

1. Information for the European Market consultation “Fluidic Force Microscope system”

1.1 Market Consultation

This is the market consultation for a “fluidic force microscope”.

Please note that this is a market consultation and not an invitation for a Tender.

The University of Twente wants to start a market research before proceeding to tender.

The market consultation document is available from 8 april 2013 and can be requested via email r.gerritsen@utwente.nl . The deadline to respond is 22 april 2013 17:00.

1.2 Client: University of Twente

The University Of Twente (UT) is an entrepreneurial research university founded in 1961. The UT provides teaching and research in scientific fields ranging from public administration, science and applied physics to biomedical technology. The UT is the only Dutch university to possess a campus: study, work, accommodation, entrepreneurship and relaxation are for the most part concentrated in one place, on the Drienerlo estate. This campus also acts as a tool for the academic and personal development of students, and for promoting a sense of entrepreneurship. The site is owned by the UT and covers around 150 ha, the buildings occupying some 200,000 m². The UT currently has around 8,500 students and around 3,000 staff, with an average of two thousand students living on the campus. The UT aims to grow to 10,000 students within 5 years.

The UT comprises the following six faculties and nine services:

Faculties

- CTW Engineering Technology
- TNW Applied Physics
- GW Behavioural Sciences
- EWI Electrical Engineering, Mathematics and Computer Science
- MB Management & Governance
- ITC International Institute of Geo-Information Sciences and Earth Observation

Services

- ICTS ICT Service Centre
- MC Directorate for Marketing & Communication
- SB Directorate for Strategy & Policy
- AZ General Affairs
- HR Human Resources Directorate
- FEZ Directorate for Financial and Economic Affairs
- FB Facility Department
- OSC Student and Education Service Centre
- BA Library and Archive Service Centre

We recommend that you visit our website www.utwente.nl to gain a good picture of the scope and complexity of the site and buildings.

MESA+ Institute for Nanotechnology

MESA+ is one of the largest nanotechnology research institutes in the world, delivering competitive and successful high quality research.

It uses a unique structure, which unites scientific disciplines, and builds fruitful international cooperation to excel in science and education.

MESA+ has created a perfect habitat for start-ups in the micro- and nano-industry to establish and to mature.

MESA+, Institute for Nanotechnology, is part of the University of Twente, having intensive cooperation with various [research groups](#) within the University.

The institute employs 500 people of which 275 are PhD's or postdocs. With its NanoLab facilities the institute holds 1250 m² of cleanroom space, 150 m² BioNanoLab and state of the art research equipment.

MESA+ has an integral turnover of 45 million euro per year of which 60% is acquired in competition from external sources.

The structure within MESA+ supports and facilitates the researchers and stimulates cooperation actively. MESA+ combines the disciplines of physics, electrical engineering, chemistry and mathematics.

Internationally appealing research is achieved through this multidisciplinary approach. It is strengthening its international academic and industrial network by fruitful cooperation programs.

MESA+ has been the breeding place for more than 40 high-tech start-ups to date. A targeted program for cooperation with small and medium-sized enterprises is specially set up for start-ups.

MESA+ offers the use of its extensive facilities and cleanroom space under friendly conditions. Start-ups and MESA+ work intensively together to promote transfer of knowledge.

Motivation of the Investment

The MESA+ Institute for Nanotechnology will invest in a new microfluidic AFM system that will add new capabilities to the NanoLab, and specifically to the BioNanoLab. Within MESA+ institute, the microfluidic AFM system will be used in a multi-user environment (researchers, students and industrial partners) for a large range of applications, as specified below. Therefore, robustness, user-friendliness, flexibility and applicability range are important factors besides accurateness and reproducibility of the experimentation results.

Applications

A microfluidic AFM is an instrument that combines a force controlled nano-manipulator (AFM technology) via a hollow cantilever. The hollow cantilevers have a tiny opening at their tip which is connected to a microfluidic channel, which is highly interesting for many applications in the fields of micro- nanotechnology, micro-/nanofabrication, cell biology, physics, chemistry and material science. Specifically, at the MESA+ Institute for nanotechnology, researchers are interested in the following applications which are made possible by a microfluidic AFM:

- Liquid delivery on a surface (spotting of proteins, release of small molecular weight compounds, polymer solution, chemicals) in a highly localized and controlled manner in terms of amount of fluid released
- Lithographic applications for nanofabrication purposes when the tip is employed for local delivery of minute amounts of a resin solution (photoresist) or of chemicals (etchants)
- Localized extraction/collection of liquid samples

- Electro spraying, where the microfluidic tip is employed as an ionization source for mass spectrometry analysis
- Spatial manipulation of individual viable cells, viruses and nano-objects (e.g., vesicles, nanoparticles, nanofibrils, etc..) in a highly precise and controlled manner
- Intracellular (or even intranuclear) injection/aspiration of liquid, with a high control on the amount of liquid retrieved or delivered for intracellular analysis (sampling) or cellular modification (injection)
- Intracellular measurements using the AFM tip as a conventional pipette in which electrodes can be inserted for electrical recordings (electrophysiology, electrochemical measurements)
- Adhesion force measurements of/on living cells
- Development of dedicated probes including e.g., smaller fluidic channels, presenting specific aperture(s) at their tip, including electrodes, etc...

Specifications

Based on the targeted applications, a list of specifications can be derived.

A micro fluidic AFM system is a combination of the following components: an atomic force microscope (AFM); a hollow AFM-cantilever; pumping/liquid control interface; an optical microscope including a unit for fluorescence measurements; and dedicated operation software.

The microfluidic channel is integrated in an AFM probe by using hollow AFM-cantilever. Liquid flows through the cantilever, this being monitored via a pressure/suction controller. The system is used in combination with an optical microscope including a fluorescence unit and everything is operated by dedicated software that controls all hardware components. These hardware components together with the dedicated software are the core components of the micro fluidic AFM system.

Mandatory requirements for a Fluidic force microscope

All the following requirements must be fulfilled:

System demands:

System part	Specifications
General	The microfluidics should be integrated in an AFM through a hollow AFM-cantilever. Liquid flows through the cantilever are regulated via a pressure controller.
	The system should be fully integrated with inverted optical microscope with motorized sample stage and motorized zoom. Full integration means that all the motorized functions of the microscope should be controlled from within the same software package that controls the AFM.
	The inverted optical microscope should be equipped with a fluorescence unit for simultaneous fluorescence monitoring of the experiments.
	The system should be fully integrated and controlled by a user-friendly interface such as an intuitive touch screen control system.
	The maximum footprint of the system should not exceed 3 m ²
AFM part	Scan range in XY larger than 90 μm and the Z range larger than 9 μm
	Automatic approach range larger than 1 mm
	Z drive resolution better than 0.2 nm
	XY drive resolution better than 2 nm
	Z-measurement noise level (RMS, StaticMode in air) better than 0.5 nm RMS
	Z-measurement noise level (RMS, DynamicMode in air) better than 0.2 nm
Pressure	Pressure range –800 to 1000 mbar
	Pressure precision better than 2.5% of full range

controller	Min. output pressure step (< 0 mbar) 0.1% of max negative pressure range
	Min. output pressure step (> 0 mbar) 0.1% of max positive pressure range
Cantilevers	The company that sells the microfluidic system should guaranty the delivery of Microfluidic cantilevers (cantilevers with a fluid channel in the cantilever and an opening at the end of the cantilever)