MSE-204

Thermodynamics for materials science

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Cursus	Sem.	Type
Materials Science and Engineering	BA3	Obl.

Language of teaching	English
Credits	4
Session	Winter
Semester	Fall
Exam	During the semester
Workload	120h
Weeks	14
Hours	**4 weekly**
Courses	3 weekly
Exercises	1 weekly
Number of positions	

Summary

This course establishes the basic concepts of thermodynamics and defines the main state functions. The concepts are then applied to the study of phase diagram of various systems.

Content

1. Reminder of the thermodynamics definitions. Work and Heat. Reversibility.
2. Auxiliary functions and their relationships. Chemical potential
3. Treatment of mixtures. Molar and partial molar variables.
4. General treatment of chemical reactions. Reaction progress. Variables of reaction
5. Chemical reactions in the gaseous state. Equilibrium constant.
6. Phase equilibiria of mixtures. Gibbs' rule of phases.
7. Chemical reactions in solutions. Equilibrium constant. Effects of pressure and temperature.
8. Non-ideal solutions. Standard states. Chemical potentials. Activity coefficients.
9. Single component, binary, eutectic, phase diagrams. Excess variables of mixing.
10. Stability of multicomponent mixtures.

Learning Prerequisites

Required courses

Introduction to Materials Science and Engineering

Recommended courses

Various courses of the Materials science and engineering section

Learning Outcomes

By the end of the course, the student must be able to:

- Analyze a thermodynamics problem
- Compute the changes in entropy, enthalpy and Gibbs free energy
- Construct a phase diagram
- Interpret the chemical potential

Teaching methods

Ex cathedra et exercises

Resources

Ressources en bibliothèque

- The bases of chemical thermodynamics - Vol.1 / Grätzel
- Principles of Chemical Equilibrium: With Applications in Chemistry and Chemical Engineering / Denbigh
- Thermodynamics for Materials Science / DeHoff
- The bases of chemical thermodynamics - Vol.2 / Grätzel