UCLouvain

lmapr2141

2021

Metals Processing and Recycling

5.00 credits	30.0 h + 30.0 h	Q2

Teacher(s)	Henry Philippe ;Proost Joris ;
Language :	English
Place of the course	Louvain-la-Neuve
Prerequisites	It is assumed that the fundamentals of thermodynamics, kinetics, electrochemistry and inorganic chemistry, as taught in the majeure/mineure FYKI, are known.
Main themes	In this course, the basic principles of electrochemistry, chemical thermodynamics and kinetics are applied to the description of the physico-chemical principles and technological aspects of metals processing and recycling. The course is divided into three main parts. In the first part, an overview is given of the different metallurgical unit operations, dealing with their thermodynamic, chemical and thermodynamic basis. A distinction will be made between pyro- and hydrometallurgical unit operations. In a second part, these operations will be used to discuss different industrially applied processes for the extraction and refining of metals, including pig iron, steel and the non-ferrous metals. In a last part, metallurgical and economical aspects of recycling will be discussed.
Learning outcomes	**At the end of this learning unit, the student is able to :** **Contribution of the course to the program objectives** In view of the learning outcomes of the Master programme in Chemical and Materials Engineering (KIMA), this activity contributes to the developpement and acquisition of the following learning outcomes (LO) : • 1.1. • 2.3. • 4.4. • 5.1., 5.3., 5.5., 5.6. **Specific learning outcomes of the course** At the end of this learning activity, the student will be able to 1 • describe the different pyro- and hydrometallurgical unit operations, dealing with their thermodynamic, chemical and technological basis ; • based on these operations, discuss different industrially applied processes for the extraction and refining of metals, including pig iron, steel and the non-ferrous metals ; • understand the economical aspects of recycling, as well as the intimate link with primary materials processing. • integrate, into a metallurgical process or flow-sheet, the thermodynamic concepts to predict the equilibrium state of a reaction, as well as the kinetics needed to dimension the reactor. • at the end of the project linked to this course and conducted in close collaboration with an industrial partner, write a report, and present its content before the industrial partner who has initially specified the objectives and the technological constraints.
Evaluation methods	The students will be evaluated individually during an oral examination with written preparation. The degree of participation during the lab sessions, as well as the quality of the written report and presentation will also constitute a significant part of the final mark according to the following modalities : If exam score> = 8/20, the score for the final lab work is taken into account in the calculation of the overall score at a rate of 1/3. If exam rating <8/20, the rating for the final lab work is not taken into account.
Teaching methods	The course is organised around 12/13 lectures and 6 half-day laboratory sessions, during which students will apply and decide themselves on the different steps needed for the extraction, refining or recycling of specific metals from a given, industrially relevant base material.
Content	1. Description of the thermodynamic, kinetic and technological aspects of hydro-metallurgical unit operations (+ lab sessions) 2. Description of the thermodynamic, kinetic and technological aspects of pyro-metallurgical unit operations 3. Iron and steel metallurgy : blast furnace processes - converter processes - alternative iron-and steelmaking processes 4. Non-ferrous metallurgy (+ plant tour) : non-reactive (Cu, Zn, Pb) and reactive metals (Al, Ti, Mg) 5. Metals recycling

Inline resources	https://moodleucl.uclouvain.be/course/view.php?id=9196
Bibliography	Les supports de cours consistent en des copies des slides du cours, disponible au service SICI ainsi que sur Moodle. Les énoncés de laboratoires sont disponible sur Moodle, et également distribués directement par le titulaire. La matière faisant l'objet de l'examen comprend tout ce qui a été dit ou montré au cours oralement, sur écran ou à l'aide d'autres media, et ne se limite donc exclusivement au texte du "support de cours".
Faculty or entity in charge	FYKI

Programmes containing this learning unit (UE)				
Program title	Acronym	Credits	Prerequisite	Learning outcomes
Master [120] in Chemical and Materials Engineering	KIMA2M	5		