GHENT UNIVERSITY

Course Specifications

Valid as from the academic year 2025-2026

Analysis of High Temperature Processes in Extractive Metallurgy (I002884)

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

Credits 5.0 **Study time 150 h**

Course offerings in academic year 2026-2027

A (Year)	English	Gent

Lecturers in academic year 2026-2027

Charitos, Alexandros	FREIBE01	lecturer-in-charge

Offered in the following programmes in 2026-2027	**crdts**	**offering**
International Master of Science in Sustainable and Innovative Natural Resource Management	5	A

Teaching languages

English

Keywords

thermodynamics, fluid-dynamics, gas-solid reactions, reductive/oxidative smelting, electrolysis, recycling

Position of the course

The goal of the module is to train the students in the analysis of high temperature processes from a process engineering perspective. After successful completion of the course, the students will be in a position to analyze aforementioned processes with regard to (i) thermodynamics (ii) fluid-dynamics (iii) link the above with unit operations and their mass and heat balances (iv) be able to conduct a short literature research and present results (v) understand troubleshooting methodology associated to these processes.

Contents

The lecture is divided to sub-modules:
(i) Brief thermodynamics recap to aid understanding for the rest of the modules
(ii) Gas-solid reaction processes: Roasting and calcination – a description of unit operations, Themodynamics – Construction of Kelogg predominance diagrams, Discussion on fluidized bed fluid dynamics, Mass and heat balances
(iii) Reduction processes: Analysis of ferroalloy production processes with focus on silicon/ ferrosilicon is included amongst other examples, Discussion on the Pidgeon process for the production of magnesium
(iv) Oxidative smelting processes: The extractive metallurgy of copper / matte smelting fundamentals / bath and flash smelters (mass and heat balances) / P-S converters / fire refining – casting and brief description in electrorefining
(v) Electrolysis in molten salt baths: Introduction to the Hall Heroult process for aluminium production
(vi) Recycling processes: Introduction to Li-ion battery and electronic waste recycling processes.

Initial competences

Revision of courses associated to metallurgical thermodynamics

Final competences

1 The goal of the module is to train the students in the analysis of high temperature processes from a process engineering perspective.
2 After successful completion of the course, the students will be in a position to analyze aforementioned processes with regard to
(i) thermodynamics

3 (ii) fluid-dynamics
4 (iii) link the above with unit operations and their mass and heat balances
5 (iv) be able to conduct a short literature research and present results
6 (v) understand troubleshooting methodology associated to these processes.

Conditions for credit contract

This course unit cannot be taken via a credit contract

Conditions for exam contract

This course unit cannot be taken via an exam contract

Teaching methods

Seminar, Lecture

Study material

None

References

Gaskell D.R., Laughlin D.E.: Introduction to the Thermodynamics of Materials

Gilchrist J.D.: Extraction Metallurgy

Schlessinger M.E., King M.J., Sole K.C., Davenport W.G.: The extr. metallurgy of copper

Schei A., Tuset J.Kr., Tveit H.: Production of High Silicon Alloys

Kunii D., Levenspiel O.: Fluidization Engineering

Course content-related study coaching

Assessment moments

end-of-term and continuous 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

Participation

Possibilities of retake in case of permanent assessment

examination during the second examination period is possible in modified form

Extra information on the examination methods

For the award of credit points it is necessary to pass the module exam.
The module exam contains:
AP*: Assignment
KA* [180 min]
* In modules requiring more than one exam, this exam has to be passed or completed with at least "ausreichend" (4,0), respectively.

Calculation of the examination mark

The Grade is generated from the examination result(s) with the following weights (w):

AP*: Assignment [w: 1]

KA* [w: 3]

* In modules requiring more than one exam, this exam has to be passed or completed with at least "ausreichend" (4,0), respectively.