Course guide
240EM121 - 240EM121 - Advanced Ceramic Materials and Inorganic Matrix Composites

Last modified: 26/06/2025

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

Degree: ERASMUS MUNDUS MASTER'S DEGREE IN ADVANCED MATERIALS SCIENCE AND ENGINEERING (Syllabus 2014). (Optional subject).

Academic year: 2025 **ECTS Credits:** 4.5 **Languages:** English

LECTURER

Coordinating lecturer: Llanes Pitarch, Luis Miguel

Others: Llanes Pitarch, Luis Miguel
Jimenez Piqué, Emilio
Turón Viñas, Miquel

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
CEMCEM-08. (ENG) Avaluar el temps de vida en servei, la reutilització, la recuperació i el reciclatge de productes atenent a les característiques dels materials que el conformen
CEMCEM-02. (ENG) Dissenyar i desenvolupar productes, processos, sistemes i serveis, així com l'optimització d'altres ja desenvolupats, atenent a la selecció de materials per a aplicacions específiques

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.
06 URI N3. EFFECTIVE USE OF INFORMATI0N RESOURCES - Level 3. Planning and using the information necessary for an academic assignment (a final thesis, for example) based on a critical appraisal of the information resources used.

TEACHING METHODOLOGY

Subject in process of extinction. There is no teaching, the students that enroll it do so only with the right to an exam.

LEARNING OBJECTIVES OF THE SUBJECT

To become familiar with advanced ceramics and inorganic-matrix (metal- and ceramic-) composites regarding structural and functional applications. Fundamental structure-property relationships underlying mechanical, thermal and energy-related parameters. Case Studies in design and performance of advanced ceramic as well as metal- and ceramic- matrix composites.

STUDY LOAD

Type	Hours	Percentage
Hours small group	13,5	12.00
Hours large group	27,0	24.00
Self study	72,0	64.00

Total learning time: 112.5 h

CONTENTS

Tema 1. Introduction: Advanced ceramics and composites

Description:
Advanced ceramics and inorganic (metal- and ceramic-) matrix composites. Microstructural and processing aspects. Properties and applications.

Full-or-part-time: 15h
Theory classes: 4h 30m
Practical classes: 1h 30m
Self study : 9h

Tema 2. Advanced ceramics

Description:
Definition. Chemical routes to precusors. Consolidation and densification. Structural ceramics. Toughneing methods. Functional Ceramics. Applications.

Full-or-part-time: 33h 45m
Theory classes: 9h
Practical classes: 4h 30m
Self study : 20h 15m

Tema 3. Ceramic matrix composites

Description:
Definition. Introduction to ceramic matrix materials and ceramic reinforcements. Processing of monolithic ceramics and particulate composites, whisker and short fiber reinforced composites; long fiber composites. Characteristics of matrix and reinforcement interfaces. Micromechanics, thermal and physical properties of composites. Mechanical and creep behaviour of ceramic matrix composites. Applications.

Full-or-part-time: 30h
Theory classes: 9h
Practical classes: 3h
Self study : 18h

Tema 4. Metal matrix composites

Description:
Definition. Types of metal-matrix composites and microstructural features. Fabrication processes. Load transfer concept. Interfacial bonding strength. Mechanical, thermal and evironmental performance. Applications

Full-or-part-time: 33h 45m
Theory classes: 9h
Practical classes: 4h 30m
Self study : 20h 15m

GRADING SYSTEM

Subject in process of extinction. There is only one final test that corresponds to 100% of the final grade of the subject.

BIBLIOGRAPHY

Basic:
- Barsoum, Michel W. Fundamentals of ceramics. New York: Taylor & Francis, 2003. ISBN 9780750309028.
- Chawla, N. ; Chawla, K. K. Metal matrix composites [on line]. New York: Springer, 2006 [Consultation: 05/05/2015]. Available on: https://ebookcentral.proquest.com/lib/upcatalunya-ebooks/detail.action?docID=302651. ISBN 9780387285672.
- Wachtman, J. B. ; W. Roger Cannon ; M. John Matthewson. Mechanical properties of ceramics. 2nd ed. Hoboken, NJ: John Wiley & Sons, 2009. ISBN 9780471735816.