EPFL

MSE-351	**Surface analysis**

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Cursus	Sem.	Type
Materials Science and Engineering	MA1, MA3	Opt.
Mechanical engineering	MA1, MA3	Opt.

Language of teaching	English
Credits	3
Withdrawal	Unauthorized
Session	Winter
Semester	Fall
Exam	Written
Workload	90h
Weeks	14
Hours	**3 weekly**
Lecture	2 weekly
Practical work	1 weekly
Number of positions	**18**

Il n'est pas autorisé de se retirer de cette matière après le délai d'inscription.

Summary

The course treats the main surface analysis methods for the characterization of surfaces, interfaces and thin films. It discusses how these methods can be applied to gain specific knowledge about structural, chemical and functional properties of surfaces and thin films. Limitation to 18 students!

Content

1. Introduction
2. Introduction to electronic states on atoms
3. Photo Electron Spectroscopy and Chemical Analysis (ESCA/XPS)
4. Auger Electron Spectroscopy (AES)
5. Secondary Ion Mass Spectrometry (SIMS)
6. Depth profiling
7. Electron diffraction from surfaces
8. Scanning Tunnelling Microscopy (STM)
9. Atomic Force Microscopy (AFM)
10. Scanning probe techniques based on AFM (MFM, Kelvin probe, PFM, others)
11. Quantitative measurements of surface properties with AFM

Keywords

electronic states on atoms, angular momentum, spin, particle wavelength, photoélectrons, energy analyzers, chemical composition, interatomic forces like van der Waal's, surface topography, tunneling effect, local mechanical and piezoelectric responses

Learning Outcomes

By the end of the course, the student must be able to:

- Describe the main features of surface analysis
- Differentiate advantages and disadvantages
- Choose the appropriate methods

Transversal skills

- Use a work methodology appropriate to the task.
- Access and evaluate appropriate sources of information.
- Evaluate one's own performance in the team, receive and respond appropriately to feedback.

Teaching methods

ex-cathedra and exercises / TP: experimental work with assistants on XPS or AFM in groups of about 4 / presentation on results and interpretation

Expected student activities

learn, look up, make exercises

Assessment methods

written exam

Resources

Bibliography

Leonard C. Feldmann and James W. Mayer, Fundamentals of surface and thin film analysis , North-Holland, (Elsevier) 1986
Hans Jörg Mathieu, Erich Bergmann, and René Gras, Analyse et technologie des surfaces , Presses polytechniques et universitaires romandes, 2003.
D.J. O¿Connor, B.A. Sexton, R.St.C. Smart (eds), Surface analysis methods in materials science , Springer, 2003.

Ressources en bibliothèque

- Analyse et technologies des surfaces / Mathieu
- Fundamentals of surface and thin film analysis / Feldman
- Surface analysis methods in materials science / Connor

Notes/Handbook

copies of foils, script available as pdf file

Moodle Link

- https://go.epfl.ch/MSE-351