Course Specifications
Valid as from the academic year 2020-2021

Surface Topology, Internal Structure and Composition (C004142)

Due to Covid 19, the education and evaluation methods may vary from the information displayed in the schedules and course details. Any changes will be communicated on Ufora.

Course size (nominal values; actual values may depend on programme)

<table>
<thead>
<tr>
<th></th>
<th>Credits</th>
<th>Study time</th>
<th>Contact hrs</th>
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<tbody>
<tr>
<td></td>
<td>6.0</td>
<td>180 h</td>
<td>45.0 h</td>
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</tbody>
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Course offerings and teaching methods in academic year 2020-2021

A (semester 1)  
English  
Gent  
online lecture  
0.0 h  
lecture  
30.0 h

Lecturers in academic year 2020-2021

Adriaens, Mieke  
WE06  
lecturer-in-charge

Dendooven, Jolien  
WE04  
co-lecturer

Vincze, Laszlo  
WE06  
co-lecturer

Offered in the following programmes in 2020-2021  

<table>
<thead>
<tr>
<th>Master of Science in Teaching in Science and Technology (main subject Chemistry)</th>
<th>credits</th>
<th>offering</th>
</tr>
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<tbody>
<tr>
<td>Offered in the following programmes in 2020-2021</td>
<td></td>
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<tr>
<td>Master of Science in Chemistry (main subject Materials and Nano Chemistry)</td>
<td>6</td>
<td>A</td>
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<tr>
<td>Exchange Programme in Chemistry (master's level)</td>
<td>6</td>
<td>A</td>
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</tbody>
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Teaching languages

English

Keywords

Chemical analysis, surfaces, nanomaterials, electron interaction, photon interaction including synchrotron radiation, ion interaction, local probe methods.

Position of the course

This course discusses analytical methods which help us understand the surface topology, internal structure and composition of material. It aims at understanding the principles of these techniques together with their capacities in various types of applications.

Contents

1. General introduction to nanomaterials and surfaces
2. Methods based on electron interaction
   • Interaction of electrons with matter
   • Overview of techniques based on electron interaction
   • Transmission electron microscopy (TEM) and electron energy loss spectroscopy (EELS)
   • Scanning electron microscopy (SEM, SEM-EDS, SEM-WDS)
   • Auger electron spectroscopy (AES, SAM)
3. Methods based on ion interaction
   • Overview of techniques based on ion interaction
   • Secondary ion mass spectrometry (SIMS)
   • Rutherford backscattering (RBS)
   • Particle Induced X-ray Emission (PIXE)
4. Methods based on photon interaction
   • Interaction of photons with matter
   • Overview of techniques based on photon interaction
   • X-ray photoelectron spectroscopy (XPS)
   • Properties of conventional X-ray and synchrotron radiation (SR) sources
   • Quantitative methods in (SR)XRF analysis
   • X-ray Absorption Near Edge Structure (XANES) spectroscopy
• Extended X-ray Absorption Fine Structure (EXAFS) spectroscopy
• Scanning X-ray micro- and nano-analysis using synchrotron radiation
• X-ray fluorescence microtomography
• Confocal X-ray fluorescence imaging
5. Local probe methods
• Principle
• Scanning probe microscopy (SMP)
• Scanning force microscopy (SFM)
• Scanning tunneling microscopy (STM)
• Atomic force microscopy (AFM)

Initial competences
Having followed the courses Physics, Analytical chemistry and Spectroscopic methods of analysis or having mastered the corresponding competences in another way.

Final competences
1 The student has an overview of methods for the chemical characterization of nanomaterials and surfaces, their application area, capabilities and limitations.
2 The student is aware of and can explain the basic operating principles of analytical instrumentation in the field of study.
3 The student is capable of suggesting and appropriate analytical technique for a given chemical problem in this context.

Conditions for credit contract
Access to this course unit via a credit contract is determined after successful competences assessment

Conditions for exam contract
This course unit cannot be taken via an exam contract

Teaching methods
Lecture, online lecture

Extra information on the teaching methods
Due to COVID19 alternate teaching methods may be implemented should these prove necessary.

Learning materials and price
English lecture notes
Estimated cost: 20 Euro

References

Course content-related study coaching
Through individual feedback by lecturer
Answering of questions after the lectures, via e-mail or during a personal meeting (appointment made via e-mail).

Evaluation methods
end-of-term evaluation

Examination methods in case of periodic evaluation during the first examination period
Written examination with open questions, written examination with multiple choice questions

Examination methods in case of periodic evaluation during the second examination period
Written examination with open questions, written examination with multiple choice questions

Examination methods in case of permanent evaluation

Possibilities of retake in case of permanent evaluation
not applicable

Extra information on the examination methods
Written examination. The examination consists of overview questions, more detailed questions on specific course subjects and questions aiming at assessing the student’s understanding of the matter. Evaluate the understanding of basic concepts and being able to apply them in concrete problem cases. Exercises are also included in the theoretical exam.

Calculation of the examination mark

(Approved)
Written exam: 100%