Faculty of Science

FYST19, Physics: Physics and Chemistry of Surfaces, 7.5 credits

Fysik: Ytors fysik och kemi, 7,5 högskolepoäng

Second Cycle / Avancerad nivå

Details of approval

The syllabus was approved by Study programmes board, Faculty of Science on 2007-06-14 to be valid from 2007-07-01, autumn semester 2007.

General Information

The course is an elective course for second-cycle studies for a Bachelor's or Master's degree in the Natural Sciences (120 credits).

Language of instruction: English and Swedish
The course is given in either Swedish or English, depending on the language knowledge of the students.

Main field of studies	*Depth of study relative to the degree requirements*
Physics	A1N, Second cycle, has only first-cycle course/s as entry requirements

Learning outcomes

The aim of the course is that the students should have acquired the following knowledge and skills upon completion of the course:

- They should be able to explain the fundamental importance of surfaces and how their structures and properties can differ from that of bulk materials.
- They should be able to give an account for and apply the real space as well as the reciprocal space nomenclature used to describe surfaces and the adsorption on surfaces.
- They should be able to interpret the results of surface science techniques such as XPS, LEED and STM as used in papers, patents, etc., and they should be able to assess the reliability of such results.

- They should be able to select relevant methods for surface the science investigation of a specific problem.

Purpose of the course

The purpose of the course is to give an introduction to the specific problems and challenges that are related to surfaces and how these are treated experimentally. These problems are of fundamental importance for a wide range of applications, such as heterogeneous catalysis, corrosion, printing, staining, detergents and sticking probability. In nanoscience surfaces play an important role, since objects in the nanosize regime have a large surface to bulk ratio. In extreme cases- such as carbon nanotubes- the object is made up from surface atoms alone.

Course content

The course starts with an introduction to surfaces and their fundamental importance in physics, chemistry, nanoscience and biology. The introduction is followed by a basic discussion of surface structure, adsorption, surface reactions, and crystal growth. In particular, it is discussed how the physics and chemistry of surfaces (and 2d gases at surfaces) can differ fundamentally from those of the surfaces' 3d equivalents.

In the remaining main part of the course, the experimental determination of surface structure, surfaces chemistry and surface is discussed and the following techniques are addressed:

Scanning tunnelling microscopy (STM, AFM, MFM), spectroscopy (AES, XPS), diffraction (LEED, SXRD), and microscopy techniques based on XPS, LEED, and SXRD.

The course treats the following aspects:

- surface-specific problems in physics, chemistry, nanoscience, and biology
- the description of surface structures, adsorption at surfaces, and alloys
- scanning tunnelling microscopy techniques for surface analysis.
- spectroscopy and diffraction techniqes for surface analysis
- newly developed methods for surface physics

Course design

The course is problem based, with some overview lectures and teaching sessions. During the course the students carry out a number of compulsory projects which address different aspects of modern surface physics. At the end of the course the student carries out individual projects that are presented in a written report and an oral presentation.

Assessment

The examination is based on the compulsory projects and the final written and oral reports.

Subcourses that are part of this course can be found in an appendix at the end of this document.

Grades

Marking scale: Fail, Pass, Pass with distinction.
To pass the entire course, passing marks on the project report and the oral presentation as well as participation in all compulsory parts of the course are required. The final grade is based equally on the marks for the written report and the oral presentation.

Entry requirements

For admission to the course, general entry requirements, English B, and knowledge equivalent to FYSA31 are required.

Subcourses in FYST19, Physics: Physics and Chemistry of Surfaces

Applies from V08

0701 Physics and Chemistry of Surfaces, 7,5 hp
Grading scale: Fail, Pass, Pass with distinction