Course Specifications
Valid as from the academic year 2017-2018

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

<table>
<thead>
<tr>
<th>Credits</th>
<th>Study time</th>
<th>Contact hrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.0</td>
<td>152 h</td>
<td>47.0 h</td>
</tr>
</tbody>
</table>

Course offerings and teaching methods in academic year 2017-2018

A (semester 2)
- Practicum: 12.5 h
- Lecture: 35.0 h

Lecturers in academic year 2017-2018

- Adriaens, Mieke (WE06) lecturer-in-charge
- Dendooven, Jolien (WE04) co-lecturer

Offered in the following programmes in 2017-2018

<table>
<thead>
<tr>
<th>Degree Programme</th>
<th>Crdts</th>
<th>Offering</th>
</tr>
</thead>
<tbody>
<tr>
<td>Master of Science in Chemistry</td>
<td>6</td>
<td>A</td>
</tr>
<tr>
<td>Master of Science in Chemical Engineering</td>
<td>6</td>
<td>A</td>
</tr>
<tr>
<td>Master of Science in Chemical Engineering</td>
<td>6</td>
<td>A</td>
</tr>
<tr>
<td>Exchange Programme in Chemistry (master's level)</td>
<td>6</td>
<td>A</td>
</tr>
</tbody>
</table>

Teaching languages

English

Keywords

Chemical surface analysis, electron interaction, photon interaction, ion interaction, local probe methods

Position of the course

- Acquiring an overview in the current state-of-the-art surface analysis techniques
- Understanding the principles of these techniques together with their capacities in various types of applications

Contents

1. General introduction on surfaces
   - Why study surfaces?
   - How do we define a surface?
   - Which information do we obtain?
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, EPMA ...)
   - Auger electron spectroscopy (AES, SAM)
3. Methods based on photon interaction
   - Interaction of photons with matter
   - Overview of techniques based on electron interaction
   - X-ray photoelectron spectroscopy (XPS)
4. Methods based on ion interaction
   - Interactions of ions with matter
   - Overview of techniques based on ion interaction
   - Secondary ion mass spectrometry (SIMS)
   - Rutherford backscattering (RBS)
   - Particle Induced X-ray Emission (PIXE)
5. Local probe methods
   - Principle
   - Scanning probe microscopy (SMP)

(Approved)
• Scanning force microscopy (SFM)
• Scanning tunnelling microscopy (STM)
• Atomic force microscopy (AFM)

6 Case studies in which a combination of the above-mentioned techniques are used
For each of the methods listed above we will discuss principle, instrumentation, type of
chemical information obtained and a set of applications.

Initial competences
Completion of the courses ‘Physics I and II’, ‘Analytical chemistry: principles’ 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 chemical surface analysis, their
   application area, capabilities and limitations.
2. The student is aware of and can explain the basic operating principles of analytical
   instrumentation for chemical surface analysis.
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, practicum

Learning materials and price
Estimated cost: 15 EUR
English lecture notes
Documents available through Minerva

References
D.J. O’Connor, B.A. Sexton, R. St. C. Smart (Eds.), “Surface Analysis Methods in
Materials Science”, Springer Series in Surface Sciences 23, Springer-Verlag, Berlin,
1992
J. Vickerman (Ed.), “Surface Analysis: the Principal Techniques”, Wiley, Chichester,
1997

Course content-related study coaching
Through individual feedback by lecturer
Interactive guidance through Minerva

Evaluation methods
end-of-term evaluation

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

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

Examination methods in case of permanent evaluation

Possibilities of retake in case of permanent evaluation
not applicable

Extra information on the examination methods
Evaluate understanding of basic concepts and being apply to them in concrete problem
cases.

Calculation of the examination mark

(Approved)