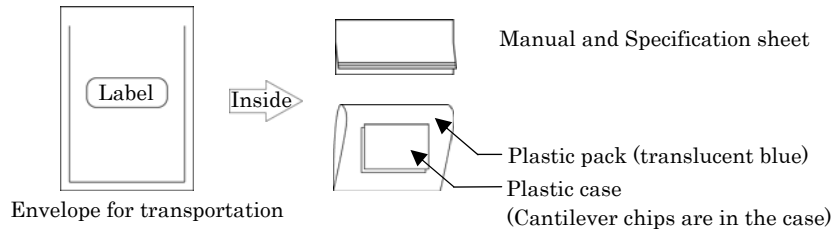


Micro cantilever user's manual

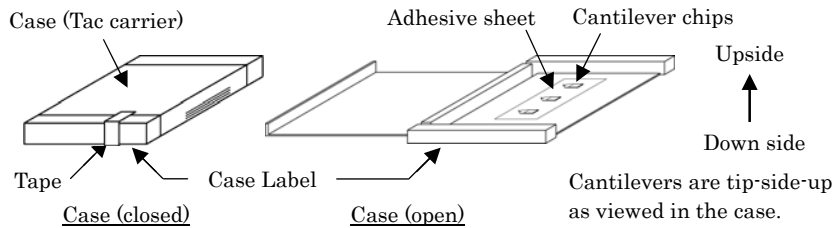
Thank you for purchasing OLYMPUS Micro cantilever.
Please read this manual carefully before use.

< Explanation of the each part of the products >

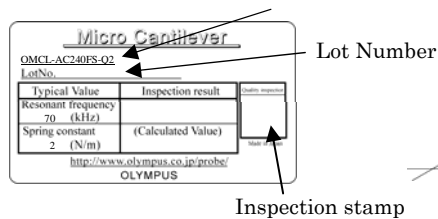
Cantilever chips in a plastic case are included in the envelope with manual and spec. sheet.



Cantilever chips are contained in the plastic case (Tac carrier)



Magnified illust.



One cantilever elongates from the side of round shoulders of the chip.

Please obey the following to the OLYMPUS micro cantilevers

Warning

- Use protective eye glasses when handling to avoid damage to the eyes from breakage of the cantilever chips.



Caution

- Please handle our cantilevers carefully because they are fragile.

Caution

- It is recommended that precautions be taken to prevent damage to the cantilever tips from electrostatic discharge.

Caution

- Be sure to store the cantilevers at room temperature and moderate humidity.

Caution

- When discarding, please obey the laws and regulations in your country and/or your company. These cantilevers are made from silicon, carbon and aluminum.

Special feature of OLYMPUS Micro cantilever (OMCL-AC240FS-Q2/-B2)

1. **AC mode cantilever** – This type of micro cantilever is for AC (dynamic) mode AFM operation.
High mechanical Q factor of the cantilevers allows you high sensitivity measurement to probe your sample surface gently.
2. **Tip View** – The tip is located on the very end of the cantilever.
This feature allows you to set the tip over a point of interest on the sample, easily and precisely, if you use an AFM combined with an optical microscope.
3. **Micro columnar fibril** – Carbon nano fiber probe (CNF probe)
A CNF probe of amorphous carbon with a length of 200 nm grows on a tetrahedral probe basement with a length of 15 μm which locates on the exact end of each cantilever. Radius of the curvature of the CNF probe is 10 nm (typ.) and the probe is also thinned with 50 nm diameter at the last 200 nm of the tip. Since the probe is not hollow, it is rigid suitable for high resolution measurements.
4. **Tilt corrected high-aspect-ratio tip**
The CNF probe grows with a tilt at 12 degrees (typ.) angle with respect to the normal of cantilever surface along the cantilever axis in order to compensate for tilt angle of chip holder. The angle is controlled within ±6 degrees.
5. **Aluminum reflex coating** - Aluminum is deposited on the back side of the cantilevers for optical deflection sensing.
Sensing high S/N ratio signal can be expected in the optical sensor circuit.
6. **Compatible chip size** – 3.4 mm (L) x 1.6 mm (W) x 0.3 mm (t)
This type of the chip can be attached to most of AFM instruments.
7. **Pre-separated chip** – Each cantilever chips is isolated in the case.
The chips can be attached to the AFM instrument as soon as the case is open.

