GHENT UNIVERSITY

Course Specifications

Valid as from the academic year 2024-2025

Materials Physics (C004215)

Course size *(nominal values; actual values may depend on programme)*

Credits 5.0 **Study time 150 h**

Course offerings and teaching methods in academic year 2024-2025

A (semester 2)	Dutch	Gent	excursion
			lecture
			seminar

Lecturers in academic year 2024-2025

Depla, Diederik	WE04	lecturer-in-charge
Dendooven, Jolien	WE04	co-lecturer

Offered in the following programmes in 2024-2025	**crdts**	**offering**
Bachelor of Science in Physics and Astronomy	5	A
Preparatory Course Master of Science in Physics and Astronomy	5	A
Preparatory Course Master of Science in Physics and Astronomy	5	A

Teaching languages

Dutch

Keywords

Crystalline and non-crystalline materials, macroscopic physical properties, experimental material research, X-ray diffraction, phase diagrams

Position of the course

This course unit belongs to the learning pathway "Structure of matter" in the Bachelor program Physics and Astronomy.
Study of the structural properties of solid materials. Give the student insight in the close relationship between the atomic structure and symmetry of solid materials and their macroscopic properties (mechanical, electrical, magnetic). Introduction to experimental scientific materials research.

Contents

- Ch1: Materials: division based on properties, bonding and atomic structure
- Ch2: Crystalline materials: geometric laws, translation symmetry, relation between habitus and internal structure, crystal symmetry, important crystalline structures, quasicrystals
- Ch3: Non-crystalline materials: description, models, examples
- Ch4: Material research using X-rays
- Ch5: Material research using electrons
- Ch6: Lattice defects: Point defects: vacancies and interstitials; Dislocations
- Ch7: Phase diagrams: Unary phase diagrams, binary phase diagrams, mixed phase regime, Development of Microstructure – Equilibrium and Non Equilibrium Cooling, Diffusion, binary eutectic systems
- Ch8: Mechanical properties: Elastic and plastic deformation, Influence of symmetry on stress and strain, Thermal expansion
- Ch9: Electrical properties: Anisotropy; Ferro-electrics and piëzo-electrics
- Ch10: Magnetic properties: Diamagnetism, paramagnetism, Magnetic domains, Ferro-, antiferro- and ferrimagnetism

Initial competences

The course implies knowledge of basic physics: mechanics, electricity and magnetism and optics. No other specific prior knowledge is assumed.

Final competences

1 Have insight in the symmetry properties of solid materials and the relation to their macroscopical physical properties.
2 Master the important concepts, needed for the courses in solid state physics: Bravais lattice, reciprocal lattice, … .
3 Have insight in the relevant historical developments in materials research.
4 Be able to select experimental analytical techniques for the determination of the structure and composition of materials.
5 Handle classical and modern scientific sources in a critical way.
6 Report orally and written on projects related to material physics.
7 Have attention for possible applications and business aspects of material physics.

Conditions for credit contract

Access to this course unit via a credit contract is determined after successful competences assessment

Conditions for exam contract

This course unit cannot be taken via an exam contract

Teaching methods

Seminar, Excursion, Lecture

Extra information on the teaching methods

Theory: oral presentations with multimedia-support (Ufora)
Exercises:
- Problems, related to the theory, under support
- Personal task: crystal growth from a solution
- Demonstration of research equipment
- Company visit

Study material

Type: Syllabus

Name: Material physics
Indicative price: € 7
Optional: no
Language : Dutch
Number of Pages : 286
Available on Ufora : No
Online Available : No
Available in the Library : No
Available through Student Association : No

References

- C. Hammond, The basics of crystallography and diffraction, 3rd ed., Oxford University Press, New York (2009)
- J.F. Nye, Physical properties of crystals, Oxford University Press (1985)
- W.D. Callister, Materials science and engineering: an introduction, 8th ed., Wiley (2010)
- V. K. Pecharsky, P. Y. Zavalij, Fundamentals of powder diffraction and structural characterization of materials, 2nd ed., Springer (2008)
- P. P. Fulay, J.-K. Lee, Electronic, magnetic and optical materials, 2nd ed., Taylor & Francis, CRC Press (2016).

Course content-related study coaching

Ample opportunity for asking questions, both personally and by electronic mail.

Assessment moments

end-of-term and continuous assessment

Examination methods in case of periodic assessment during the first examination period

Written assessment with open-ended questions

Examination methods in case of periodic assessment during the second examination period

Written assessment with open-ended questions

Examination methods in case of permanent assessment

Assignment

Possibilities of retake in case of permanent assessment

examination during the second examination period is not possible

Extra information on the examination methods

Theory and exercises: written exam (closed book) with open questions. Evaluation of home-grown crystal.

Calculation of the examination mark

- Evaluation of home-grown crystal: 10%;
- Exam: 90%.