Module Description

Hybrid Materials: Selection and Design

General Information

Number of ECTS Credits

3

Abbreviation

TSM_HybrMat

Version

2017.04.04

Responsible of module

Alberto Ortona, SUPSI

Language

	Lausanne	Bern	Zürich	Lugano/Manno
Instruction	☐ E ☐ F	☐ D ☐ E ☐ F	☐ D ☐ E	☒ E
Documentation	☐ E ☐ F	☐ D ☐ E ☐ F	☐ D ☐ E	☒ E
Examination	☐ E ☐ F	☐ D ☐ E ☐ F	☐ D ☐ E	☒ E

Module category

☐ Fundamental theoretical principles
☒ Technical/scientific specialization module
☐ Context module

Lessons

☒ 2 lecture periods and 1 tutorial period per week
☐ 2 lecture periods per week

Brief course description of module objectives and content

Hybrid materials can be defined as a combination of two or more materials (or of material and space) in a predetermined geometry and scale, optimally serving a specific engineering purpose. These materials are widespread and can be used in several different applications. Sandwich panels, foams, bones and composites in general are all examples of hybrid materials. The effective properties (mechanical, thermal, electrical, etc.) of these materials depend on individual phase properties and spatial arrangement, usually according to a non-trivial dependence. The objective of this course is to provide and illustrate design and selection concepts for engineering materials in general and to explore the relation between materials structure and properties in hybrid materials, using both numerical and analytical techniques.

Aims, content, methods

Learning objectives and acquired competencies

Understand the importance of material property charts and learn the basics of material selection and design
Understand the concept of effective properties and their dependence on phase spatial arrangement in hybrid materials.
Learn the basics of different analytical and numerical approaches used to predict the effective properties of hybrid materials.

Contents of module with emphasis on teaching content

The course content will be focused on:

- Material property charts
- Process of material selection and design
- Examples of hybrid materials and their applications
- Approaches for microstructural description
- Analytical and numerical methods for the calculation of effective properties

Teaching and learning methods

Teaching: Ex cathedra teaching (theory), presentation of case studies and exercises
Learning methods: Self study

Prerequisites, previous knowledge, entrance competencies

Fundamentals of Material Science

Literature

M. F. Ashby, “Materials Selection in Mechanical Design”, Elsevier, 2011.
M. Sejnoha and J. Zeman, ”Micromechanics in Practice”, WIT Press, 2013.
S. Torquato, “Random Heterogeneous Materials – Microstructure and Macroscopic Properties”, Springer, 2002.

Assessment

Certification requirements for final examinations (conditions for attestation)

Written module examination

Duration of exam:	120 minutes
Permissible aids:	None