MATERIALS ENGINEERING AND NANOTECHNOLOGY (LM76)

(Lecce - Università degli Studi)

Teaching PHYSICAL METALLURGY AND METALS PROCESSING

GenCod A006456

Owner professor PAOLA LEO

Reference professors for teaching
PAOLA LEO, GILDA RENNA

Teaching in italian PHYSICAL METALLURGY AND METALS

Teaching PHYSICAL METALLURGY AND METALS PROCESSING

SSD code ING-IND/21

Reference course MATERIALS ENGINEERING AND

Course type Laurea Magistrale

Credits 9.0

Teaching hours Front activity hours: 81.0

For enrolled in 2022/2023

Taught in 2022/2023

Course year 1

Language ENGLISH

Curriculum PERCORSO COMUNE

Location Lecce

Semester First Semester

Exam type Oral

Assessment Final grade

Course timetable
https://easyroom.unisalento.it/Orario

BRIEF COURSE DESCRIPTION

The physical metallurgy contents are the following: Evolution of structures in solid as it form from liquid, solid-solid state diffusional transformation of microstructure, solid solid state undiffusional trasformation of microstructure, Effect of alloy elements on the transformation processes, Structure property relations.
Metals are fabricated or finished by different means to achieve metals and alloys of desired characteristics. There been many kinds of fabrication techniques depends on properties of metal, product shape-size-properties, cost, etc. Effect of processing techniques on the evolution of microstructure with regards to the standard and innovative process will analized.

REQUIREMENTS

Metallurgy basics

COURSE AIMS

Engineering problems needs the skill of choosing the most suitable material and processing. Understanding the behavior of materials, particularly structure-property correlation, will help selecting suitable materials for a particular application. Moreover, also the understanding of the principles that determines the changing of the metals properties due to during their processing and its relation with their properties are necessary to define the service performances of the components. Both the Physical metallurgy and metal processing subjects are necessary to supply the previows skills.
After the course the student should be able to:
1)Recognize the main microstructural and mechanical features induced by casting, plastic deformation and joining methods;
2)Identify the role of process parameters (welding, casting, plastic deformation) on microstrucural evolution and properties;
3)Apply strengthening methods and heat treatments;
4)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: 1. first written part: the student is asked to illustrate theoretical topics 2. second part: the student is asked to discuss the laboratory topics and individual project with the lecturer.
FULL SYLLABUS	**Lectures:** 1) Introduction to the course: Why Should I study Physical Metallurgy and Metal processing? 2) Cristallography, defects 3) Metallography and experimental tecniques 4) Physical metallurgy of light alloys 40 hours: a)Solidification principles: microstructure, heat treatments, defects b) Diffusional and diffusionless solid state evolution c) Plastic deformation and microstructure induced by plastic deformation and heat treatments d) microstructure and mechanical evolution by processing thermal cycle Case studies on above topics. 4) New processing: microstructure evolution and properties 20 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. **Individual/group project** New joining/ coating/ 3D buildings tecnniques applied to non ferrous alloys: microstructural and mechanical characterization of samples (6-8 hours). **Laboratory (30hours) :** Laboratory practice will be devoted both to clarify theorical subjects and train the student to develop their projects. The main techniques and subjects are shown in the following: 1)Grinding, polishing, chemical etching, electrolytic etching, optical microscopy analysis,hardness :applied to microstructural and mechanical characterization. 2) Heat treatment 3)Cold and hot tensile test 4) Corrosion Test 5) welds microstructure 6) coating microstructure 7) additive manufacturing microstructures **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, *Metals Handbook*, V. 15, *Casting,* Metals Park, Ohio, 1988.
[2] J.D. Verhoeven, *Fundamentals of Physical Metallurgy,* 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, *Mechanical Metallurgy*, McGraw-Hill
[6] I.J.Polmear, *Light Alloys,* BH
[7] W.F.Smith, *Structure and Properties of Engineering Alloys*,McGraw-Hill
[7] G. Lutjering, J. C. Williams,*'Titanium', Springer* 2nd edition, New York
[8] R.W. Messler, *Principles of welding*, J.Wiley & Son