Atomic Force Microscopy (AFM) for Polymer- and Forest-based materials 5.0 credit, FCK3114, VT 2022

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

W.	Time	Activity	Content	Teacher
20	**Monday 16/05/2022**			
	8:15 – 10:00	Lecture	AFM introduction and overview	TP, MRe
	10:15 – 12:00		Imaging modes	TP, MRe
	13:00 – 17:00	Lab	Lab group A: AFM intro	
	Tuesday 17/05/2022			
	8:15 – 10:00	Lecture	NanoIR	MJ
	10:15 – 12:00		Surface forces and friction	TP
	13:00 – 17:00	Lab	Lab group B: AFM intro	
	Wednesday 18/05/2022			
	8:15 – 10:00	Lecture	Calibration and artifacts	TP, MRe
	10:15 – 12:00		AFM for industrial research	MRu
	13:00 – 17:00	Lab	Lab group C: AFM intro	
	13:00 – 17:00		Lab group A & B: Sample preparation	
	Thursday 19/05/2022			
	13:00 – 17:00	Lab	Lab group C: AFM intro	
	Friday 20/05/2022			
	8:00 – 12:00	Lab	Lab Group A: Imaging	
	8:00 – 12:00		Lab group C & D: Sample preparation	
	13:00 – 17:00		Lab Group B: Imaging	
21	**Monday 23/05/2022**			
	8:00 – 12:00	Lab	Lab Group C: Imaging	
	13:00 – 17:00		Lab Group D: Imaging	
	13:00 – 17:00		Lab group A & B: Image analysis	
	Tuesday 24/05/2022			
	8:15 – 10:00	Lecture	Nanomechanical measurements	MF
	10:15 – 12:00	Lecture	Elector and magnetic AFM modes	LB
	13:00 – 17:00	Lab	Lab group C & D: Image analysis	
	Wednesday 25/05/2022			
	8:00 – 12:00	Lab	Lab Group A: Liquid measurements	
	13:00 – 17:00	Lab	Lab Group B: Liquid measurements	
22	**Tuesday 31/05/2022**			
	8:00 – 12:00	Lab	Lab Group C: Liquid measurements	
	13:00 – 17:00	Lab	Lab Group D: Liquid measurements	
23	**Tuesday 07/06/2022**			
	10:00 – 15:00	Seminar	Seminar with individual presentations	

TP: Torbjörn Pettersson, **MRe:** Michael Reid, **MJ:** Magnus Johnson, **MRu:** Mark Rutland, **MF:** Matthew Fielden, **LB:** Liubov Belova.

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.

Contact information

Examiner: Torbjörn Pettersson, e-mail: torbj@kth.se

Couse responsible: Michael Reid, email: mreid@kth.se and
Torbjörn Pettersson, e-mail: torbj@kth.se