* Course Name	Chinese				
	English Integrated Computational Materials Engineering				
* Credits	2	* Teaching Hours	32 1 =16		
* Semester	Fall	* Cross-semester?	No	Spanning over Semesters	
* Course Type	Program Frontier Course	* Course Type	For full-time students		
* Course Category	Specialized Course	Targeting Students	Doctoral Level		
* Instruction Language	Chinese	Teaching Method	In class teaching		
* Grade	Letter grading	Exam Method	Essay		
* School	School of Materials Science and Engineering				
Subject					

Person in charge	Name	ID	School	E-mail
				gujf@sjtu.edu.cn

* ( ) Course Description	200 ICME ICME - ICME - / / /
* English Course Description	This course is a frontier elective course for PhD students in materials science and engineering. It mainly describes the ICME technology in the frontier of intelligent manufacturing, laying a foundation for further research of doctoral dissertation. : This course introduces the key technology of ICME for typical thermal processing technology, and helps master the process analysis of multi-scale and multi-field coupling, as well as the basic framework of macro-micro combined numerical analysis, and its application in materials research.

	The first part briefly introduces the basic elements, concepts and key technologies of ICME, and the latest developments at home and abroad, highlighting its position in intelligent manufacturing and its important role in promoting high-end manufacturing. The second part introduces the physical process and mathematical model of heat transfer, phase transformation, mechanics during hot working process of casting, forging and heat treatment, respectively. The necessary inputs for FEM numerical simulation are emphasized, such as material parameters, process parameters, initial conditions and boundary conditions, etc. Students are expected to be familiar with research direction and progress of each individual process, and be able to perform simulation and analysis of typical hot working process correctly. The third part firstly introduces the basic principle and application of the mesoscopic simulation method (phase field method and the cellular automata method) and design principle of multi-scales coupling algorithm. The basic framework of macro- micro combined numerical analysis for typical thermal process should be mastered. Secondly, the transferred field variables between casting/forging, casting/heat treatment, forging/heat treatment are introduced, highlighting the data interface design and data transfer. Students are expected to master the design of the development plan for the whole process simulation of two or more processes. Principles of Materials Processing, Finite Element Analysis (FEA) Computational Materials Science.

* ( ) Syllabus				
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* English Syllabus	Chapter	Content	Hours	Format
	Chapter 1 Introduction of ICME	Section 1, Basic concept and history of ICME Section 2, Application of ICME in the field of materials thermal processing		lecture
	Chapter 2 Numerical simulation of liquid forming process	Section 1, Basic principle and analysis of heat transfer Section 2, Basic principle and analysis of flow and solidification Section 3, Casting simulation and		lecture

		engineering application		
	Chapter 3 Numerical simulation of plastic forming process	Section 1, Finite element calculation principle of forging forming Section 2, Integrated forging computing technology Section 3, Typical forming simulation cases		lecture
	Chapter 4 Numerical simulation of heat treatment process	Section 1, Multi-field coupling model in heat treatment process Section 2, Numerical simulation principle and realization of heat treatment process Section 3, Simulation parameters and their tests Section 4, Development direction, trend and typical cases of heat treatment simulation		lecture
	Chapter 5 Principle and technology of multi-scale coupling simulation	Section 1,Mesoscopic scale simulation -- phase field method Section 2, Mesoscopic scale simulation -- cellular automata method Section 3, Cross-scale coupling principle and implementation method		lecture
	Chapter 6 The whole process simulation technology of multi-process connection	Section 1, Data interface design and data transfer in the whole process simulation of thermal machining Section 2, Typical application of ICME in the whole process of thermal processing		lecture
* Requirements	50 1. 1 (3000) 2. PPT 15			
* English Requirements	1. A reading report (3000 words at least in Chinese character) related to the knowledge of the lectures should be submitted;			

	3. Plastic finite element method and its application in metal forming. Eds. Ruxing CHEN, Zhongming HU, Chongqing University Press 1989 4. Multiscale Methods—Bridging the Scales in Science and Engineering, Edited by JACOB FISH, Oxford University Press, 2010. 5. Modeling materials: continuum, atomistic, and multiscale techniques, Ellad B. Tadmor, Ronald E. Miller. Cambridge University Press, 2011. In addition, At least three classical papers will be provided for each chapter during the lecture.
Note	