Course guides
295703 - MACE - Ceramic Materials

Last modified: 04/04/2022

Unit in charge: Barcelona East School of Engineering
Teaching unit: 702 - CEM - Department of Materials Science and Engineering.

Degree: BACHELOR'S DEGREE IN MATERIALS ENGINEERING (Syllabus 2010). (Compulsory subject).

Academic year: 2021 **ECTS Credits:** 6.0 **Languages:** Spanish

LECTURER

Coordinating lecturer: MIGUEL MORALES COMAS

Others: Primer quadrimestre:
MIGUEL MORALES COMAS - Grup: M11, Grup: M12

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
CEI-09. Understand the fundamentals of materials science, technology and chemistry. Understand the relationship between the microstructure, synthesis or processing and the properties of materials.
CEMT-19. Knowledge of the structure of different types of materials, as well as material characterisation and analysis techniques.

CEMT-22. Knowledge and application of materials technology in the production, transformation, processing, selection, control, maintenance, recycling and storage of all types of materials.

Transversal:
04 COE N3. EFFICIENT ORAL AND WRITTEN COMMUNICATION - Level 3. Communicating clearly and efficiently in oral and written presentations. Adapting to audiences and communication aims by using suitable strategies and means.

TEACHING METHODOLOGY

Theoretical class in conjunction with Laboratory: sessions and autonomous learning exercises will be done. Two exams, a presentation and small exercises will be part of the grade.Theoretical class in conjunction with Laboratory: sessions and autonomous learning exercises will be done. Two exams, a presentation and small exercises will be part of the grade.

LEARNING OBJECTIVES OF THE SUBJECT

The objective of this subject is that the student will acquire the introductory knowledge and skills over structure, properties, processing, design and in-service response of traditional and advanced ceramic materials.
At the end of the course the student should be able to:
- Identify the main crystallographic structures and microstructures of ceramic materials
- Identify the main defects in ceramics, as well as formulate the main reactions between them
- Select the optimal processing route of ceramic components
- Design to optimize the structural integrity and reliability of ceramic devices.

STUDY LOAD

Type	Hours	Percentage
Hours large group	45,0	30.00
Hours small group	15,0	10.00
Guided activities	90,0	60.00

Total learning time: 150 h

CONTENTS

Introduction to ceramic materials

Description:
History of ceramic technology. Classification of ceramic materials. Crystallography of ceramics. Silicates and Aluminosilicates. Glass.

Full-or-part-time: 15h
Theory classes: 6h
Practical classes: 1h
Laboratory classes: 2h
Self study : 6h

Crystallographic defects in ceramics

Description:
Point defects. Kröger-Vink notation. Dislocations. Pores. Grain Boundaries.

Full-or-part-time: 13h
Theory classes: 4h
Practical classes: 1h
Self study : 8h

Microstructure and Phase Equilibrium

Description:
Ceramic phase diagrams. Phases out of equilibrium. TTT curves and glass formation. Ceramic Microstructures

Full-or-part-time: 10h
Theory classes: 2h
Practical classes: 2h
Self study : 6h

Processing Technology

Description:
Overview of ceramic processing routes. Raw materials. Solid state sintering. Densification. Forming. Additives. Glass. Single crystals.

Full-or-part-time: 34h
Theory classes: 8h
Practical classes: 1h
Laboratory classes: 6h
Self study : 19h

Design, mechanical properties and reliability

Description:
Design issues. Mechanical properties. Toughness and reliability of ceramics. Weibul statistics Hardness and wear.

Full-or-part-time: 21h
Theory classes: 5h
Practical classes: 1h
Laboratory classes: 2h
Self study : 13h

Thermo-mechanical behaviour

Description:
Thermal properties. Thermo-mechanics: thermal shock and creep.

Full-or-part-time: 8h 30m
Theory classes: 1h
Practical classes: 1h
Laboratory classes: 2h
Self study : 4h 30m

Engineering applications

Description:
Engineering applications

Full-or-part-time: 11h
Practical classes: 1h
Self study : 10h

GRADING SYSTEM

60% Final Exam (15% Mid-term exam 1 + 45% Final-term exam 2) + 10 % laboratory + 30% quiz (12% presentation Lesson 2 + 18% presentation Final activity)

There will not be a reevaluation exam

BIBLIOGRAPHY

Basic:
- Barsoum, M. W. Fundamentals of ceramics. London: London : Taylor & Francis, 2003. ISBN 9780750309028.
- Carter, C. Barry ; Grant Norton, M. Ceramic materials science and engineering. 2nd ed. New York: Springer, cop. 2013. ISBN 9780387462707.
- Richerson, David W. Modern ceramic engineering : properties, processing, and use in design. 3rd ed. Boca Raton, FL: CRC Taylor & Francis, 2006. ISBN 9781574446937.

Complementary:
- Mari, Eduardo Ambrosio. Los Materiales cerámicos : un enfoque unificador sobre las cerámicas tradicionales y avanzadas, los vidrios, los cementos, los refractarios y otros materiales inorgánicos no metálicos. Buenos Aires: Alsina, 1998. ISBN 9505530552.