See the specification sheet of OLYMPUS Micro cantilevers at the last page of this manual.

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1 | Preparation

- 1) Please prepare the followings before using OLYMPUS cantilevers.
- 2) To gain a better understanding of how cantilevers and chips are connected, cantilevers should be inspected under the microscope.

- | | |
|-----------------------------|---|
| 1) Work environment | : <u>Clean bench</u>
(Use of an electrical charge neutralizer or ionizer is recommended.) |
| 2) For hazard avoidance | : <u>Protective eye glasses</u> |
| 3) For cantilever treatment | : <u>Tweezers</u>
(Use of anti-electrostatic discharge mat and a wrist band is recommended.) |
| 4) For inspection | : <u>Stereo microscope</u> |

2 | Open the case



- Please handle our cantilevers carefully because they are fragile.



- It is recommended that precautions be taken to prevent damage to the cantilever tips from electrostatic discharge.

- 1) It is recommended that the cantilever case be opened in a clean environment like a clean bench in order to avoid the cantilever being contaminated. Handling under an ionizer is recommended.
- 2) Avoid wearing clothes like woolen sweaters, fleece etc that give off the static electricity when handling the cantilever cases and chips. Use of an anti-electrostatic mat and wrist band is preferable.
- 3) In opening the case, put the plastic case label-side down on a desk.
The cantilevers are tip-side-up as viewed in the case.
- 4) Open the case.

3 | Picking up the cantilever chip from the case



- Avoid any contact with the cantilevers when you pull up the cantilever tip from the case.

- 1) Pick up the chip by the long side with the tweezers and mount it in the AFM.

4 Tip shape of CNF tip

A CNF probe is fabricated on the exact end of the sharpened tetrahedral silicon probe by our unique growth process. The CNF probe is in the shape of a rod. It is expected that the probe is higher rigidity than carbon nano tube (CNT) which is hollow structure.

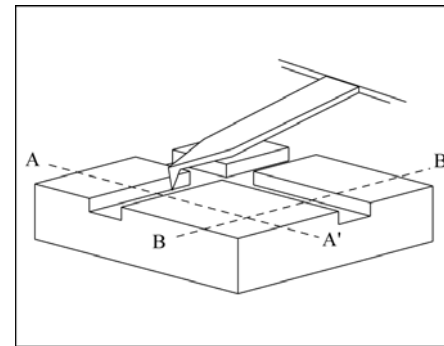
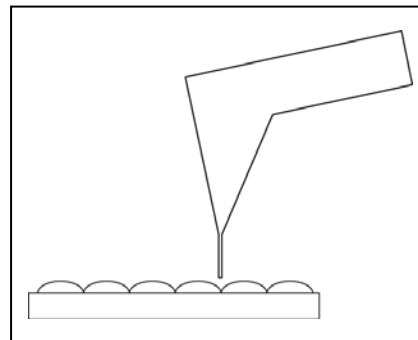
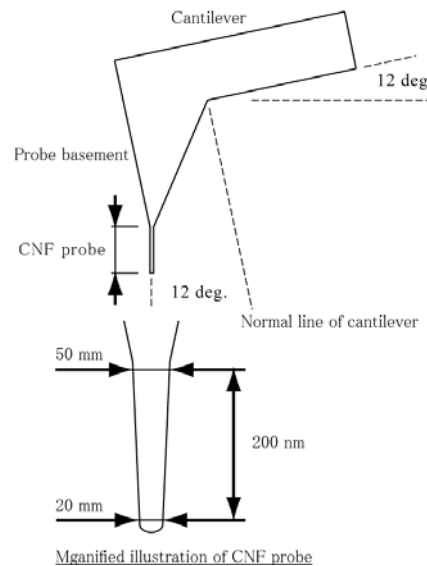
The length of CNF probe is more than 200 nm. It is suitable for measuring surface roughness less than 200 nm.

The CNF probe grows with a tilt at 12 degrees (typ.) angle with respect to the normal of cantilever surface along the cantilever axis. The angle is controlled within ± 6 degrees.

The CNF probe is high-aspect-ratio (see right illustration) and variation of the probe diameter between the tip and the last 200 nm of the tip is small.

