

MATERIALS SCIENCE

Materials Science I

Module assigned to 1st semester

Identification Code	2288870100
ECTS-Points	5
Credit Hours	4
Language	English
Length of the Module	1 semester
Date and Capacity	Winter term 60 students
Responsible Lecturer	Prof. Dr. Ulrich Herr
Further Lecturer	Prof. Dr. Ulrich Herr
Study Programme	Master degree in Advanced Materials Master degree in Energy Science and Technology compulsory
Prerequisites	BSc degree
Study Objectives	Students should <ul style="list-style-type: none">- understand the basics of materials science- be able to apply this knowledge to optimize materials properties, especially mechanical properties.
Module Contents	<ol style="list-style-type: none">1. Introduction<ul style="list-style-type: none">- structure and bonding- classification of materials2. Crystal structure<ul style="list-style-type: none">- symmetry classes, lattices- reciprocal lattice, diffraction- band structure3. Defects in solids<ul style="list-style-type: none">- point defects, dislocations, grain and phase boundaries- microstructure of materials4. Characterization of the microstructure<ul style="list-style-type: none">- microscopic methods (optical, SEM, FIM)- diffraction techniques (XRD, TEM)- scanning probe techniques (introduction)5. Phase diagrams<ul style="list-style-type: none">- thermodynamics of solutions- chemical potential, phase equilibrium- basic types of phase diagrams- important examples6. Transport<ul style="list-style-type: none">- diffusion: macroscopic and microscopic description- diffusion at surfaces and interfaces- electromigration- thermotransport7. Phase Transformations<ul style="list-style-type: none">- thermodynamics and kinetics- diffusive transformations- non-diffusive transformations

	8. Mechanical properties <ul style="list-style-type: none"> - elastic properties - plastic deformation - viscous flow and creep - fracture
Literature	<ul style="list-style-type: none"> - W.D. Callister: <i>Materials Science and Engineering - An Introduction</i> (Wiley) - Atkins: <i>Physical Chemistry - for chemical potential, thermodynamics of mixtures and thermodynamics of phase transformations</i> - M. Ohring: <i>Engineering Materials Science</i> (Academic Press) - M.F. Ashby, D.R.H. Jones: <i>Engineering Materials 1&2</i> (Butterworth Heinemann) - C. Barrett and T.B. Massalski: <i>Structure of Metals</i> (Pergamon)
Teaching Methods	Materials Science I (L), 3 h/week Materials Science I (E), 1 h/week lecture with demonstrations, exercises
Estimation of working load	42 h lecture (presence) 14 h exercises (presence) 50 h preparation and postprocessing lecture 28h solution of exercises, postprocessing 16 h exam preparation lecture total 150 h
Examinations	written examination of 120 min., precondition: successful participation in exercises
Grade Composition	exam result
Usability	MSc course of studies Advanced Materials MSc course of studies Energy Science and Technology Materials Science II