



Course guide

295755 - 295EM033 - Advanced Ceramics

Last modified: 08/08/2024

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

Degree: MASTER'S DEGREE IN MATERIALS SCIENCE AND ADVANCED MATERIALS ENGINEERING (Syllabus 2019). (Compulsory subject).
ERASMUS MUNDUS MASTER'S DEGREE IN ADVANCED MATERIALS SCIENCE AND ENGINEERING (Syllabus 2021). (Optional subject).

Academic year: 2024 **ECTS Credits:** 6.0 **Languages:** Spanish

LECTURER

Coordinating lecturer: MARIA PAU GINEBRA MOLINS

Others: Primer quadrimestre:
ANNA DÍEZ ESCUDERO - Grup: T1
MARIA PAU GINEBRA MOLINS - Grup: T1
EMILIO JIMENEZ PIQUÉ - Grup: T1
MIGUEL MORALES COMAS - Grup: T1

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:

CEMCEAM-01. (ENG) Dissenyar i desenvolupar productes, processos i sistemes, aixó com l'optimització d'altres ja desenvolupats, atenent a la selecció de materials per aplicacions específiques.

CEMCEAM-02. (ENG) Aplicar métodos innovadores para el diseño, simulación, optimización y control de procesos de producción y transformación de materiales

CEMCEAM-05. (ENG) Interpretar y aplicar normativas y especificaciones relativas a los materiales y sus aplicaciones

Transversal:

06 URI. EFFECTIVE USE OF INFORMATION RESOURCES. Managing the acquisition, structure, analysis and display of information from the own field of specialization. Taking a critical stance with regard to the results obtained.

TEACHING METHODOLOGY

LEARNING OBJECTIVES OF THE SUBJECT

- 1.- Understand the microstructure and properties of advanced ceramics
- 2- Design optimal sintering and processing strategies to optimize properties
- 3- Select the best advanced ceramics for different applications
- 4- Understand the design requirements and the biological response to ceramics and glass for biomedical applications



STUDY LOAD

Type	Hours	Percentage
Hours small group	9,0	6.00
Self study	96,0	64.00
Hours large group	45,0	30.00

Total learning time: 150 h

CONTENTS

TOPIC 1 CERAMIC STRUCTURES AND MECHANICAL PROPERTIES

Description:

Introduction. Advanced ceramics vs. Traditional Ceramics. Main applications. Mechanical properties. Hardness, toughness, reliability, creep.

Full-or-part-time: 12h 30m

Theory classes: 3h

Laboratory classes: 1h

Self study : 8h 30m

TOPIC 2. SINTERING

Description:

Manufacturing: Dry routes. Wet routes. Colloids. Sintering, including FAST techniques. Monocrystals. 3D printing

Full-or-part-time: 25h

Theory classes: 6h

Laboratory classes: 2h

Self study : 17h

TOPIC 3. CERAMIC TYPES

Description:

Oxides, carbides, nitrides. Cerments. Structural ceramics. Functional ceramics.

Full-or-part-time: 25h

Theory classes: 6h

Laboratory classes: 2h

Self study : 17h

TOPIC 4: CERAMICS FOR STRUCTURAL PROSTHESIS

Description:

Dental ceramics. Dental implants. Ceramics for Joints. Reliability and mechanical considerations

Full-or-part-time: 25h

Theory classes: 6h

Laboratory classes: 2h

Guided activities: 17h



TOPIC 5. BIOLOGICAL CERAMICS: BIOMINERALS

Description:

Biomineralization. Structural characteristics and properties of biological ceramics. Bioceramics in biological tissues.

Full-or-part-time: 20h

Theory classes: 3h

Self study : 17h

TOPIC 6: BIOCERAMICS

Description:

Bioactive ceramics and resorbable ceramics. Glass and glass ceramic for biomedical applications. Biological characterization of bioceramics

Full-or-part-time: 63h 30m

Theory classes: 15h

Laboratory classes: 6h

Self study : 42h 30m

GRADING SYSTEM

BIBLIOGRAPHY

Basic:

- Carter, C. Barry; Norton, M. Grant. Ceramic materials : science and engineering. 2nd ed. New York: Springer Science+Business Media, cop. 2013. ISBN 9781461435228.
- So^{miya}, Shigeyuki. Handbook of advanced ceramics : materials, applications, processing, and propertiesties. Second edition. Amsterdam ; Boston: Academic Press, [2013]. ISBN 9780123854698.
- Bergmann, Carlos P.; Stumpf, Aisha. Dental Ceramics: Microstructure, Properties and Degradation. Berlin: Springer, 2013. ISBN 9783642382246.
- Reza Rezaie, H.; Nasiry, M.; Rezaei Khamseh, M.M.; Öchsner, A. A Review on dental materials. Springer International Publishing, 2020. ISBN 9783030489311.
- Kokubo, Tadashi. Bioceramics and their clinical applications. Cambridge : Boca Raton, Florida: Woodhead ; CRC Press, 2008. ISBN 9781845692049.
- Rey, C., Combes, C., Drouet, C., Grossin, D., Bertrand, G., and Soulié. "Bioactive Calcium Phosphate Compounds: Physical Chemistry". Ducheyne, P., Grainger, D.W., Healy, K.E., Hutmacher, D.W., and Kirkpatrick, C.J. Comprehensive Biomaterials II. Vol. 1. Elsevier, 244.
- Kokubo, Tadashi. Bioceramics and their clinical applications. Cambridge : Boca Raton, Florida: Woodhead ; CRC Press, 2008. ISBN 9781845692049.
- Dill Pasteris, Jill; Wopenka, Brigitte; Valsami-Jones, Eugenia. "One and Tooth Mineralization : Why Apatite?". Elements. 4 (2) : 97-104.

Complementary:

- Aldinger, Fritz; Weberruss, Volker Achim. Advanced ceramics and future materials : an introduction to structures, properties and technologies. Weinheim; Chichester: Wiley-VCH, cop. 2010. ISBN 9783527321575.