Module Handbook

TUK  MODHB  Homepage

Notes on the module handbook of the department Mechanical and Process Engineering


Ausnahmen:


Module MV-WKK-B100-M-4
Materials Science (M, 11.0 LP)

Module Identification

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<th>CP (Effort)</th>
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<td>MV-WKK-B100-M-4</td>
<td>Materials Science</td>
<td>11.0 CP (330 h)</td>
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<td>MV-BEMT-4-M-4</td>
<td>Materials Science</td>
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Hint concerning Module Number MV-BEMT-4-M-4:
Number for Bachelor’s degree teaching profession for vocational schools in metal technology

Basedata
CP, Effort
11.0 CP = 330 h

Position of the semester
2 Sem. from WiSe

Level
[4] Bachelor (Specialization)

Language
[DE] German

Module Manager
Beck, Tilmann, Prof. Dr.-Ing. (PROF | DEPT: MV)

Lecturers
Beck, Tilmann, Prof. Dr.-Ing. (PROF | DEPT: MV)
Blinn, Bastian, Dr.-Ing. (WMA | DEPT: MV)

Area of study
[MV-WKK] Materials Science and Engineering

Reference course of study
[MV-82.103-SG] B.Sc. Mechanical Engineering

Livecycle-State
[NORM] Active

Courses

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<tr>
<th>Type/SWS</th>
<th>Course Number</th>
<th>Choice in Module-Part</th>
<th>SL</th>
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<td>2V+1U</td>
<td>MV-WKK-86150-K-4</td>
<td>P</td>
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<td>PL1</td>
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<td>2V+1U</td>
<td>MV-WKK-86151-K-4</td>
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<td>2L</td>
<td>MV-WKK-86168-K-4</td>
<td>P TESTAT no</td>
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<td>SuSe</td>
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- About [MV-WKK-86150-K-4]: Title: "Materials Science I"; Presence-Time: 42 h; Self-Study: 78 h
- About [MV-WKK-86151-K-4]: Title: "Materials Science II"; Presence-Time: 42 h; Self-Study: 78 h
- About [MV-WKK-86168-K-4]: Title: "Laboratory Materials Science"; Presence-Time: 28 h; Self-Study: 62 h
- About [MV-WKK-86168-K-4]: The study achievement "[TESTAT] tests / audited elaborations" must be obtained. It is a prerequisite for the examination.

Examination achievement PL1

- Form of examination: written exam (Klausur) (180 Min.)
- Examination Frequency: each semester
- Examination number: 10152 ("Material science I, II")

Evaluation of grades

The grade of the module examination is also the module grade.

Contents

Description of the structure of solid materials, lattice structure, solid solution, dislocations, alloys, Gibbs’ phase rule, phase diagrams of binary and ternary alloys.

From [MV-WKK-86151-K-4] Materials Science II:
Metastable Fe,Fe3C system, stable system of Fe,C (Cast iron), behavior of metallic materials at monotonic and creep
loadings as well as notch impact test, crack propagation, fatigue behavior, iron-based materials, heat treatment of steels, aluminum alloys.

From [MV-WKK-86168-K-4] Laboratory Materials Science:

In the laboratory, the handling of material testing devices and analysis equipment is demonstrated. Furthermore, it is shown how the resulting material parameters can be presented and interpreted. The following experiments are conducted:

- Hardness test
- Charpy impact test (notched impact test)
- Thermal analysis
- Metallography
- Tensile test
- Fatigue test

Competencies / intended learning achievements

1. Lecture
The students will be able to:

- state the main groups of materials and their application.
- explain the relevant binding mechanisms in solid materials and their influence on the mechanical properties.
- describe the main types of crystal lattices and to assign them to technical materials.
- state the major lattice imperfections and to link them to the deformation and diffusion mechanisms.
- illustrate the basic types of binary phase diagrams and to describe the processes during solidification of the material, with a special focus on the development of the microstructure. Moreover, they will be enabled to analyze the phase distribution in the material volume, considering the concentration and weight fraction of the single phases.
- apply the relevant aspects of binary phase diagrams on technical alloys and especially on the alloy system of iron and carbon.
- define the phase distributions depending on commonly used heat treatment and to qualitatively correlate this with the mechanical properties.
- explain how to perform the relevant testing methods of mechanical characterization (tensile test, hardness test, notch impact test, fatigue test) and to define which characteristic values of mechanical properties are obtained, respectively.
- state the technically relevant types of aluminum alloy and attribute them qualitatively to mechanical properties as well as technical applications. Moreover, they will be enabled to describe heat treatments of precipitation hardening aluminum alloys as well as their influence on the mechanical properties.

2. Exercises
The students will be enabled to use the methods, which are defined in the following and will taught in the lecture at given examples.

- Description of crystal lattices as well as their imperfections
- Quantitative analysis of binary phase diagrams and transformation diagrams
- Determination of characteristic values on the basis of the measurements obtained in mechanical testing of construction materials

3. Laboratory
Based on the laboratory tests, the students will be able to

- carry out the essential experiments of mechanical material testing under supervision
- evaluate the test results regarding the resulting material parameters
- interpret the results based on the alloy composition and the material microstructure

For Bachelor's degree teaching profession for vocational schools in metal technology:

The students will gain knowledge about the relevant basics of materials science and its technical application, especially in the areas relevant for vocational school. Moreover, they will understand fundamental methods of materials science and will be able to apply them.
Literature

- W. Schatt, H. Worch: Werkstoffwissenschaft, Wiley-VCH;
- W. Bergmann: Werkstofftechnik Teil 1 Grundlagen, Carl Hanser Verlag;
- E. Macherauch: Praktikum in Werkstoffkunde, Vieweg;
- J. F. Shackelford: Materials Science for Engineers, Prentice Hall;

Registration

Registration for participation in the laboratory at the Chair of Materials Science and Engineering. In addition, the laboratory must be registered via the QIS.

Requirements for attendance of the module (informal)

None

- Notice: Some Courses have informal requirements for attendance:

Requirements for attendance of the module (formal)

None

References to Module / Module Number [MV-BEMT-4-M-4]

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