

Surfaces & films: general info 2021

CHEM-E5150

5 cr

Periods I-II

Learning goals

- The student knows atomic and nanoscale phenomena that affect chemical, mechanical, optical, biological and fluidic surface processes.
- The student can explain most important subtractive and additive surface modification methods.
- The student knows major thin film deposition processes: PVD, CVD, ALD.
- The student is aware of surface non-idealities and degradation processes.
- The student can design and execute a simple surface preparation process and report on its results.
- The student can critically read original scientific literature on the topical area of surfaces and films.

Zoom-based plus live lab project

Wednesdays 12.15-15.00 till December 8th

Homework presentation session Wednesdays
12.15-13 o'clock (9 sessions)

Lecture Wednesdays 13.15-15.00
11 lectures+Wrap up at last session

Lab project starts September 29th (pre task on 22nd)

Lectures and exercises

- 1A Introduction
- 1B Thin films and coatings

- E1 Exercise 1: film deposition
- 2A Wetting
- 2B Superhydrophobicity

- Lab Lab project launch and pre-task return
- 3A Ideal and real surfaces
- 3B Vacuum and thin film growth

- E2 Exercise 2: vacuum
- 4A Cleaning, activation passivation
- 4B Cleaning, activation passivation

- E3 Exercise 3: Cleaning
- 5A PVD, physical vapor deposition
- 5B Plasma, ion-surface interactions, film growth mechanisms

- E4 Exercise 4: PVD
- 6A CVD, chemical vapor deposition
- 6B CVD and PVD of polymers and CVD and PVD on polymers

- E5 Exercise 5: CVD
- 7A ALD, atomic layer deposition
- 7B MLD, molecular layer deposition

- E6 Exercise 6: ALD
- 8A Multilayer films and reliability
- 8B Thin film metrics and measurement

- E7 Exercise 7: Films
- 9A Adhesion
- 9B Wet adhesion, dry adhesion

- E8 Exercise 8: gekko
- 10A Biomolecules on surfaces
- 10B Biocompatibility

- E9 Exercise 9: biomolecule adsorption
- 11A Friction and lubrication
- 11B Tribology and wear

- 12 Wrap-up Q&A
+2h Final Quiz

Lectures

Access lectures from MyCourses, there is a Zoom-link

Be active in Zoom-chat.

Quiz every week:

- Quiz is before lecture and requires that you have familiarized yourself with material beforehand.
- Material will be made available latest on previous Friday.
- Worth 1 point each, 11 in total

Teachers

Jari Koskinen, intro, PVD, tribology

Sami Franssila, surface prep, CVD, epitaxy

Ville Jokinen, wetting, adhesion, biosurfaces; lab

Maarit Karppinen, ALD

Mehran Mirmohammadi, lab assistant

Homeworks (9 in total)

Based on scientific articles

Questions and calculations based on article

Personal

Returned to MyCourses

Deadline Tuesday 23.59 o'clock

Discussed in Zoom-session at 12.15 Wednesdays

Worth 7 points each.

Note: These are the majority of the points for the course.

Lab project

- Topic: Ice-phobic surfaces
- 10-12 Groups of ~4-5 students
- Background task (individual)
- Research plan (as group)
- Single lab session 2-3h (as group)
- Writing a report (as group)

Worth 15 points in total

If you cannot make it to the lab contact session, you can compensate by working more in the report for your group.

Timeslots reserved through MyCourses. 2nd half of 1st period.

Workload

36 hours contact teaching (=Zoom)

22 hours lab project

40 hours homework problems (4.5h per)

37 hours reading and self-study

135 hours total = 5 cr

Assesment

Homeworks 9 x 7 points	63 points
Pre lecture Quizzes 11 x 1 points	11 points
Lab project	15 points
Last lecture special Quiz	10 points
Webropol feedback	1 point
Total 100 points, 50% to pass.	

The course is semi-examless.

The Quiz at the last lecture is a bit like an exam but:

1. Only 10% of points and
2. You can pass the course with 0 points from it

Next courses

Thin film technology (IV)

Microfabrication (IV-V)

Microfluidics & BioMEMS (III-IV)