

**SYLLABUS**

# **Refractory materials and slags 7.5 credits Q0034B**

**Infodringsmaterial och slagger**

**Course syllabus admitted: Autumn 2018 Sp 1 - Spring 2019 Sp 3**

**DECISION DATE  
2018-06-13**

# Refractory materials and slags 7.5 credits Q0034B

## Infodringsmaterial och slagger

### First cycle, Q0034B

Education level	Grade scale	Subject	Subject group (SCB)
First cycle	G U 3 4 5	Processmetallurgi	Chemical Engineering

## Entry requirements

In order to meet the general entry requirements for first cycle studies you must have successfully completed upper secondary education and documented skills in English language + Mathematics 1a/1b/1c (specifik entry A7).

Or:

Mathematics A (specifik entry 7)

## Selection

The selection is based on final school grades or Swedish Scholastic Aptitude Test.

## Examiner

Caisa Samuelsson

## Course Aim

The goal is to give the students basic knowledge in different refractory materials used within the metal industry and the production and design of advanced refractory materials, used for different applications. The properties of these materials are discussed in combination with how these properties will change during the process. The course will present the structure of the slag, the composition and properties and how different slag will influence the corrosion resistance of the lining. The course consists of lectures, practices and project work. The student will:

- \*Know and describe different ceramic materials
- \*Get basic knowledge in technically important refractories
- \*Understand the basics in the production processes for refractories
- \* Get an understanding how these properties are created and how they depend on the crystal structure, microstructure, working and design
- \* Describe important applications of refractory materials
- \* Get knowledge of the properties of the slag and functions in different metal production processes
- \* Be able to analyze refractory/slag compatibility in relation to different metallurgical processes

## Contents

- Definition and systematic of basic refractory materials
- Raw materials: Mineral aspects and mineral treatments. Properties and characterization of ceramic materials. Crystal structures for different ceramic material. Thermomechanical, thermo physical and, thermo chemical properties, processing methods and fireproof materials
- Strategy for specific application areas (including installation, methods and maintenance) Technical-economic questions. Natural and synthetic raw material, quality and influence of the properties at the products and slitage.
- Castable and pumpbara elfasta, plastic, rammar mixer, slitage mechanism and manufacturing
- Slags, compositions and properties
- Slag and refractory compatible  
Criteria for the choice of refractory material in relation to different slag compositions  
The possibilities of energy efficiency

## Realization

Each course occasion's language and form is stated and appear on the course page on Luleå University of Technology's website.

The education consists of lectures combined with practices, laboratory experiments, project work and study visits. The lectures and the practices will give the students the possibilities to describe the refractories and the slag from practical and theoretical angles and practice calculation procedures in related problems. Laboratory experiments and industrial related project works are carried out in groups. The study visits join the theory from the lectures, laboratory works, and project works with practical application in the industry.

## Examination

If there is a decision on special educational support, in accordance with the Guideline Student's rights and obligations at Luleå University of Technology, an adapted or alternative form of examination can be provided.

Approved result at the laboration and project work including written and oral presentation

At the laboration and project work the certificate not approved or approved are given.

Written examination with the grades U,3, 4 and 5 are given.

A student not approved at 5 examinations has no right to participate in further tests.

## Remarks

Compulsory presence at the first lecture, laboration, studievisit and project introduction and projectreporting

## Literature. Valid from Autumn 2013 Sp 1

1. Richerson W.David: Modern Ceramic Engineering, Third edition, Marcel Dekker Inc., New York, ISBN 0-8247-8634-3
2. Banerjee Subrata: Monolithic refractories, World Scientific Publishing Co. Pte. Ltd, 1998, ISBN 9810231202
3. Carniglia C. Stephen, Barna L. Gordon: Handbook of industrial refractories technology, Noyes Publications, 1992. ISBN: 0-8155-1304-6.
4. D 830 Eldfasta material. Utbildningspaket Framställt inom Jernkontorets teknikområde 23. Eldfasta material 2010. 290 s.
5. Bennet P. James and Smith D. Jeffrey; Fundamentals of refractory technology. The American Ceramic Society. 2001. ISBN: 1-57498-133-1.

## Course offered by

Department of Civil, Environmental and Natural Resources Engineering

## Items/credits

Number	Type	Credits	Grade
0001	Written exam	4	TG G U 3 4 5
0002	Laboratory report	1.5	TG U G#
0003	Project work	2	TG U G#

## Study guidance

Study guidance for the course is to be found in our learning platform Canvas before the course starts. Students applying for single subject courses get more information in the Welcome letter. You will find the learning platform via My LTU.

## Last revised

by Assistant Director of Undergraduate Studies Eva Gunneriusson, Department of Civil, Environmental and Natural Resources Engineering 2018-06-13

## Syllabus established

by Eva Gunneriusson 2013-02-06