Excerpt from Module Descriptions

Master of Science Energy Science and Technology

Examination Regulations in the Version of: 2014

Sub-Section: Materials Science
Index

Materials Science

Materials Science 1
## Materials Science

Modules referring to Materials Science

<table>
<thead>
<tr>
<th>Code</th>
<th>8833270978</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECTS credits</td>
<td>10</td>
</tr>
<tr>
<td>Attendance time</td>
<td>8</td>
</tr>
<tr>
<td>Language of instruction</td>
<td>English</td>
</tr>
<tr>
<td>Duration</td>
<td>2 semester Semester</td>
</tr>
<tr>
<td>Cycle</td>
<td>starts every Winter Semester</td>
</tr>
<tr>
<td>Coordinator</td>
<td>Prof. Dr. U. Herr, Faculty of Engineering and Computer Science</td>
</tr>
<tr>
<td>Instructor(s)</td>
<td>Prof. Dr. U. Herr and lecturers of the Faculty of Engineering and Computer Science</td>
</tr>
<tr>
<td>Allocation of study programmes</td>
<td>First and second semester MSc Energy Science and Technology</td>
</tr>
<tr>
<td>Recommended prerequisites</td>
<td>Fundamentals of mathematics, physics and chemistry</td>
</tr>
</tbody>
</table>
| Learning objectives | Materials Science I  
Students should be able to  
  • classify metallic, ceramic and polymeric materials based on their structure on the atomic scale, microstructure and macroscopic properties.  
  • analyze different materials with respect to mechanical strength.  
  • understand the physical basis for thermal, electrical and magnetic properties of solid materials.  
Materials Science II  
Students should be able to  
  • interpret the influence of the processing of a metallic alloy, ceramic and polymeric substance on its microstructure and properties.  
  • relate the structure of a composite material to improved strength and toughness.  
  • select appropriate materials and processing routes for the realization of an engineering design goal, based on properties and performance characteristics. |
Materials Science I

- Classification of materials with respect to chemical bond and structure.
- Crystal structure: Symmetry classes, lattices, reciprocal lattice, diffraction.
- Defects in solids: Point defects, dislocations, grain and phase boundaries.
- Characterization of the microstructure: Microscopic methods (optical, SEM), diffraction techniques (XRD, TEM), scanning probe techniques (introduction).
- Phase diagrams: Thermodynamics of solutions, chemical potential, phase equilibrium, basic types of phase diagrams, important examples.
- Transport: Diffusion (macroscopic and microscopic description), diffusion at surfaces and interfaces, electromigration, thermotransport.
- Phase transformations: Thermodynamics and kinetics, diffusive transformations, non-diffusive transformations.
- Mechanical properties: Elasticity, plastic deformation, viscous flow and creep, fracture.

Materials Science II

- Application of basic concepts introduced in part I of the lecture to different classes of materials: Metallic alloys, ceramics, glasses, polymers.
- Processing/optimization of materials, heat treatment
- Electrical properties of materials
- Semiconductors
- Magnetic properties of materials
- Optical properties of materials

Literature


Teaching and learning methods

Materials Science I
- 5 credit points
- Lecture 3 h/week
- Exercise 1 h/week

Materials Science II
- 5 credit points
- Lecture 3 h/week
- Exercise 1 h/week

Workload

Materials Science I:
- Total 150 h
- Lecture: 48 h lecture (presence)
- 38 h preparation and revision
- Solving problems: 16 h presence
- 32 h revision
- Exam: 16 h preparation
Materials Science II:
Total 150 h
Lecture: 42 h presence
50 h preparation and revision
Solving problems: 14 h presence
28 h revision, solution of exercises
Exam: 16 h preparation

Assessment
Derzeit steht keine deutsche Modulbeschreibung zur Verfügung.

Grading procedure
Weighted average of graded exams according to credit points

Basis for
Module Energy Science and Technology III-Electrochemical EST MSc Energy Science and Technology