

MH2040 APPLIED THERMODYNAMICS AND KINETICS, 6 hp

Objectives:

The overall aim of the course is to extend the knowledge gained in the basic courses in thermodynamics and kinetics for materials science. This knowledge will be applied to thermodynamic and kinetic problems in this and coming courses.

Course Content

- Thermodynamics for phase transformations
- Phase equilibria and phase diagrams (unary, binary and higher order systems)
- Gibbs energy and driving forces.
- Modelling of solid substitutional and interstitial solutions, carbides, oxides and intermetallic phases.
- Modelling of metallic liquids and slags.
- Reference states, change of reference states, and change of components.
- Driving force for diffusion, thermodynamic factor and mobility.
- Analytical and numerical methods to solve thermodynamic and kinetic problems.

Intended Learning Outcomes

After the course, the student should be able to:

1. Explain the basic concepts of thermodynamic modelling.
2. Use thermodynamic relationships for solution phases (solid phases, liquids, gas).
3. Model these phases with simple models and with the sublattice formalism (Compound Energy Formalism).
4. Illustrate relationships between thermodynamics, Gibbs energy and phase diagrams.
5. Perform analytical and numerical calculations to solve thermodynamic problems.
6. Explain the basic concepts of diffusion in binary and multicomponent systems.
7. Perform analytical and numerical calculations of diffusion controlled phase transformations.

For higher grades, the student should be able to

8. Combine thermodynamics and kinetics in problem solving.

Course Structure

Lectures and exercises/computer based exercises.

Examiner & Teacher (Thermodynamics)

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Literature

Compendia and other course material on Canvas.

Examination

INL1 – Thermodynamics assignments, 2 hp, grade scale: P, F

INL2 – Kinetics assignments, 2 hp, grade scale: P, F

TEN1* – Examination, 2 hp, grade scale: A, B, C, D, E, FX, F

*Partial exams:

Partial exam 1: Examines Learning Outcomes 1-5 on a basic level.

Partial exam 2: Examines Learning Outcomes 6-7 on a basic level.

If both partial exams are passed → E

The partial exams are not mandatory but highly recommended. The result of the partial exams will only be valid on the first ordinary exam and on the consecutive re-exam.

The end of the course exam (TEN1) consists of two parts, A and B:

Part A: Examines Learning Outcomes 1-7 on a basic level. If Partial Exams 1 and 2 have been passed then you do not need to take this part.

Part B: Examines Learning Outcomes 1-7 on a higher level and Learning Outcome 8. Part B is only considered/corrected if Part A is passed.

Student office, ITM

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Compensatory support for students with disabilities during examination

For students with disabilities who have a statement from KTH's FUNKA unit on recommended support during examination, the following applies in this course:

- All support under code R (i.e. adjustments relating to space, time and physical circumstances) are granted without special decision by the examiner
- Support under code P (educational adaptation) must be actively granted or rejected by the examiner after contact has been made by the student in accordance with KTH's rules. Normally, support actions under code P will also be approved.