MH2017 Micro and Nanostructures 6.0 credits

Mikro-och nanostrukturer

This is a translation of the Swedish, legally binding, course syllabus.

Establishment

On 2023-06-09, the Dean of the ITM school has decided to establish this official course syllabus to apply from autumn term 2023 (registration number M-2023-1200)

Grading scale

A, B, C, D, E, FX, F

Education cycle

Second cycle

Main field of study

Materials Science and Engineering

Specific prerequisites

Basic knowledge about thermodynamics and material science equivalent MH1024 Materials science, 6 higher education credits and MH1028 Thermodynamic modelling, 6 higher education credits.

Language of instruction

The language of instruction is specified in the course offering information in the course catalogue.

Intended learning outcomes

After passing the course, the participant should be able to:

- give an account of basic terminology and concepts in the microstructures and transformations of metallic materials
- identify characteristic structural elements and analyse the microstructure of a material, and by means of phase diagrams be able to draw reasonable conclusions about how the material has been treated and which phase transformations that occurred.
- give an account of common transformations and structures in the most used metallic materials and analyse how they are influenced by different factors, e.g. composition and temperature process, and explain and justify which basic chemical and physical quantities, such as surface energy and diffusion that are of importance.
- carry out calculations concerning microstructure development under reasonable assumptions.
- explain and schematically be able to show the geometric meaning of concepts central for phase transformations in a Gibbs energy diagram and be able to connect it to phase diagrams.
- apply TTT and CCT diagrams to analyse what happens in a material under certain circumstances.

Course contents

In the course the following topics are treated:

- equilibria and transformations in metallic materials
- basic theory of phase transformations
- thermodynamic basics of and application of binary phase diagrams
- development of micro and nanostructures through nucleation and growth
- crystalline and amorphous solidification
- transformations in solid phase
- recrystallisation, grain growth and coarsening
- TTT and CCT diagrams
- calculations of the effect of the surface tension on an equilibrium, the driving force for initial precipitation, critical radius for nucleation, growth speeds, segregations at solidification, grain growth and transformation speed

Examination

- ÖVN1 - Written Assignments, 1.0 credits, grading scale: P, F

- TEN1 - Written examination, 4.0 credits, grading scale: A, B, C, D, E, FX, F
- LAB1 - Laboratory Work, 1.0 credits, grading scale: P, F

Based on recommendation from KTH's coordinator for disabilities, the examiner will decide how to adapt an examination for students with documented disability.

The examiner may apply another examination format when re-examining individual students.

If the course is discontinued, students may request to be examined during the following two academic years.

Ethical approach

- All members of a group are responsible for the group's work.
- In any assessment, every student shall honestly disclose any help received and sources used.
- In an oral assessment, every student shall be able to present and answer questions about the entire assignment and solution.