GHENT UNIVERSITY

Course Specifications

Valid as from the academic year 2024-2025

Rational Use of Materials (E065460)

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

Credits 5.0 **Study time 150 h**

Course offerings in academic year 2024-2025

A (semester 1) English Gent

Lecturers in academic year 2024-2025

Depover, Tom TW11 lecturer-in-charge

Offered in the following programmes in 2024-2025	crdts	offering
Master of Science in Teaching in Science and Technology(main subject Chemistry)	5	A
Master of Science in Teaching in Science and Technology(main subject Physics and Astronomy)	5	A
Master of Science in Chemistry(main subject (Bio)Organic and Polymer Chemistry)	5	A
Master of Science in Chemistry(main subject Analytical and Environmental Chemistry)	5	A
Master of Science in Electromechanical Engineering(main subject Control Engineering and Automation)	5	A
Master of Science in Business Engineering(main subject Data Analytics)	5	A
Master of Science in Business Engineering (Double Degree)(main subject Data Analytics)	5	A
Master of Science in Electromechanical Engineering(main subject Electrical Power Engineering)	5	A
Master of Science in Electromechanical Engineering(main subject Maritime Engineering)	5	A
Master of Science in Chemistry(main subject Materials and Nano Chemistry)	5	A
Master of Science in Electromechanical Engineering(main subject Mechanical Construction)	5	A
Master of Science in Electromechanical Engineering(main subject Mechanical Energy Engineering)	5	A
Master of Science in Business Engineering (Double Degree)(main subject Operations Management)	5	A
Master of Science in Business Engineering(main subject Operations Management)	5	A
International Master of Science in Sustainable and Innovative Natural Resource Management	5	A
Master of Science in Biology	5	A
Master of Science in Chemical Engineering	5	A
Master of Science in Chemical Engineering	5	A
Master of Science in Materials Engineering	5	A
Master of Science in Physics and Astronomy	5	A
Master of Science in Sustainable Materials Engineering	5	A
Exchange Programme Architecture	5	A
Postgraduate Programme in Innovation and Entrepreneurship in Engineering – Advanced	5	A
Postgraduate Programme in Innovation and Entrepreneurship in Engineering – Foundations	5	A

Teaching languages

English

Keywords

Sustainable transition, sustainable development, life cycle analysis, materials properties, sustainable material selection, recycling technology, material scarcity, precious metals, light weight materials

Position of the course

This course takes a closer look on the complete life cycle of different products and on the role materials play in this life cycle. Materials properties determine material selection during design, but also affect the recyclability of the product afterwards. Different recycling options and advanced recycling technologies are discussed. The scarcity debate is elaborated. The differences between the recycling of bulk materials (steel, aluminum, polymers) and special/technology materials (precious metals) and their specific life cycle structure is given. Waste products of one life cycle can offer valuable materials for another life cycle. Dedicated material selection problems are solved, including for example the CO2 footprint. This will lead to a common knowledge on recycling, the scarcity debate and other related environmental and climate related issues. This in line with the European climate ambition to be net CO2 neutral by 2050.

Contents

- Introduction on the different material groups and their properties. Link between material processing, structure, properties and performance.
- Significance of special and precious metals. Relation with sustainable energy transition (wind energy, solar energy). Scarcity debate
- Opportunities and challenges for recovering valuable materials. Factors determining recycling efficiency for technology materials. Significance of life cycle structures.
- Materials selection for light weight vehicles. Overview of different materials available (metals, polymers, ceramics, composites)
- Introduction on life cycle analysis and exercises on sustainable materials selection taking into account eco-properties such as CO2 footprint. The aluminum life cycle as an example of cradle to cradle life cycle.
- Recycling and life cycle issues for lightweight vehicles. Overview terminology. Complexity of the recycling process, overview of available and advanced recycling technologies.
- Difficulties in lightweight materials recycling. Effect of presence of coatings. Difficulties in recycling polymer matrix composites
- Sustainable use of materials in fucntion of their life span in the use phase. Lifetime extension, ecological and economic impact, material integrity and degradation. Energy transition.

Initial competences

Basics on chemistry and physics as lectured in the bachelor

Final competences

1 Understanding the impact of material properties on the material selection process during design and how this affects the recyclability of the final product
2 Knowledge on advanced recycling technologies and how material properties can be used during recycling as well
3 Understanding the difference between the recyclability of special/precious metals and bulk materials. Insights in complete life cycle, importance of material's life span and the role of recycling in life cycle analysis
4 Being able to enter a broad societal discussion concerning environmental issues, recycling and material scarcity

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, Lecture

Study material

None

References

Course content-related study coaching

Assessment moments

end-of-term assessment

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

Written assessment

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

Written assessment

Examination methods in case of permanent assessment

Possibilities of retake in case of permanent assessment

not applicable

Extra information on the examination methods

During examination period: written exam (theory + exercise)

Calculation of the examination mark