

Upright Fluorescence Microscope (UFM) Kit for NanoWizard® 3 AFM & CellHesion® 200

JPK Instruments recently developed a new microscope kit which enables the combined use of AFM and upright fluorescence zoom microscopy. This unique combination of fluorescence and atomic force microscopy enables co-localization experiments on opaque substrates.

Integrated design

The upright fluorescence microscope kit for NanoWizard® 3 AFM and CellHesion® 200 is based on a solid and stable stand which holds an Axio Zoom.V16 from Zeiss. The stand can be equipped with a life science sample stage,



Fig. 1: The JPK NanoWizard® 3 in combination with an Axio Zoom.V16 from Zeiss

CellHesion® module stage or a TAO™ stage. The sample can be illuminated in transmission from below or using reflected light or epi-fluorescence from above. Due to the novel optical design of the NanoWizard® 3 and the CellHesion® 200 head, the epi-fluorescence and the transmitted light can be collected simultaneously with the AFM measurements.

There are no restrictions in experimental design for standard AFM applications. Once the cantilever and sample position have been adjusted for optically co-localized experiments, the AFM experiments can start. Imaging or force measurements can be done as well as material properties testing. The recently developed Quantitative Imaging (QI™) mode completes the package.

Field of applications

Applications include high resolution AFM imaging or mapping of sample properties such as mechanical (stiffness, elasticity, dissipation), electrical (conductivity and surface charge) or thermal properties.

A wide range of samples may be studied including:

- Biomaterials
 - o Cells and microaggregates
 - o Embryos and tissues
 - o Model organisms in developmental biology (zebra-fish, *C. elegans*, etc)
 - o Biointerfaces
 - o Implants
- Microbiology
- Biofouling
- Biosensors and biochips
- Material science and bionic applications
- Optically active polymer films and coatings such as toner for printers, paint or OLEDs

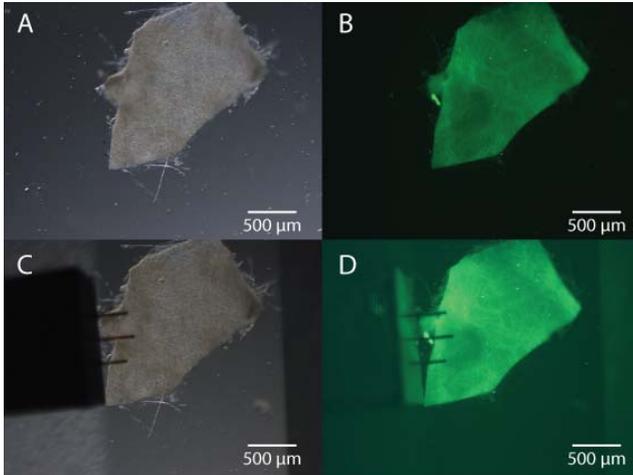


Fig. 2: Common brightfield illumination (A) and epi-fluorescence (B) of endothelial aorta tissue. Fluorescent images were collected with a ProgRes CFCool from Jenoptik. In (C) and (D) the cantilever chip can be seen as the AFM head is in place. Sample courtesy of the Institute of Physiology II, University Medical Center Münster, Germany.

Applications example: Optical correlation of endothelial tissue with AFM

Due to its long working distance the Axio Zoom.V16 allows the collection of optical images with or without the AFM head. Furthermore, the placement of the AFM head does not require a readjustment of the sample. Once the region of interest is found in the optical image it can be used to position the AFM probe with respect to the area of interest.

The images of figure 2 display bright field and fluorescence images of native endothelial aorta tissue. All images were collected without rearranging the sample. This clearly illustrates the benefits of the upright fluorescence microscope kit.

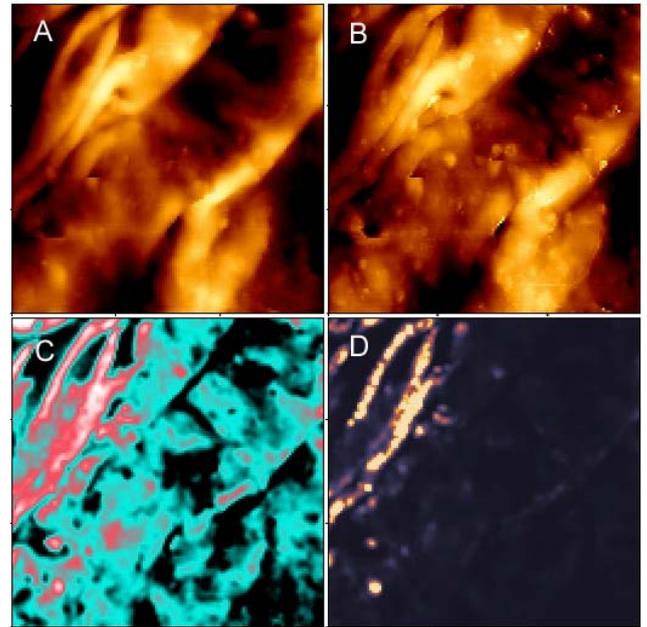


Fig. 3: Height image (A), contact point image (B), stiffness (C) and corresponding Young's Modulus image (D) of a mouse skin tissue, using QI™ Advanced mode. Scan field 6.0 microns. Height z-range 353.3 nm, Contact point z-range 326.5 nm, stiffness z-range 65.6 nN/μm, Young's Modulus z-range 1 GPa. Sample courtesy of Prof. Michael F. Olson, Beatson Institute for Cancer Research, Glasgow University, UK.

Conclusion

The benefit of the upright fluorescence microscope kit for NanoWizard® 3 AFM lies in the possibility to perform co-localized optical and fluorescence microscopy in combination with simultaneous AFM measurements. The kit avoids the need to rearrange the sample when switching between the different analyzing techniques.

Compatibilities

- **Optical microscope:**
 - o Zeiss Axio Zoom.V16 with epi-fluorescence and brightfield

- **Objective lenses:**
 - o Objective lenses with long working distance:
e.g. Zeiss PlanApo Z 0.5/0.125 FWD 114mm

- **Stages:**
 - o Manual Precision Stage, TAO™ module, Motorized Precision Stage, Precision Mapping Stage, CellHesion® module

- **Sample holders:**
 - o Standard Sample Holder, PetriDishHeater™, BioCell™, CoverSlipHolder™, Heating Cooling Module (HCM™), ECCell™ electrochemistry cell