

**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	<input type="checkbox"/> E <input type="checkbox"/> F	<input type="checkbox"/> D <input type="checkbox"/> E <input type="checkbox"/> F	<input type="checkbox"/> D <input type="checkbox"/> E	<input checked="" type="checkbox"/> E
Documentation	<input type="checkbox"/> E <input type="checkbox"/> F	<input type="checkbox"/> D <input type="checkbox"/> E <input type="checkbox"/> F	<input type="checkbox"/> D <input type="checkbox"/> E	<input checked="" type="checkbox"/> E
Examination	<input type="checkbox"/> E <input type="checkbox"/> F	<input type="checkbox"/> D <input type="checkbox"/> E <input type="checkbox"/> F	<input type="checkbox"/> D <input type="checkbox"/> E	<input checked="" type="checkbox"/> 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