

# Thin film technology

---

**Credits:** 5ECTS (hp)

**Course period:** January-March 2020

**Description:** The course provides introduction into synthesis of thin film materials and coatings. This knowledge is essential for all students in materials science as well as for those utilizing thin films in systems and devices. The aim is to provide understanding of the different deposition techniques and the relation between growth conditions and material properties, rather than describe detailed technology implementation. Traditional vacuum techniques are covered and a brief overview of wet-chemical methods is also given. Given the varied background of the students, the focus is on active learning facilitated by a combination of traditional lectures and seminars, where the participant work themselves under guidance.

## CONTENT

Deposition of thin films by physical (PVD) and chemical (CVD and ALD) techniques with focus on the fundamental physical and chemical processes. A brief overview of solgel and electrochemical deposition.

Main topics covered in the course are: Evaporation, sputtering, ion-plating as well as CVD and ALD. Plasma technologies for thin films. Effect of the substrate on the film growth and techniques for surface modification. Models for nucleation and film growth. Morphology and texture and their impact on material properties. Solgel, electrochemical deposition. Examples of applications of thin film materials and deposition technologies.

Optional project module (2hp): A thin film experimental project related to the PhD work.

**Teachers:** Doc Tomas Kubart and Doc Tobias Törndahl (Department of Engineering Sciences), Prof Leif Nyholm and Prof Gunnar Westin (Chemistry)

**Assesment:** Presentation at all seminars, Home exam +oral interview

**Lectures and seminars**

	<i>Format</i>	<i>Description</i>	
<b>Fundamentals</b>			
1	Surface processes and growth	L	Introductions into surface processes, diffusion, adsorption, growth modes Tomas +Tobias
2	Surface processes and growth	S	Tomas
<b>Vacuum processing</b>			
3	PVD –sputtering and evaporation	L	Tomas
4	PVD Seminar	S	Tomas
5	Plasma technology	L	Basics of plasma physics, technological plasmas, generation, discharges Tomas
6	Plasma technologies	S	Ionized deposition, plasma etching, plasma activation Tomas
7	CVD	L	Tobias
8	CVD	S	Tobias
9	ALD	L	Tobias
	ALD	S	Tobias
10	<b>Non-vacuum processing</b>		
11	Electrochemistry	L	Leif
12	Electrochemistry	S	Leif
13	Solgel	L	Gunnar
14	Solgel	S	Gunnar

Combination of standard lectures and seminars. Each module introduced in a lecture and then the students present specific topics during a follow up seminar. Main focus on the theoretical principles, only brief overview of the technologies.

**Seminars:** Working in pairs, each group prepares presentation on a defined topic and presents. Each presentation about 8 minutes.