“Theory of pyro- and hydrometallurgical processes” (course annotation)

About the course

The aim of this course is to improve theoretical knowledge and practical skills of students interseted in non-ferrous extractive metallurgy processes.

Special Features

This course gives a strong attention to a fundamental research of non-ferrous extractive metallurgy processes in connection with operating technologies.

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Course description

The course acquaints students with the fundamentals of non-ferrous extractive metallurgy processes. Lecturers and seminars on the course provide students with the knowledge of the key concepts and tools of thermodynamic and kinetic analysis of these processes. The laboratory practices create a productive environment for students where they are able to develop their skills and competences necessary for analyzing the behavior of multi-component metallurgical systems.

Course aim

To give students a fundamental theoretical understanding of the principles underlying production of non-ferrous metals, what is essential for a competent and effective future professional activity.

Course objectives

- To give students an understanding of prospects which are necessary for the development of the theory of extractive metallurgy;
- To give students an understanding of physico-chemical substance of phenomena and processes related to the realization of different stages of non-ferrous extractive metallurgy;
- To teach students how to analyze metallurgical processes using laws of the physical chemistry.

Learning outcomes

By the end of the course, students will be able

- To estimate thermodynamic probability of various processes according to specific conditions and material composition of analyzed systems;
- To estimate the influence of different factors on the rate of operation;
- To establish the most probable limiting stage of process and to search for a solution which will be made according to quality control.

Outline of content

Week	Lectures	Experimental (Laboratory) Sessions / Practicals	Hours
Module 1. Theory of pyrometallurgical processes			
1-2	Dissociation of chemical compounds	Laboratory practicum; Calculation of thermodynamic characteristics of dissociation processes	12
3-4	Reduction of metal oxides and sulfides	Laboratory practicum; Calculation of thermodynamic characteristics of reduction processes	12
5-6	Oxidation of metals and sulfides. Oxidizing refining	Laboratory practicum; Calculation of residual concentration of impurities after oxidizing refining	12
7	Physicochemical properties of metal and slag melts	Calculation of physical properties of metal and slag melts	6
8	Liquation refining	-	1
	Recrystallization methods	Laboratory practicum	5
9	Processes of evaporation, sublimation and condensation	Analysis of thermodynamics of evaporation, sublimation and condensation	6
Module 2. Theory of hydrometallurgical processes			
10-14	Leaching	Laboratory practicum; Analysis of thermodynamics and kinetics of leaching	30
15-18	Extraction of metals from solutions	Laboratory practicum; Analysis of thermodynamics of extraction processes	24

Course components:

- 108 hrs lectures and experimental sessions;
- 108 hrs self-study time, including home assignments.

Assessments and assessments methods

The course assessment assignments will include:

- Short-response questionnaire
- Written examination

Student's grades will be based on the following scheme:

- 40 % Short-response questionnaire and class participation
- 60 % Written examination

Attendance policy

Students are expected to attend classes regularly, otherwise they won't be able to fully understand main concepts of the course.