Information Form for SJTU Graduate Profession Courses

Basic Information					
* Course Name	Chinese				
	English Thin Film Materials and Technique				
* Credits	3	* Teaching Hours	48 1 =16		
* Semester	Fall	* Cross-semester?	No	Spanning over Semesters	
* Course Type	Program Elective 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					
Subject					
Person in charge	Name	ID	School	E-mail	
				ybdai@sjtu.edu.cn	

Extended Information	
* ( ) Course Description	200
* English Course Description	"Thin Film Materials and Technique" is a specialized elective course for doctoral students majoring in materials science and engineering, and those in other related disciplines. This course aims to enable students to systematically grasp the basic knowledge of thin film materials and technique, have a general understanding of the developing trends and some frontier directions in this field, and lay a solid foundation for future career related to thin film materials. This course will systematically introduces the fundamentals of thin film materials and technique, including the basic characteristics of thin film materials, and their preparation, characterization, simulation, patterning techniques and applications. Besides, a newly emerging discipline, i.e., printed electronics, which features the combination of the preparation and patterning of thin film materials in one simple, flexible and low-cost technique will also be covered. Prerequisite course: Fundamentals of Materials Science

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Syllabus

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* English Syllabus

Chapter	Main content	Credit hour	Teaching method
Chapter 1. The basic characteristics of thin film materials 1. The definition of thin film 2. The size effects in thin film 3. Thin film and substrate 4. Internal stress	The definition of thin film and its relation to thick film. The main size effects in thin film. The characteristics of thin film/substrate system and the adhesion measurement methods. Internal stress and film exfoliation.	3	class lecture, class discussion
Chapter 2. The preparation techniques of thin films 1. Vapor deposition techniques 2. Non-vapor deposition techniques	Two kinds of vapor deposition techniques: physical vapor deposition (PVD) and chemical vapor deposition (CVD), PVD techniques: vacuum evaporation, molecular beam epitaxy (MBE), pulsed-laser ablation, sputtering and reactive sputtering, and CVD techniques: plasma-enhanced chemical vapor deposition (PECVD), metal-organic chemical vapor deposition (MOCVD). Non-vapor deposition techniques: liquid-phase epitaxy, solid-phase epitaxy, Langmuir-Blodgett method, and chemical solution coating.	15	class lecture, class discussion
Chapter 3. The characterization techniques of thin films 1. Structure characterization of thin films 2. Microstructure and morphology characterization of thin films 3. Composition characterization of thin films	The working-principles of grazing-incidence X-ray diffraction (GIXRD), reflection high-energy electron diffraction (RHEED), spectroscopic ellipsometry (SE) and their applications in the structure characterization of thin films. The applications of transmission electron microscope (TEM), scanning electron microscope (SEM), and scanning probe microscope (SPM) in the microstructure and morphology characterization of thin films. The applications of secondary ion mass spectrometry (SIMS), Auger electron spectroscopy (AES), and photoelectron	3	class lecture, class discussion

	spectroscopy (PES) in the composition characterization of thin films.		
Chapter 4. The simulation techniques of thin films 1. Commonly-used molecular simulation techniques 2. The growth simulation of thin films via molecular dynamics method 3. Structures and physical properties of amorphous thin films	The principles of two commonly-used molecular simulation techniques: molecular dynamics (MD) and Monte Carlo (MC) methods. The technical details of the application of MD method in the growth simulation of thin films. The calculation of pair correlation function (PCF), bond-angle distribution function, static structure factor (SSF), and ring statistics of amorphous films simulated by MD method.	15	class lecture, class discussion, quiz, big project
Chapter 5. The patterning techniques of thin films 1. Commonly-used patterning techniques of thin films 2. Mask fabrication	The merits and shortcomings of three kinds of commonly-used patter [illegible] [illegible] class [illegible] papESsh [illegible] [illegible] nails		

	and corrosion resistance.
* Requirements	50 3000 15 50%
* English Requirements	Based upon learning in classroom and by themselves, students are required to choose a specific topic in the field of thin film materials and technique, and after literature survey and summary, write a paper with no less than 3000 Chinese characters and then make an oral presentation about 15 minutes accordingly. The paper and the oral presentation will each account for 50% of the final grade.
* Resources	1 2013 2 [ ] 1997 3 2012 4 [ ] 2013
* English Resources	Reference: 1. Thin Film Growth, Ziqin Wu et al., Science Press (2013) 2. Electronic Thin Film Science, King-Ning Tu et al., Macmillan (1992) 3. Printed Electronics: Materials, Technologies, and Applications, Zheng Cui et al., Higher Education Press (2012) 4. Materials Science of Thin Films: Deposition & Structure (2nd edition), M. Ohring, Academic Press (2002)
Note	