SK2761 Characterization of Nanomaterials 7.5 credits

Karakterisering av nanomaterial

This is a translation of the Swedish, legally binding, course syllabus.

If the course is discontinued, students may request to be examined during the following two academic years

Establishment

The course syllabus is valid from Spring 2022 according to the school principal's decision: S-2022-0529 Decision date: 2022-02-24

Grading scale

A, B, C, D, E, FX, F

Education cycle

Second cycle

Main field of study

Engineering Physics

Specific prerequisites

English B / English 6

Master level courses on nanomaterials and chemistry.

Language of instruction

The language of instruction is specified in the course offering information in the course catalogue.

Intended learning outcomes

This course will give a thorough theoretical background and hands-on experience on a variety of experimental techniques that are used for the characterisation of bulk nanomaterials.

After a successful completion of the course, students should be able to

- describe techniques used for the evaluation of surface properties of materials
- explain the underlying principle of means of detection/signal generation for surface analysis techniques
- name and describe the underlying principles for the techniques used for structural characterization of materials
- name and describe the underlying principles for techniques used for composition analysis of materials
- describe underlying principles of signal generation and analysis in SEM and TEM
- name and describe techniques used for investigation of thermal properties of materials.
- name and describe techniques used for microstructure investigation of materials
- name and describe techniques used for magnetic characterization of materials
- name and describe techniques used for investigation of optical properties of materials
- name and describe techniques used for particle size and surface charge analysis
- name and describe techniques used for investigation of magnetic properties of materials
- interpret analysis results from an FT-IR spectrum
- interpret XRD results and relate it to homogeneity of material
- interpret TGA thermogram, indicating corresponding physical/chemical changes
- interpret DSC thermogram, indicating corresponding physical/chemical changes
- interpret magnetic behavior of the material from VSM measurement
- interpret materials characteristics from SEM and TEM micrographs
- present research article using at tleast three of the techniques learned in detail
- recognize the characteristics of analytical instruments for advanced materials, such as their sensitivity, resolution, depth of analysis, etc.

Course contents

This course aims at teaching the students underlying principles of analytical techniques that are commonly used for the evaluation of bulk properties of nanomaterials. These include surface analysis technique FTIR spectroscopy; optical properties evaluation by UV-Vis spectroscopy; crystallographic phase identification by XRD; thermal properties evaluation using TGA and DSC; microstructure investigation by Electron microscopy (SEM and HRTEM);

surface area analysis by BET surface area analyzer; magnetic properties by VSM and particle size- surface charge analysis by DLS and seta potential techniques.

The course is planned in the form of theoretical and experimental modules for each analysis technique.

Examination

- INL1 - Assignment 1, 0.5 credits, grading scale: P, F
- INL2 - Assignment 2, 0.5 credits, grading scale: P, F
- INL3 - Assignment 3, 0.5 credits, grading scale: P, F
- LAB1 - Laboration, 2.0 credits, grading scale: P, F
- OVN1 - Oral Presentation, 1.0 credits, grading scale: P, F
- TEN1 - Exam - home exam, 3.0 credits, grading scale: A, B, C, D, E, FX, F

Based on recommendation from KTH's coordinator for disabilities, the examiner will decide how to adapt an examination for students with documented disability.

The examiner may apply another examination format when re-examining individual students.

- Assignments, compulsory to hand in (0.5 p x 3 : 1.5 credits)
- Laboratory: compulsory to attend all practical sessions (2,0 credits)
- Oral Exam: Presentation of a selected article using at least three of the techniques introduced (1,0 credits)
- Final exam: in the form of take home exam (3,0 credits)

Other requirements for final grade

All parts are compulsory to attend. To pass the course, all lab sessions have to be taken, the assignments have to be handed in, oral presentation has to be successfully performed and final exam has to be answered (with at least 60% achievement).

Ethical approach

- All members of a group are responsible for the group's work.
- In any assessment, every student shall honestly disclose any help received and sources used.
- In an oral assessment, every student shall be able to present and answer questions about the entire assignment and solution.