RhySearch
Das Forschungs- und Innovationszentrum Rheintal

AFM

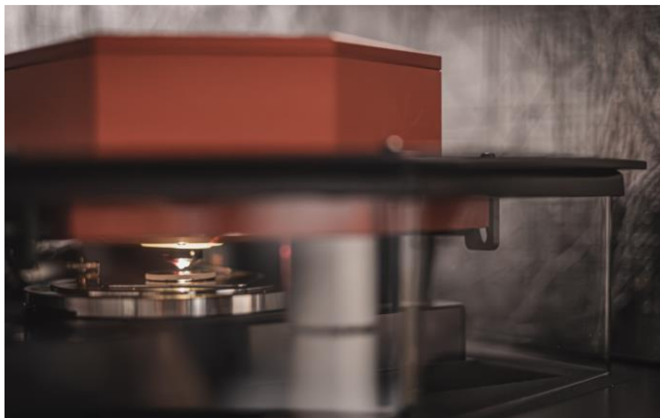
ATOMIC FORCE MICROSCOPE

Surface investigation of optical components on an atomic scale

The AFM allows the creation of high resolution images of the surface topography, and the measurement of surface roughness in the single angstrom range. It also facilitates layer thickness measurements from single nanometers to several hundred nanometers or determination of the local work function (KPFM), thus providing a means to measure an important electrical property of the surface.

A flexible arm (cantilever) with a tip is moving over the surface of the sample under investigation. The tip is in interplay with the surface and consequently deflected. The deflection is measured by a laser beam, reflected by the backside of the cantilever. The amplitude of the deflection can be used to get a height map of the surface.

In Static- or Contact Mode, the tip is in continuous contact with the surface. While scanning the tip over the surface, the contact force is kept constant by changing the tip-surface distance. With this closed feedback loop one gets information about the surface height. The contact mode is useful to measure the local height of the surface, but it's also prone to tip damage since the tip is in close contact with the surface. This disadvantage can be overcome with the Dynamic Mode, where the cantilever oscillates close to its resonance frequency. The cantilever is then brought into quasi contact with the surface, such that the oscillation amplitude is dampened. This dampened amplitude is then defined as contact and can be used again in a feedback loop to get the surface height map. KPFM functions similar to the Dynamic Force Mode but with an additional AC and DC bias voltage applied between the tip and surface. By changing the DC voltage, the contact potential difference between tip and sample surface can be measured and the local work function of the sample determined.



Test methods
Static Force Mode
Dynamic Force Mode
Kelvin Probe Force Microscopy (KPFM)

Device
CoreAFM from Nanosurf

Test conditions
Sample thickness up to 12 mm
Maximum lateral-range: 100 µm
Maximum Z-range: 12 µm
Sensitivity: 150 pm

Standard
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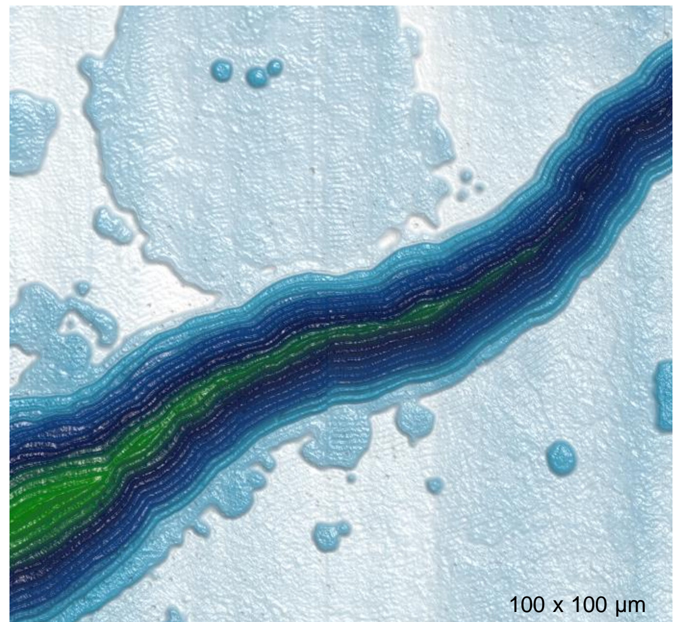

Top-down view in isometric projection of a 3D model generated from an AFM measurement using the Dynamic Force Mode. The measured object shows a crack in an optical interference coating which was induced by high pulse energy laser irradiation.

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