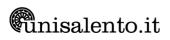
# **MATERIALS ENGINEERING AND NANOTECHNOLOGY (LM56)**

(Lecce - Università degli Studi)

Teaching NON-FERROUS METALLURGY		Teaching in italian NON-FERROUSCourse year 2METALLURGYTeaching NON-FERROUS METALLURGYLanguage ENGLISH	
GenCod A003984		SSD code ING-IND/21	Curriculum PERCORSO COMUNE
Owner professor PAOLA LEO		<b>Reference course</b> MATERIALS ENGINEERING AND	
		<b>Course type</b> Laurea Magistrale <b>Credits</b> 6.0 <b>Teaching hours</b> Front activity hours: 54.0	Location Lecce
			Semester First Semester
			Exam type Oral
			Assessment Final grade
		For enrolled in 2020/2021	Course timetable
		Taught in 2021/2022	https://easyroom.unisalento.it/Orario
BRIEF COURSE DESCRIPTION	The course clarifies the microstructure, mechanical properties, processing, physical metallurgy and engineering applications of non ferrous alloys. Particular attention is devoted to microstructure/property relationships and to the role of processing and heat treatments on the microstructure evolutions.		
REQUIREMENTS	Metallurgy basics		
COURSE AIMS	After the course the student should be able to: 1)Identfy the microstructural features, properties and applications of the main non ferrous alloys; 2)Recognize the main microstructural and mechanical features induced by casting, plastic deformation and joining methods; 3)Identify the role of process parameters (welding, casting, plastic deformation) on microstrucural evolution and properties; 4)Apply strengthening methods and heat treatments; 5)Recognize the role of the processing thermal cycle on the microstructure evolution. The development of individual projects helps each student to pursue the goals.		
TEACHING METHODOLOGY	Lectures, laboratory practice, individual project		
ASSESSMENT TYPE	The exam consists of two parts:		
		en part: the student is asked to illustrate t art: the student is asked to discuss the la	heoretical topics aboratory topics and individual project with



#### FULL SYLLABUS

# Lectures:

1) A general introduction on the main alloys in terms of the main microstructural features, properties, applications, processing (1h) 2) Cristallography, defects, strengthening mechanism (3 hours) 3) Metallography and experimental tecniques (3 hours): a) Specimen Preparation for Light Microscopy b) Optical microscope c) Hardness test d) EDS 4) Physical metallurgy of light alloys: a)Solidification principles: microstructure, heat treatments, defects (8 hours). b) Plastic deformation and solid-solid phase transformation induced by plastic deformation and heat treatments. Recovery and Recrystallization (3 hours). c)Principles of age hardening (6 hours). d) microstructure and mechanical evolution by processing thermal cycle (3hours) Case studies on above topics. 5) Aluminum alloys (4 hours) Wrought aluminum alloy: microstructures and heat treatments, designation of alloys and temper, work hardening, non heat treatable alloys, heat treatable alloys, Joining. Applications. Case studies on above topics Cast aluminum alloys: microstructures and heat treatments, designation of alloys and temper, alloys based on the Aluminum-silicon system, alloys based on the Aluminum-copper system, Aluminum-Magnesium alloys, Aluminum- Zinc-Magnesium alloys. Applications. Case studies on above topics. 6) Magnesium Alloys (2 hours) Microstructures and heat treatments, designation of alloys and temper, Zirconium free casting alloys, Zirconium containing casting alloys.Applications. Case studies on above topics. 7) Titanium alloys (4 hours) Alpha alloys: microstructure and properties Alpha/Beta alloys: microstructure and properties Heat treatments Joining Applications.

Case studies on above topics.

8) Nichel alloys, shape memory and superplasticity
8) New processing for non ferrous alloys: microstructure evolution and properties (9 hours): New joining techniques: microstructures and properties
New coatings tecniques: microstructures and properties
Three dimensional (3D) building process: microstructures and properties
Case studies on above topics.

## Laboratory (16h):

Grinding, polishing, chemical etching, electrolytic etching, optical microscopy analysis,hardness test and tensile test of light alloys:applied to microstructural and mechanical characterization
 As cast and as welded microstructure characterization
 Deformed microstructure and Recovery and Recrystallization
 Ti-6AI-4V heat treatment (2 hours)
 Microstructure evolution and hardness of Ti-6AI-4V due to annealing from Beta phase field.



Microstructure evolution and hardness of Ti-6AI-4V due to annealing from Alpha+Beta phase field Microstructure evolution and hardness of Ti-6AI-V due to air cooling from Beta phase field. Microstructure evolution and hardness of Ti-6AI-V due to air cooling from Alpha+Beta phase field. Microstructure evolution and hardness of Ti-6AI-V due to quenching from Beta phase field. 6) Microstructural and Mechanical Characterization of samples for the projects development.

## Individual project

New joining/ coating/ 3D buildings tecnniques applied to non ferrous alloys: microstructural and mechanical characterization of samples (6-8 hours).

REFERENCE TEXT BOOKS	[1] American Society for Metals, <i>Metals Handbook</i> , V. 15, <i>Casting,</i> Metals Park, Ohio, 1988. [2] J.D. Verhoeven, <i>Fundamentals of Physical Metallurgy,</i> Wiley	
	[3] R.W. Hertzberg, Deformation and Fracture Mechanics of Engineering Materials, Wiley	
	[4] M.Tisza, Physical Metallurgy for Engineers, ASM,	
	[5] G.E Dieter, <i>Mechanical Metallurgy</i> , McGraw-Hill	
	[6] I.J.Polmear, <i>Light Alloys,</i> BH	
	[7] W.F.Smith, Structure and Properties of Engineering Alloys,McGraw-Hill	
	[7] G. Lutjering, J. C. Williams, <i>'Titanium', Springer</i> 2nd edition, New York	

[8] R.W. Messler, Principles of welding, J.Wiley & Son

