

MSE-465

**Thin film fabrication technologies**

Michler Johann

Cursus	Sem.	Type
Materials Science and Engineering	MA2, MA4	Opt.

Language of teaching	English
Credits	2
Session	Summer
Semester	Spring
Exam	Oral
Workload	60h
Weeks	14
<b>Hours</b>	<b>2 weekly</b>
Courses	2 weekly
<b>Number of positions</b>	

**Summary**

The students will learn about the essential chemical, thermodynamic and physical mechanisms governing thin film growth, about the most important process techniques and their typical features, including process-microstructure-relationships.

**Content**

- Introduction (applications, importance, history, overview, vacuum science and technology)
- Major deposition methods with examples and typical applications: evaporation; plasmas, ion beam processing, sputtering; chemical vapor deposition; atomic layer deposition
- Nucleation and growth models, epitaxy
- Film morphology and microstructure
- Interdiffusion, reactions and transformations
- Characterisation techniques of thin films and surfaces
- Mechanical properties of thin films

Examples throughout the chapters mostly from Swiss companies on hard coatings, microelectronics, architectural glass, decorative coatings

**Keywords**

Plasma and thermal activation  
Thin film growth models  
Non-equilibrium and equilibrium processes  
Ion bombardment & sputtering  
Film morphology and microstructure  
Thin film characterisation methods  
Mechanical properties  
Industrial application of thin films

**Learning Prerequisites****Important concepts to start the course**

Basic courses on thermodynamics, physics, and chemistry

**Learning Outcomes**

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

- Describe thin film growth methods
- Explain main mechanisms
- Propose methods according to requirements
- Theorize on the effect of process parameters
- Describe thin film characterisation methods
- Propose thin film characterisation methods according to damage cases or quality control requirement

### Transversal skills

- Assess one's own level of skill acquisition, and plan their on-going learning goals.
- Access and evaluate appropriate sources of information.

### Teaching methods

ex cathedra  
exercices  
demonstrations

### Assessment methods

oral exam

### Supervision

Assistants                      Yes

### Resources

#### Bibliography

Copies of slides will be distributed via moodle  
Recommended books

#### Moodle Link

- <http://moodle.epfl.ch>