Atomic Force Microscopy (AFM) for Polymer- and Forest-based materials 5.0 credit, FCK3114, VT 2025

Course information

This course is designed to provide the background, fundamental concepts, and practical knowledge of Atomic Force Microscopy (AFM) in its relation to polymer- and forest-based materials. Doctoral students of this course will learn from experts in the field, get hands-on experience preparing samples, operating various AFM imaging modes and analysing AFM data. Following this course doctoral students will have a firm understanding of AFM and how it can be applied to their own research in polymer- and forest-based materials.

Intended learning outcomes

After completion of the course the doctoral student should have the knowledge and ability to:

- Describe the working principles and the components of the atomic force microscopy (AFM)
- Explain and differentiate between the various AFM operation modes
- Interpret, process and discuss results obtained by AFM
- Critically interpret AFM data both own and in literature with relation to polymer and forest-based materials
- Prepare samples suitable for AFM experiments

Course content

This course is designed to provide the background, fundamental concepts, and practical knowledge of atomic force microscopy (AFM) in its relation to polymer- and forest-based materials. The course will consist of:

- The working principles and the components of atomic force microscopy (AFM)
- What information and results that can be obtained with AFM in relation to polymer- and forest-based materials
- How AFM can be utilized in applied research and/or industrial settings
- Be able to recognize common artifacts, analyse surface force measurements, interpret results with relation to surface interactions
- Design AFM experiments with relevance to own research

Schedule

Date	Time	Activity	Content	Teacher
Wednesday, 5 February	9:00 – 11:00	Lecture	AFM introduction and overview	TP/KG
Wednesday, 5 February	12:30 – 16:30	Lab	Lab group A & B: AFM intro	TP
Friday, 7 February	9:00 – 11:00	Lecture	Imaging modes	TB
Tuesday, 11 February	9:00 – 10:00	Lecture	Surface thermodynamics	TP
Tuesday, 11 February	10:00 – 11:00	Lecture	NanoIR	MJ
Tuesday, 11 February	13:00 – 17:00	Lab	Lab group C & D: AFM intro	TP
Tuesday, 18 February	9:00 – 11:00	Lecture	Surface forces and friction	TP
Wednesday, 19 February	9:00 – 11:00	Lecture	Calibration and artefacts	TP
Wednesday, 19 February	13:00 – 17:00	Lab	Lab group A & B: Sample preparation	TB
Thursday, 20 February	13:00 – 17:00	Lab	Lab group C & D: Sample preparation	TB
Monday, 24 February	13:00 – 17:00	Lab	Lab Group A: Imaging	KG
Wednesday, 26 February	8:00 – 12:00	Lab	Lab Group B: Imaging	KG
Wednesday, 26 February	13:00 – 17:00	Lab	Lab Group C: Imaging	KG
Friday, 28 February	8:00 – 12:00	Lab	Lab Group D: Imaging	KG
Tuesday, 4 March	9:00 – 11:00	Lecture	AFM for applied research	EC
Wednesday, 5 March	13:00 – 17:00	Lab	Lab group A, B, C & D: Image analysis	TB/KG
Thursday, 6 March	9:00 – 11:00	Lecture	Nanomechanical measurements	TP
Friday, 7 March	9:00 – 11:00	Lecture	Functional SPM (magnetic, electic)	AR
Monday, 10 March	13:00 – 17:00	Lab	Lab Group A: Liquid measurements	TP
Tuesday, 11 March	13:00 – 17:00	Lab	Lab Group B: Liquid measurements	TP
Wednesday, 12 March	8:00 – 12:00	Lab	Lab Group C: Liquid measurements	TP
Thursday, 13 March	13:00 – 17:00	Lab	Lab Group D: Liquid measurements	TP
Wednesday, 2 April	09:00 – 15:00	Seminar	Seminar with individual presentations	TP, TB

TP: Torbjörn Pettersson, **TB:** Tobias Bensefeldt, **MJ:** Magnus Johnson, **KG:** Korneliya Gordeyeva, **EC:** Emily Cranston, **AR:** Anastasia Riazanova.

Course disposition

The course comprises of approximately 130 full-time study hours, whereof 16 hours obligatory lectures and tutorials, 20 hours laboratory project and 9 hours of seminar in addition to self-studies. The lectures include basic principles atomic force microscopy, and a survey of a number of the most important AFM techniques. In this context specific instrumental aspects, sample preparation, optimization and problem solving will also be discussed.

Literature

Hand-outs from presentations, scientific articles and instruction manuals.

Canvas

All information related to the course will be available on Canvas. This includes lecture notes, instructions in the preparation of the proposal and schedules for the laboratory work. The Canvas page will continuously be updated throughout the course.

Laboratory work (20h)

The schedule and group divisions for the laboratory work will be published on Canvas in connection to the start of the course.

Examination

Grading scale: Pass (P), Fail (F)

The examination will consist of three modules:

- SEM1 – Seminars, 2.0 credits: attending lectures and seminars throughout the course (minimum 90% attendance on the lectures and 100% attendance on the seminars) (P, F).
- LAB1 – Laboratory work, 2.0 credits: participation in the laboratory lessons (P, F).
- PRO1– Project, 1.0 credits: completing a project which consist of a written proposal, peer review, and a short presentation of the own proposal (P, F).

The examiner may apply another examination format when re-examining individual students.

Passed grades on all grading modules are required to receive final grade in the course.

Course fee

Free for PhD students from CBH school. For others 4000 SEK excluding VAT.

Contact information

Examiner:	Torbjörn Pettersson, e-mail: torbj@kth.se
Course responsible:	Torbjörn Pettersson, e-mail: torbj@kth.se
	and Korneliya Gordeyeva: gorde@kth.se