Materials for the production and storage of clean energy in transport

Academic Year: (2023 / 2024) **Review date: 27/04/2023 16:33:57**

Department assigned to the subject: Materials Science and Engineering and Chemical Engineering Department

Coordinating teacher: VAREZ ALVAREZ, ALEJANDRO

Type: Electives ECTS Credits : 3.0

Year : 1 Semester : 2

OBJECTIVES

The objective of this course is to know the different energy storage and production systems in order to acquire skills that allow you to understand the operation of some of the modern electrical energy storage and production systems and the importance of materials within the device. Likewise, its repercussion in terms of environmental impact will be analyzed. To achieve this objective, students must acquire a series of knowledge, skills, and attitudes.

With regard to knowledge, at the end of the course, the student will be able to:
-Learn about the most current trends in the world of materials for energy in terms of their formulation and identify the potential advantages that they can offer compared to more traditional materials.
-Design ways of optimizing the properties of different materials for specific applications through modifications in their structure and composition.
-Learn about advanced processing and synthesis systems that make it possible to obtain materials for energy with improved properties.
-Acquire useful scientific-technical knowledge and skills to solve specific problems associated with working in a laboratory in the field of materials for energy.

Regarding the specific abilities, at the end of the course, the student will be able to:
- Know the requirements that materials have to meet for energy in specific applications.
- Within certain applications, knowing how to identify which materials are currently the most used and knowing the alternatives that are currently being considered to achieve improved properties.
- Identify the necessary requirements for the selection of materials in some energy storage and production devices.
- Being able to evaluate the reasons why materials are used in particular applications.

DESCRIPTION OF CONTENTS: PROGRAMME

1. Clean energy production systems.
   a. photovoltaic
   b. fuel cells
2. Energy storage systems
   a. electrochemical
   b. Electric
   c. Magnetic
   d. phase change materials
   e. electrolysers
   f. green hydrogen
3. Practical aspects of clean energy production or storage systems
4. Characterization of batteries and fuel cells

LEARNING ACTIVITIES AND METHODOLOGY

LEARNING ACTIVITIES
Theoretical-practical classes
Laboratory practices

tutorials
Teamwork
Individual student work

LEARNING METHODOLOGIES
Presentations in class by the teacher with the support of computer and audiovisual media, in which the main concepts of the subject are developed and examples of the resolution of exercises or practical cases are given.
Critical reading by the student of texts and scientific publications recommended by the teacher
Obtaining experimental results in the laboratory. managing research equipment and techniques, under the guidance of the professor
Preparation of work and reports individually or in groups

TUTORIALS
Those marked by the regulations of the University

ASSESSMENT SYSTEM

% end-of-term-examination/test:	0
% of continuous assessment (assigments, laboratory, practicals…):	100

Laboratory 10%
Work in groups 50%
Exam:40%

BASIC BIBLIOGRAPHY

- S.C. Singhal, K. Kendall. High-temperature Solid Oxide Fuel Cells: Fundamentals, Design and Applications, Elsevier, 2003

- Vladimir S. Bagotsky, Alexander M. Skundin, Yurij M. Volfkovich Electrochemical Power Sources: Batteries, Fuel Cells, and Supercapacitors., John Wiley & Sons, 2015

- Yoshinobu Tanaka Ion Exchange Membranes: Fundamentals and Applications., Elsevier, 2015

ADDITIONAL BIBLIOGRAPHY

- Aiping Yu, Victor Chabot, Jiujun Zhang Electrochemical Supercapacitors for Energy Storage and Delivery: Fundamentals and Applications, CRC Press., 2013

- Ajay Kumar Saxena. High-Temperature Superconductors., Springer Science & Business Media, 2012

- David P. Wilkinson, Jiujun Zhang, Rob Hui, Jeffrey Fergus, Xianguo Li. Proton Exchange Membrane Fuel Cells: Materials Properties and Performance. , CRC Press., 2009

- J. M. D. Coey. Magnetism and Magnetic Materials, Cambridge University Press,, 2010

- Masaki Yoshio, Ralph J. Brodd, Akiya Kozawa Lithium-Ion Batteries: Science and Technologies, Springer Science & Business Media, , 2010