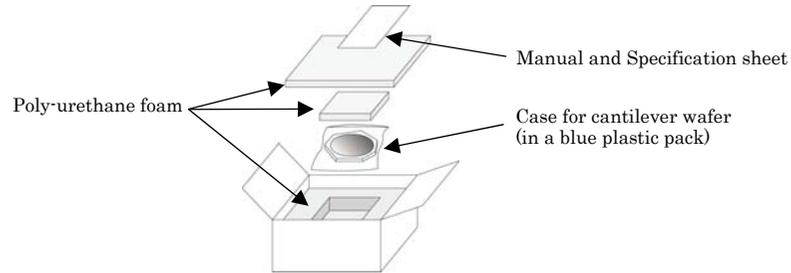


Micro cantilever user's manual

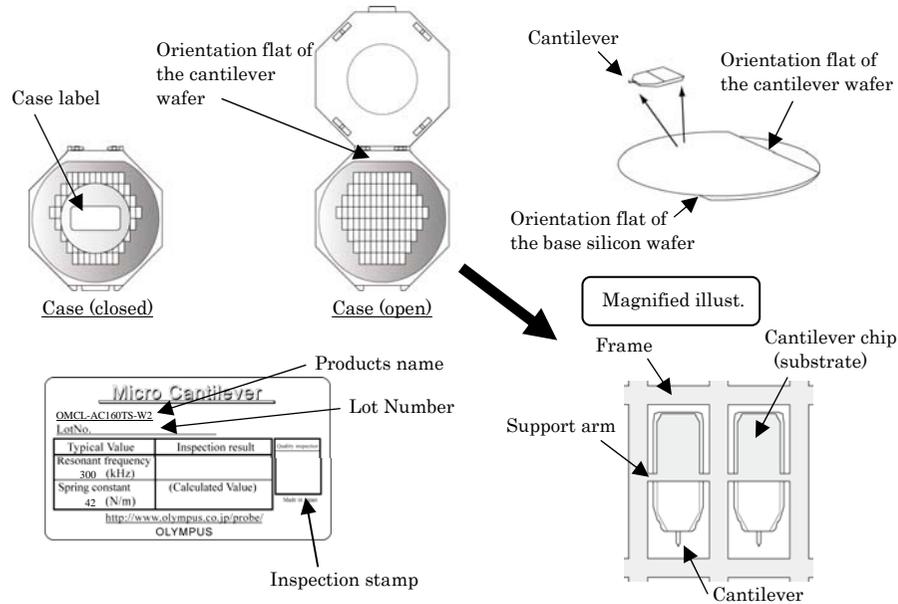
Thank you for purchasing OLYMPUS Micro cantilever.
Please read this manual carefully before use.

< Explanation of the each part of the products >

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



A cantilever wafer on a base silicon wafer is inside the plastic case.



OLYMPUS

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

- Do not drop or shake the cantilever case. Even when the cantilever chips are contained in the cantilever case, the cantilevers may break if the case is handled roughly or jarred.

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 of silicon and aluminum.

Special feature of OLYMPUS Micro cantilever (OMCL-AC160TS-W2)

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. This type of micro cantilever is used as a standard cantilever for AC mode measurement.
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. **Point terminated tip** – The tip radius is typically 10 nm or less.
A sharpened tetrahedral tip of single crystal silicon is employed for high-resolution measurements. The tetrahedral shape is ideal for achieving a point terminated tip. In addition to the geometrical dimensions of the tip, the tip is further sharpened with our exclusive sharpening process.
4. **Symmetric tip** – The tetrahedral tip is thin with the macroscopic tip angle of 35 degrees viewing from both its front and side. Tip shows good symmetry in viewing along the cantilever axis (see Chapter 4).
Symmetric shape tip results AFM images less distortion which reduce misinterpret of the data.
5. **Reflex coating cantilever** – Aluminum is coated onto the back side of the cantilevers for optical deflection sensing.
Good S/N signal can be expected in the optical sensor circuit.
6. **Compatible chip** – 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. **Easy handling** – Chip are fixed through the support arms. (Bottom left illust. in the first page)
375 chips are contained in a wafer. A chip can be separated from the wafer frame by pushing it gently in the middle with a pair of tweezers.

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 : Clean bench
(Use of an electrical charge neutralizer or ionizer is recommended.)
- 2) For hazard avoidance : Protective eye glasses
- 3) For cantilever treatment : Tweezers (sharp pointed tip), Tweezers (flat tip)
(Use of those made of insulator is recommended.)
(Use of anti-electrostatic discharge mat and a wrist band is recommended.)
- 4) For inspection : Stereo microscope

2 Open the case



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.

