DFM
Danish National Metrology Institute

ABOUT DFM

DFM is Denmark's National Metrology Institute (NMI). DFM is a signatory to the CIPM-MRA arrangement that ensures mutual recognition of measurements worldwide

TRACEABILITY

All measurements are traceable to recognised national and international standards.

ISO CERTIFICATION

All services are covered by DFM's ISO 9001 certification

CONTACT DFM

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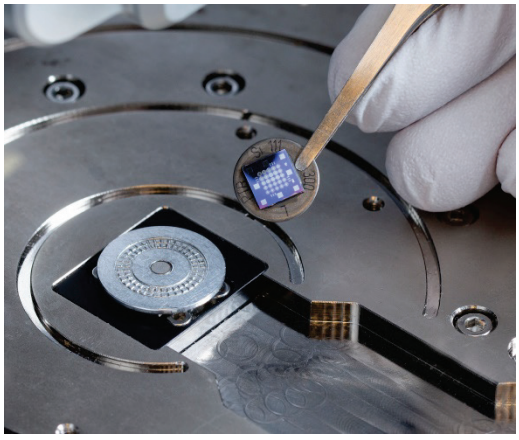
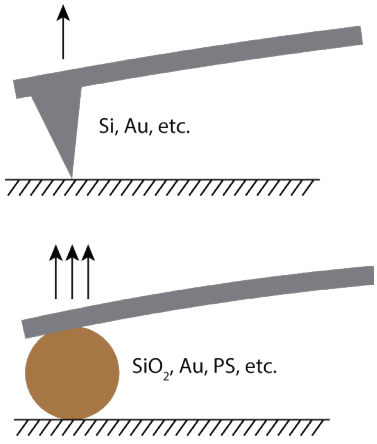
Microadhesion

Quantification of interfacial adhesion with AFM





Applications

Adhesion of surfaces and micro- and nano-sized particles affect properties such as aggregation, mixing, transportation, and immobilization to specific targets, to name a few. Furthermore, it is often required to either enhance or suppress the surface adhesion to obtain the desired properties.

For a long time, the measurements of adhesion forces have been a challenge, in particular in combination with high-resolution imaging. In a response to this, DFM has developed a new measurement service to quantify surface adhesion with atomic force microscopy (AFM).

DFM measures the adhesion force by means of AFM probes made of different materials, ranging from metals and semiconductors to polymers. Sharp AFM probes allow high resolution imaging, essential to many particles and surfaces with features at the micro- or nanometer scale.

As an alternative, we may use spherical AFM probes, which give more accurate measurements of the adhesion force for homogeneous surfaces. Also, spherical probes allow a wider selection of probe materials.

Our measurements are done under ambient conditions, in either air or liquid. Get in contact with DFM to learn more, or to get a quotation.

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CONSULTANCY SERVICES

Do you need new measurement capabilities, does a method call for a bit of scrutiny, or are you perhaps seeking to acquire new equipment? Take advantage of the consultancy services we provide in addition to our calibration services.

As an independent institute deeply rooted within research and metrology, DFM has gained the reputation of being an agile, solid, and valuable partner. Contact us and find out why.

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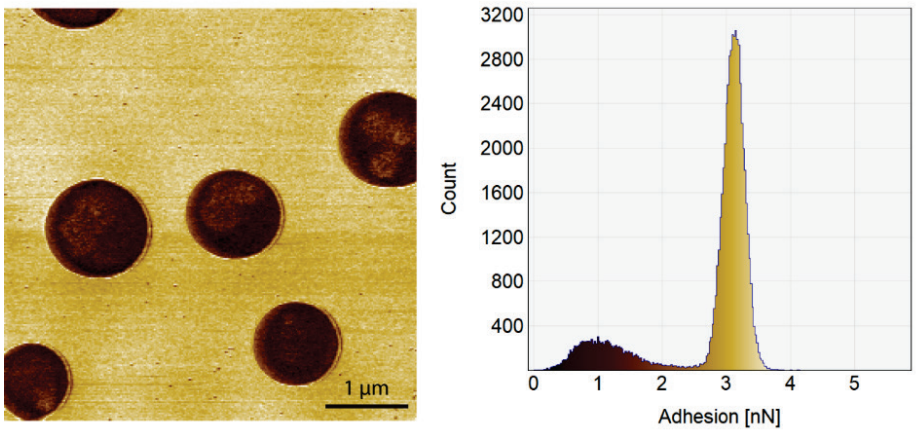
Services and specifications

- K07.210 AFM measurements of surface adhesion, according to quotation

DFM measures the adhesion force between the AFM probe and the sample, using either sharp AFM probes, which give both adhesion and high-resolution imaging, or spherical probes, which give more accurate measurements of the adhesion force, and offer a wider selection of probe materials.

Because adhesion force is a combined effect of contact area, interfacial interactions, and capillary forces (due to the surface water), the adhesion force of different samples are compared to measure the relative strength of adhesion.

- Adhesion force range: 50 pN – 100 µN
- Probe materials: Silicon, gold (sharp probes); silicon dioxide, gold, polystyrene (spherical probes); other materials on demand (contact us for details)
- Maximum image range: 100×100 µm^2
- Resolution: 0.1 nm for Z and 1 nm for X and Y (sample dependent)
- Medium: Air, water (buffer)
- Temperature range: 4 - 180 ºC in air, and 22 - 60 °C in water
- Humidity range: RH 11% - 85%
- Sample requirement: micrograms and above (contact us for details)



Example: The figure on the left shows an adhesion map of a two-component polymer blend (PS-LDPE). The figure on the right shows a histogram illustrating the difference between adhesion forces of the two components.

Examples of adhesion measurement results.

Material 1	Material 2	Increase of adhesion (*)
Hardness coating	Steel	(48 ± 25)%
Polystyrene	Mica	(267 ± 25)%
LDPE	Polystyrene	(134 ± 25)%

(*) The relative increase of the adhesion force for material 2 compared to material 1. It is calculated as [(F2 - F1)/F1] × 100% where F1 is the measured force between material 1 and a probe and F2 is the measured force between material 2 and the same probe. The measurement uncertainty is stated at a confidence level of 95%.