GHENT UNIVERSITY

Course Specifications

Valid as from the academic year 2018-2019

Metallurgy: Ferrous and Non Ferrous (E721045)

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

Credits 6.0	Study time 180 h	Contact hrs	44.0 h

Course offerings and teaching methods in academic year 2018-2019

A (semester 2)	Dutch, English	lecture: plenary exercises	3.0 h
		lecture	41.0 h

Lecturers in academic year 2018-2019

Ragaert, Kim	TW11	lecturer-in-charge
Verbeken, Kim	TW11	co-lecturer

Offered in the following programmes in 2018-2019	crdts	offering
Master of Science in Chemical Engineering Technology	6	A

Teaching languages

Dutch, English

Keywords

Materials science, metals, ferrous alloys, non-ferrous alloys, corrosion, surface technology.

Position of the course

PARTIM STRUCTURE AND FERROUS ALLOYS
Continuing on the basis principles introduced during Materials (1 Ba), here the structure, properties and applications of the material class metals are further elaborated upon. Focus is on the different structures of steel and the heat treatments which can be applied to obtain these structures.

PARTIM NON FERROUS ALLOYS AND CORROSION
Using the same basic principles as in the first part, the heat treatment, microstructure and the corresponding mechanical properties of some of the most often used non-ferrous alloys will be discussed: Al- and Cu-alloys.
As a final part, we consider corrosion phenomena and how these can be mitigated through surface technology.
Corrosion is an undesirable material degradation due to the interaction between a metal and the environment in which it is used. Both high temperature corrosion and corrosion in aqueous solution are discussed. The influence of the metal properties and the environment are discussed, as well as the interaction between corrosion and mechanical loading. Through a complete study of corrosion phenomena we come to the concept of corrosion control (with a strong focus on practical examples). In this way, a well-founded choice is made for material selection in terms of its usage. In addition, some specific designer mistakes are discussed.
One part of the course is dedicated to surface treatments of metals for the creation of various surface mechanical and functional properties, including corrosion protection. The concept of a metal surface is discussed and the importance of surface properties is emphasized. Examples of corrosion are given to illustrate the importance of surface processing for metal protection.
Various types of surface treatments are explained and illustrated by research related case studies.
The mechanisms and technological issues of these surface processes are detailed and the properties of the metal surfaces are explained. The importance of the full processing procedure including cleaning, etching, surface conversion and final metal finishing is illustrated for industrial examples.

Contents

PARTIM STRUCTURE AND FERROUS ALLOYS
- use of binary phase diagrams
- ferrous alloys (alloying strategy, heat treatment, microstructure)
- TTT, CCT and hardenability

PARTIM NON FERROUS ALLOYS AND CORROSION
- Al- and Cu-alloys
- Basic theory and electrochemical corrosion
- Metallurgical corrosion cells and ambient corrosion
- Corrosive-mechanical interactions, corrosion in some important environments
- Material selection (incl. stainless steel and Ni-based super alloys), cathodic and anodic protection
- Corrosion inhibitors, corrosion testing, corrosion and design
- Surface technology: Objectives of surface treatments and introduction to surface, related properties of metals and the concepts of the full surface processing, illustrated for industrial applications.

Initial competences

Final competences of Materials (1Ba)

Final competences

1 To be able to think and to reason permanently in a critical, creative and scientific way: To analyze metallic structure and to make the link to material properties and previous thermal treatment.
2 To be able to implement scientific insights on complex engineering technical problems:
   - To be able to associate material, structure and properties to a given problem.
   - To be able to correlate chemical composition, heat treatment and microstructure to material properties.
   - To understand the corrosion of metals, to be able to interpret corrosion case studies and to propose a methodology to control the corrosion process.
3 To be able to acquire advanced disciplinary chemical technological knowledge and to master specific practical skills:
   - To be able to make physical and chemical interpretations of the different transformation mechanisms to obtain a certain structure in metals.

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

Lecture, lecture: plenary exercises

Extra information on the teaching methods

partim structure & ferrous alloys is taught in Dutch. The plenary excercises are included in this part.
Al- and Cu-alloys are taught in Dutch.
partim non-ferrous alloys and corrosion is taught in English.

Learning materials and price

partim structure and ferrous alloys + Al- and Cu-alloys: Handbook: 'Materiaalkunde voor Ontwerpers en Constructeurs', 4de editie, Van Mourik & van Dam, ISBN 978-90-6562-305-8, slides from classroom, extra course material for certain topics.
partim non-ferrous alloys and corrosion: English lecture notes

References

Course content-related study coaching

after appointment with the lecturer

Evaluation methods

end-of-term evaluation

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

Written examination with open questions

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

Written examination with open questions

Examination methods in case of permanent evaluation

Possibilities of retake in case of permanent evaluation

not applicable

Extra information on the examination methods

All exams are fully in Dutch.

Calculation of the examination mark

a weighted average is made of the scores of the separate parts:

- structure and ferrous alloys: 35%
- non ferrous alloys and corrosion: 65%