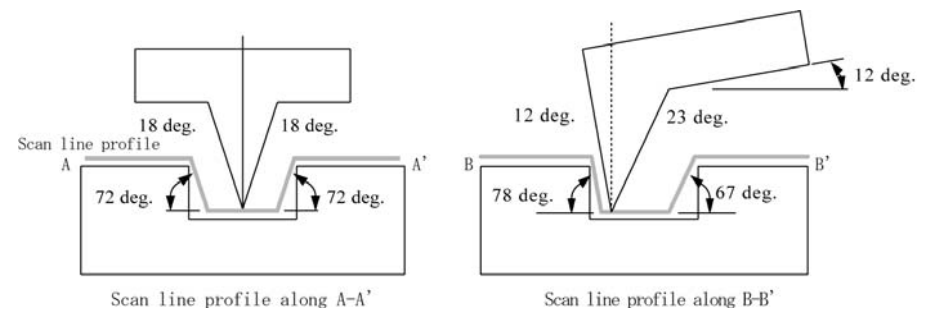
Therefore, the CNF probe is suitable for measuring roughness of thin-film like polysilicon and ITO. Many of thin-films fabricated by vapor deposition or sputtering have small roughness. The CNF probe could be inserted in the roughness and obtained the line profile of it effectively.

When the CNF probe is worn after the several scans, deterioration of image is slight because of small change of the probe diameter.



When measuring rectangular grooves which depth is over 200 nm, the tetrahedral tip profile is related to the scan line profile.

However, if the tetrahedral tip without CNF probe is used for measuring, you can get the precipitous scan line profile (see below illustration). The CNF probe is expected to obtain good result like this sample.



5 Specification range

The following is not trouble.

1) When measuring samples at a temperature of 100 degrees centigrade, the image looks like flowing compared to the measuring result at room temperature.

Specification)

This cantilever is for using at room temperature. It is not suitable for measuring with over heat.

2) When using the probe for electric measurement, it can not measure because of its low electric conductance.

Specification)

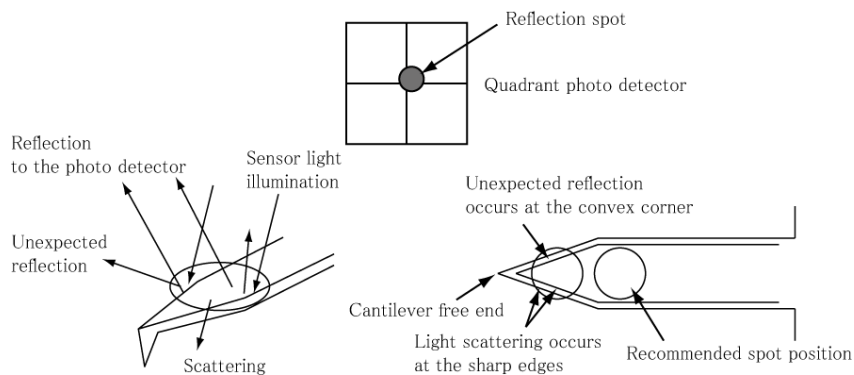
The CNF probe is made of carbon. However, when you look at the cantilever chip as a whole, the electric conductance is not guaranteed.

Situations as described below may arise when using this type of cantilever.

Case1: In adjusting the sensor optics before scanning, the movement of the reflection spot on the photo detector is critical so that the sensor optics is hard to adjust to zero position. When the sensor illumination spot on the cantilever is not small enough and is positioned at the triangular part of the cantilever, unexpected reflection and light scattering occur. This may cause the unexpected movement of the reflection spot on the photo detector.

Solution:

Try to adjust the focus of the sensor optics again and move the spot position a little opposite to the free end of the cantilever.



Case2: AFM images turn to vague after several scans. It may be that some particles attach to the CNF probe tip.

Solution:

In the case that some particles attach to the CNF probe tip, it is recommended that the cantilever is replaced. Since this case is found frequently, please use of an electrical charge neutralizer or look the servo condition of your SPM again.

Please contact following if you have any question on this user's manual.

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Please access to the web page of OLYMPUS micro cantilevers.

<http://www.olympus.co.jp/probe>

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 OLYMPUS CORPORATION