

## 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 2023-2024**

A (year)                      English                      Gent

**Lecturers in academic year 2023-2024**

Charitos, Alexandros                      FREIBE01    lecturer-in-charge

**Offered in the following programmes in 2023-2024**

	crdts	offering
<a href="#">International Master of Science in Sustainable and Innovative Natural Resource Management</a>	5	A

**Teaching languages**

English

**Keywords**

**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, Thermodynamics – Construction of Kellogg 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**

Lecture

#### **Learning materials and price**

#### **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**

#### **Evaluation methods**

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

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

#### **Examination methods in case of permanent evaluation**

#### **Possibilities of retake in case of permanent evaluation**

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.