level. This course requires combing the course content, and makes a good connection between the teaching content and teaching depth. The students need to master higher level in learning content, grasp the thermodynamics principles of phase transformation, phase diagram, interface, statistics, irreversible process and so on. Be familiar with and grasp the application of the basic principles of thermodynamics in material design and processing, and apply it to practice.</p>			
*教学安排 Schedules	教学内容 Content	授课学时 Hours	教学方式 Format	授课教师 Instructor
	导论：材料热力学及其应用 Introduction: thermodynamics of material and its application	2	课堂教学 classroom teaching	金学军
	热力学基础（复习及研讨） Fundamentals of thermodynamics (review and discussion)	6	课堂教学 / 课后自习 classroom teaching / Self study after class	金学军
	自由能计算、溶体模型与相图热力学 Free energy calculation, solution model and phase diagram thermodynamics	8	课堂教学 classroom teaching	金学军
	相图计算原理与实践 Principle and practice of phase diagram calculation	4	机房实践 Computer room practice	李伟
	相变热力学 thermodynamics of phase transformation	8	课堂教学 classroom teaching	金学军
	界面热力学 Thermodynamics of interface	6	课堂教学 classroom teaching	李伟
	统计热力学概述 Overview of statistical thermodynamics	6	课堂教学 classroom teaching	李伟
	不可逆过程热力学 Thermodynamics of irreversible process	2	课堂教学 classroom teaching	李伟
	小组研讨（热力学及其应用解析） Group discussion (thermodynamics and its application analysis)	4	互动 Classroom interaction	金学军 / 李伟

	考试 Exam	2	随堂 quiz	金 学 军 / 李 伟
*考核方式 Grading Policy	平时成绩（20%） 考试（30%） 课程设计（50%）  Regular grade （20%） Exam grade （30%） Curriculum project （50%）			
*教材或参 考资料 Textbooks & References	David V. Ragone, Thermodynamics of Materials, John Wiley & Sons, 1995 郝士明译, Nishizawa T 著,《微观组织热力学》,化学工业出版社, 2006 徐祖耀, 材料热力学, 高等教育出版社, 2010 David V. Ragone, Thermodynamics of Materials, John Wiley & Sons, 1995 Nishizawa T, Thermodynamics of microstructure,translated by Hao Shiming, Chemical industry press,2006 Xu Zuyao, material thermodynamics, higher education press, 2010			