Titulación

Master en Ingeniería de Materiales

MATERIALS AND MICROFABRICATION TECHNOLOGIES FOR ELECTRONIC DEVICES

Department (Faculty)
Departamento de Ingeniería Electrónica (E.T.S.I. de Telecomunicación)

Subject	Code
Materials and Microfabrication Technologies for Electronic Devices	43000341

ECTS	Type	Year/Semester	Schedule	Language
6	OB-INT	1/2	Spring Semester	English/Spanish

Objectives

The students will become familiar with the most relevant techniques used in thin film materials technology for the fabrication of electronic devices, different from silicon-based integrated circuits. These devices include sensors, actuators, RF passive components and devices with complex functionality such as microelectromechanical systems (MEMS). Some particular issues in thin film technology will be studied, which include thin film deposition and control of the film properties, design of a complete technology and specific characterization techniques of polycrystalline thin films. Design and fabrication principles of typical thin-film-based devices will be approached under a practical point of view, including actual fabrication and characterization of some of them.
The course contains a large amount of practical work, which includes the design of a complete technology for the fabrication of functional devices and the subsequent characterization of their behaviour.

Prerequirements

None

Previous knowledge recommended

Basic Physics and Thermodynamics. Basic Electricity and Magnetism; Structure of Materials; Semiconductor Physics; Instrumentation.

Coordination with other subjects

Generic Competencies

CG1, Use of English language
CG2, Capacity for teamwork
CG3, Spoken and written communication skills
CG4, Use of communication and Information technologies
CG7, Planning and organizational capacity
CG9, Capacity of interdisciplinary work

Specific Competencies

CE1, Knowledge of the structure of materials and the techniques for their characterization and analysis
CE5, Capacity for autonomous learning
CE6, Capacity for designing, assessment, selection and manufacture of materials

Contents and Schedule

The contents of the course are shown in the following table. Student attendance is divided in theory (LM) and practical work in the laboratory (LB), which will be in 3h or 4 h sessions depending on the work to do. Due to the limited space in some labs, the students will form small groups for some sessions.

The students will make group reports based on the activity at the laboratory (TG).

Session	Description	LM	LB	TG
1-10	Introduction to non-integrated-circuit electronic devices. Fundamentals on Thin Film technology Thin film functional materials (semiconductors, insulators, metals, piezoelectric, etc.) Thin film properties control by deposition processing (sputtering evaporation, chemical vapour deposition, atomic layer deposition) Technology for 3D micromachining Integration and Encapsulation	2h 4h 4h 6h 2h 2h		
2 - 14	Technology design Thin Film deposition techniques Thin film patterning Encapsulation Functional testing		8h 8h 8h 4h 8h	
15	Work exposition for evaluation			8h
25	Exams (if needed)			
	TOTALS	20h	36h	8h

Office hours

Office hours give students the opportunity to ask in-depth questions and to explore points of confusion or interest that cannot be fully addressed in class.

The progress of the students will be monitored through the individual assignments during laboratory sessions.

Evaluation

1. The students will be continuously monitored by the instructor as the laboratory groups will be very small (3 or 4 student/group).

2. The individual progress will be tested by individual assignments including concepts viewed in the theoretical lessons and exercises on practical aspects, such as the analysis of actual measurements corresponding to the different techniques. Resolution of the exercises will require the usage of computer tools.

3. Each group will have to prepare an extended presentation (30 to 45 minutes long) to be exposed in class. This will have the main weight in the evaluation at the end of the course.

4. After continuous evaluation result, there will be a final exam for the students, who have not reached the minimal mark.

Evaluation:

Exercises:	30%
Laboratory reports:	60%
Exam:	10%

Bibliography

Handbook of Thin Film Technology. Frey, Hartmut, Khan, H. R. Springer (2015)

Thin Films Material Technology: Sputtering of Compound Materials. Wasa, Kiyotaka, Kitabatake, Makoto, Adachi, Hideaki. Springer (2004)

Sputtering Materials for VLSI and Thin Film Devices. Jaydeep Sarkar. Elsevier (2013)

Thin Film Technology Handbook. Aicha Elshabini, Aicha Elshabini-Riad, Fred D. Barlow. McGraw Hill Professional, 1998

Introduction to Surface and Thin Film Processes. John a. Venables. Cambridge U. Press. 2001
Handbook of Thin Film Devices. Maurice H. Francombe. Elsevier (2000)

Teaching Staff

Instructors:

Enrique Iborra Grau (Catedrático de Universidad)
Jimena Olivares Roza (Profesor Titular de Universidad)
Marta Clement Lorenzo (Profesor Titular de Universidad)
Jesús Sangrador García (Catedrático de Universidad)