Module Description, available in: EN

Hybrid Materials: Selection and Design

General Information

Number of ECTS Credits

3

Module code

TSM_HybrMat

Valid for academic year

2019-2020

Last modification

2018-11-05

Responsible of module

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Explanations regarding the language definitions for each location:

- Instruction is given in the language defined below for each location/each time the module is held.
- Documentation is available in the languages defined below. Where documents are in several languages, the percentage distribution is shown (100% = all the documentation).
- The examination is available 100% in the languages shown for each location/each time it is held.

	Berne	Lausanne			Lugano	Zurich		
Instruction					**X** E 100%			
Documentation					**X** E 100%			
Examination					**X** E 100%			

Module Category

TSM Technical/scientific specialization module

Lessons

2 lecture periods and 1 tutorial period per week

Entry level competences

Prerequisites, previous knowledge

Fundamentals of Material Science

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

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

Module does not use certification requirements

Basic principle for exams

As a rule, all the standard final exams for modules and also all repetition exams are to be in written form

Standard final exam for a module and written repetition exam

Kind of exam

written

Duration of exam

120 minutes

Permissible aids

No aids permitted

Special case: Repetition exam as oral exam

Kind of exam

oral

Duration of exam

30 minutes

Permissible aids

No aids permitted