MATERIALS ENGINEERING AND NANOTECHNOLOGY (LM76)

(Lecce - Università degli Studi)

Insegnamento GREEN TECHNOLOGIES AND HYDROGEN FOR ENERGY STORAGE AND

GenCod A007329
Docente titolare

Docente responsabile dell'erogazione
PATRIZIA BOCCHETTA

Insegnamento GREEN TECHNOLOGIES AND HYDROGEN FOR ENERGY STORAGE AND PRODUCTION MOD.

Insegnamento in inglese

Settore disciplinare ING-IND/23

Corso di studi di riferimento
MATERIALS ENGINEERING AND

Tipo corso di studi Laurea Magistrale

Crediti 6.0

Ripartizione oraria Ore Attività frontale: 54.0

Per immatricolati nel 2023/2024

Erogato nel 2024/2025

Anno di corso 2

Lingua

Percorso MATERIALS FOR SUSTAINABILITY

Sede Lecce

Periodo

Tipo esame

Valutazione

Orario dell'insegnamento
https://easyroom.unisalento.it/Orario

BREVE DESCRIZIONE DEL CORSO	The course aims to provide the students with fundamental knowledge and understanding in (1) hydrogen as energy vector and related electrochemical energy conversion and (2) circular economy of batteries. The contents are emphasized through theoretical lessons and numerical as well as experimental practice.
PREREQUISITI	Basic knowledge of physics and chemistry.

OBIETTIVI FORMATIVI

Knowledge and understanding

The course provides the basic concepts of (1) hydrogen as energy vector and related electrochemical energy conversion and (2) circular economy of batteries by focusing the attention on the performance, application, material science aspects relevant devices and processes.

Applying knowledge and understanding

After the course, the student will acquire a basic knowledge of the principal topics of in (1) hydrogen as energy vector and related electrochemical energy conversion and (2) circular economy of batteries. The student will learn theoretical and technological aspects of hydrogen conversion, storage and production by taking familiarity with electrolyzers, batteries, and fuel cells devices. The student will also understand of environmental aspects of batteries and fuel cells finalized to promote eco-friendly systems and recycle processes.

Making judgments

Students will acquire the ability to critically discuss the principal problems related to hydrogen production, utilization and storage, to electrolyzers, batteries and fuel cell and to propose solutions to material choices, enviromentals aspects and stability issues by using basic electrochemical notions.

Communication

The students will be able to communicate the scientific knowledge and methodological tools acquired in the course with a varied and composite audience in a clear and technical way. The student will sustain conversations on hydrogen production, utilization and storage, on electrochemical energy conversion themes and batterues enviromental aspects. The ability to use a technical language will be improved during the laboratory practice, where the students will be called to propose solutions to the investigated systems.

Learning skills

The student will acquire basic concepts of applied electrochemistry that will guide him/her to a critical assessment of the positive and negative aspects of hydrogen as novel energy vector, its involvment in electrochemical conversion systems and to the project of possible solutions. The same approach is use for the enviromental aspects and recycle processes of batteries. Students skills will be enhanced thanks to a long and focused laboratory practice.

METODI DIDATTICI

The course consists of frontal lessons, numerical and experimental exercises. Class contents will be given on the board or presented with the aid of Power Point Slides. Interactions with students will be stimulated during lessons in order to keep high the attention and comprehension of the contents.

MODALITA' D'ESAME

Exams will be composed of an oral discussion of the theoretical part of the course and a written report on the experimental activity.

The oral discussion will relate on four topics:

1) Hydrogen production, storage and utilization.

2) Electrochemical energy storage and conversion (theoretical aspects).

3) Fuel cells. Electrolysers. Power to Hydrogen systems.

4) Recycling of spent batteries and synthesis of new functional materials from wastes.

With the aim to verify to what extent the student has acquired the aptitude to manage electrochemical theoretical aspect of batteries/fuel cells systems and to apply them to the design and problem solving activities characteristic of these devices.

The written report on the experimental activity will be evaluated by taking into account the level of the scientific discussion, the correctness of the technical language and the completeness/precision of the overall document.

PROGRAMMA ESTESO	**Theoretical lessons** 1) Introduction to Hydrogen Economics. Hydrogen production methodologies. Hydrogen storage methods. 2) Electrochemical energy storage and conversion: introduction, electrochemical fundamental aspects and state of the art. 3) Fuel cells. Electrolysers. Power to Hydrogen systems. Processes and materials (in particular nanomaterials for electrocatalysis and/or hydrogen storage) for electrochemical hydrogen production and storage. 4) Technologies for the recycling of spent battery active materials. **Laboratory Practice**
TESTI DI RIFERIMENTO	Electrochemical Methods - Fundamentals and Applications, A. J. Bard, L. R. Faulkner, Wiley (II edition), 2001 Modern Electrochemistry 2B, 2nd edition J. O'M. Bockris e A.K.N. Reddy Kluwer Academic/Plenum Publishers NY (2000) Papers and reviews provided during the course by the Professor.