



UNIVERSITÀ  
DEGLI STUDI DI MILANO-BICOCCA

## COURSE SYLLABUS

### Technologies for production and conversion of green hydrogen

2223-116R-M4

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#### Title

Technologies for production and conversion of green hydrogen

#### Teacher(s)

Dr. Carlo Santoro

#### Language

English

#### Short description

The course aims to provide a description of the electrochemical systems for the production and conversion of green hydrogen. The course will focus on materials and reaction mechanism with particular attention to fuel cells and water electrolyzers. Within the course, reactions mechanism occurring on the electrodes, electrochemical processes, electrodes and electrolyte synthesis methods, technological operation and electrochemical performance will be evaluated.

The following topics will be addressed.

LECTURE 1 (2h)

Title: Hydrogen vector and electrochemical tools

Hydrogen as green vector; production of hydrogen (status and perspective); green hydrogen production; green hydrogen within the EU decarbonization goal for 2050.

#### LECTURE 2 (2h)

Title: Electrolyzers with focus on materials and performance

Type of electrolyzers (AEL, PEMEL, AEMEL, SOEC, CO<sub>2</sub> electrolyzers); reaction mechanisms involved (hydrogen evolution reaction, oxygen evolution reaction); identification of performance, polarization curves, losses, durability issues;

organic, inorganic and hybrid materials for electrocatalysts and membranes/separators.

#### LECTURE 3 (2h)

Title: Fuel cells with focus on materials and performance

Type of fuel cells operating with gaseous feedstock (PEMFC, AEMFC, AFC, MCFC, SOFC); reaction mechanisms involved (hydrogen oxidation reaction, oxygen reduction reaction)

Identification of performance, polarization curves, losses, durability issues; organic, inorganic and hybrid materials for electrocatalysts and membranes.

#### LECTURE 4 (2h)

Title: Overcoming limitations and perspectives

Identification of gaps in electrolyzers, fuel cells and solution proposed.

### **CFU / Hours**

1 CFU / 8 hours

### **Teaching period**

### **Sustainable Development Goals**

AFFORDABLE AND CLEAN ENERGY

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