SK2772 Chemistry for Nanotechnology 5.0 credits

Kemi för nanoteknik

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

Establishment

Course syllabus for SK2772 valid from Autumn 2018

Grading scale

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

Education cycle

Second cycle

Main field of study

Engineering Physics

Specific prerequisites

Bachelor's degree in Physics, Electrical Engineering, Materials science, Chemistry or equivalent, including courses in mathematics corresponding to at least 20 ECTS credits and courses in physics corresponding to at least 30 ECTS credits.

Language of instruction

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

Intended learning outcomes

After the successful completion of the course students should be able to:

- Describe fundamental thermodynamic parameters for chemical processes and their inter-relation
- Explain enthalpy driven processes vs entropy driven processes
- Describe precipitation process and explain underlying principles for size and morphology control
- Apply solution chemical processes for nanomaterial fabrication, directional etching/de-position
- Recognize the risks of handling chemicals with various degrees of content and strength

Course contents

An essential pre-requisite nanotechnology research area is the reliable synthesis/fabrication routes to well defined nanostructures/nanoparticles, their modification and functionalization as well as their organization into larger hierarchical and functional structures.

This module/ course aims at introducing the fundamentals of thermodynamics and kinetics in solution phase nanofabrication processes. Definitions and calculations using the concepts of Enthalpy (H), Entropy (S) and Gibbs Free Energy (G) will be discussed and their role on reactions will be investigated with examples. Basic chemical calculations, dissolution vs. precipitation processes will be investigated from solubility equilibrium aspects. As a common route to substrate processing electrochemical processes, aka redox reactions, along with the governing principles will be introduced. Electro-less, electrochemical and electrophoretic processes will be discussed. Examples on the control and use of electrochemical processes on the directional, or selective, etching or deposition will be presented. Some common clean room substrate treatment processes will be discussed emphasizing the type and risks associated with the chemicals used.

Course literature

Nanomaterials and Nanochemistry, C. Brechignac P. Houdy M. Lahmani (Eds.), ISBN 978-3-540-72992-1 Springer Berlin Heidelberg New York (available on line at the following address: http://folk.ntnu.no/fredrol/Nanomaterials%20and%20Nanochemistry.pdf)

Nanochemistry: A Chemical Approach to Nanomaterials by Geoffrey A Ozin, ISBN: 9781847558954, RSC Publishing

- Lecture notes and reference literature.

Examination

- INL1 - Assignment, 1.0 credits, grading scale: P, F
- TEN1 - Written examination, 4.0 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.

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

Other requirements for final grade

All assignments and exam are obligatory for completion of the course.

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.