UNIVERSITY OF GOTHENBURG

PHYSICS

FIM840 Energy related materials, 7.5 higher education credits

Energirelaterade material, 7,5 högskolepoäng

Second Cycle

Confirmation

This course syllabus was confirmed by Department of Physics on 2015-04-17 to be valid from 2015-04-17, autumn semester of 2015.

Field of education: Science 100%
Department: Physics

Position in the educational system

The course is elective within all of the departments master programs.

The course is part of the following programmes: 1) Complex Adaptive Systems, Master's Programme, 2) Physics of Materials and Biological Systems, Master's Programme and 3) Physics, Master's Programme

Main field of studies	*Specialization*
Physics	A1N, Second cycle, has only first-cycle course/s as entry requirements

Entry requirements

Bachelors degree in physics, or the equivalent.

Learning outcomes

The course gives an insight into how materials properties affect functionality in modern energy technologies such as batteries, solar cells, fuel cells, hydrogen storage, CO2 capture, storage and conversion, thermoelectric materials, and lighting technologies.

Knowledge and understanding

On successful completion of the course the student will be able to:

-assess and communicate the importance of materials science for the development of sustainable and environmentally friendly energy technologies.

Skills and abilities

- be able to give an overview of and explain state-of-the-art functional materials utilized in energy related technologies, such as batteries, solar cells, fuel cells, hydrogen storage, CO2 capture, storage and conversion, thermoelectric materials, and lighting technologies, as well as explain the working principle(s) of these technologies.
-understand and explain the key fundamental properties, such as composition, structure, electronic properties, and ion conduction mechanisms, of selected groups of materials, and understand the requirements on the materials' properties as set by the demands of the final functional device, such as efficiency, weight, thermodynamic stability, lifetime and cost.
-understand and explain how the materials key properties affect the functionality of the devices, and be familiar with strategies for the development of new materials with better performance.

Course content

In this course the student will learn how materials development is of key importance and can lead to new energy-production, use and storage alternatives that have the potential to compete with and exceed existing technologies. The importance of thinking and working in terms of an integrated approach where all the levels from fundamental materials properties to system requirements are taken into account will be highlighted. Furthermore, focus is laid on the discussion of state-of-the-art scientific materials characterization methods used to investigate the materials properties. After a broad and general introduction to the materials challenges related to the design and development of next-generation energy technologies, the following topics will be addressed with focus on material-related aspects: batteries, solar cells, fuel cells, hydrogen storage, CO2 capture, conversion and storage, thermoelectric materials, and efficient lighting technologies.

Form of teaching

The course includes a series of lectures, including some guest lectures given by expert scientists from industry/academia, as well as a visit to a Swedish energy related company or research laboratory.

Language of instruction: English

Assessment

A written exam and oral & written project presentation (review of a scientific article) at the end of the course constitute in sum the examination.

Short quizzes at every lecture occasion about the material discussed in the previous lecture offer the possibility to collect bonus points that count as part of the written examination at the end of the course.

A passing grade requires satisfactory performance in both written and project examinations, as well as presence at the project presentation session, at the excursion and at the lab visit.

If a student, who has failed the same examined component twice, wishes to change examiner before the next examination, a written application shall be sent to the department responsible for the course and shall be granted unless there are special reasons to the contrary (Chapter 6, Section 22 of Higher Education Ordinance).

In cases where a course has been discontinued or has undergone major changes, the student shall normally be guaranteed at least three examination occasions (including the ordinary examination) during a period of at least one year from the last time the course was given.

Grades

The grading scale comprises: Pass with Distinction (VG), Pass (G) and Fail (U).

Course evaluation

Students are given the opportunity to fill out an anonymous on line evaluation

The results of and possible changes to the course will be shared with students who participated in the evaluation and students who are starting the course.