UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Sustainable Management of Raw Materials

2627-1-F7603Q023-F7603Q02302

Aims

The teaching of the second laboratory module aims at providing the knowledge and the working principles behind case studies related to relevant emerging and real industrial activities and projects of implementation of circularity, clean technology and climate technology, with particular emphasis on carbon capture utilization and storage.
The topics of this module are delivered with the aim of highlighting the fundamental physical-chemical aspects of the processes shown, enabling the assessment of mass and energy balances in relation to all their steps. The laboratory activity will be corroborated by practical sessions to be delivered in the classroom with basic apparatuses and materials of immediate availability to simulate transformations processes involving carbon dioxide and carbonate equilibria.

The students are invited to consult the syllabus of the entire course for details regarding learning- and skill-related objectives.

Contents

• The pathways of carbon capture.
• The pathways of carbon utilization.
• Focus on mineral carbonation.

Detailed program

The pathways of carbon capture
• direct air capture: absorption-based carbon capture, hot potassium carbonate, amine-based absorbers, electrodialysis, with discussion of industrial realities: Carbonco, Catacarb, Mega;

• ocean alkalinity enhancement, direct ocean capture, with discussion of industrial realities: Limenet, SeaO2, ResourSEAs;
• geological sequestration, with discussion of industrial reality: CarbFix;
• practical session: determination of the acidity of an acidic solution by gravimetry with sodium bicarbonate – determination of the capture ability of basic solutions.

The pathways of carbon utilization
• electrochemical conversion into chemicals and fuels;
• CO2 battery.

Focus on mineral carbonation
• reactivity of Mg- and Ca-bearing minerals and their conversion into stable and valuable carbonate phases;
• the Anticarb project.

Prerequisites

• Basic knowledge of inorganic chemistry.
• Basic knowledge of classical physics.

Teaching form

2 CFU of mixed didactics in the classroom (20 hours):
• 4 two-hour lectures, in person, Delivered Didactics;
• 3 two-hour experimental sessions, in person, Interactive Teaching;
• 1 two-hour lecture with virtual and on-site visit and illustration of the analytical laboratories of Anticarb, Interactive Teaching.

Attendance to lectures and interactive exercises is highly recommended.

Textbook and teaching resource

• Lecture notes provided by the lecturer.
• Research articles and book chapters provided by the lecturer.
• On-line material.

Semester

II semester (March - June)

Assessment method

At the end of this module, an online multiple choice (true/false) test needs to be passed.

The final oral exam for the laboratory course as a whole comprises the discussion of various topics covered in the three modules, with an emphasis also on the connections between concepts and tools, such as to arrive at a critical evaluation of the laboratory course topics as a whole.

The final score will be between 18/30 and 30/30 *cum laude*, based on the overall assessment considering the following criteria:
(1) knowledge and understanding;
(2) ability to connect different concepts;
(3) autonomy of analysis and judgment;
(4) ability to correctly use scientific language.

Office hours

Always, after scheduling an appointment *via* phone or e-mail.

Sustainable Development Goals

QUALITY EDUCATION | INDUSTRY, INNOVATION AND INFRASTRUCTURE | SUSTAINABLE CITIES AND COMMUNITIES | RESPONSIBLE CONSUMPTION AND PRODUCTION