- 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

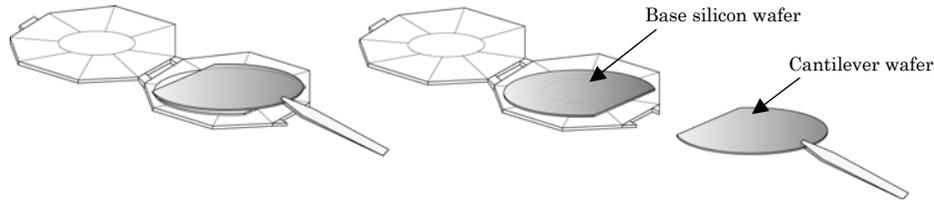


Caution

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

- 1) Keep a working area on the desk. This operation is NEVER carried out in the cantilever case.

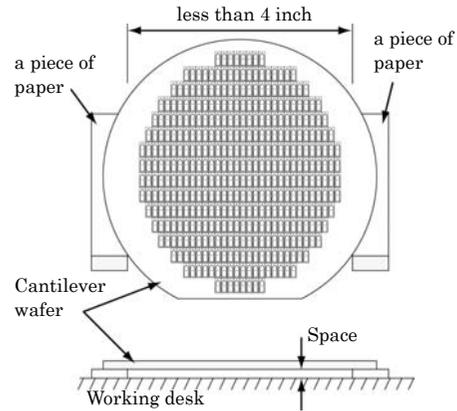
- Place two pieces of paper on the working desk, e.g. Post-it™ which is available in your office.
- Take out the cantilever wafer from the case with the flat-tip tweezers and place it on the working desk.



⚠ Caution

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

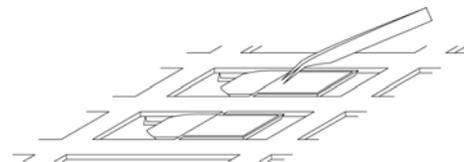
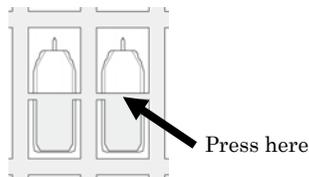
- As illustrated below, place the papers with a space to hold the cantilever wafer. Make sure that the space is narrower than the diameter of the cantilever wafer (4 inch or 10 cm).



Replace the cantilever wafer on the two pieces of paper so that space is left between the cantilever wafer and the working desk.

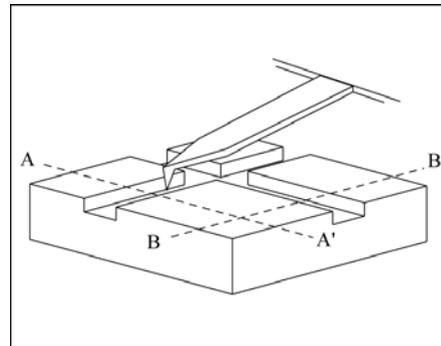
A paper-thickness as Post-it™ is good enough to leave a space between the wafer and the desk. Do NOT insert thick papers.

- Push gently the center of the chip (arrow in the illustration) with the sharp-pointed tweezers to snap the support arms
- Pick up the chip carefully by the long side with the tweezers and mount it on the cantilever holder of your AFM.



- Put away the cantilever wafer in the case for storage.

4 | Tip shape of Tetrahedral tip

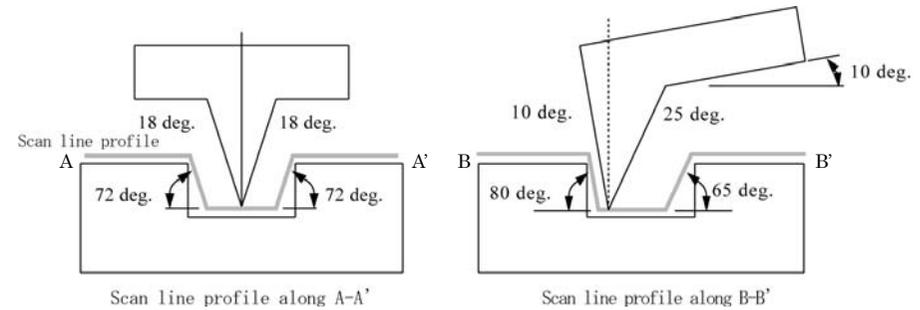


As can be seen in the left illustration, a tetrahedral tip is located at the exact end of the cantilever.

The finite tip shape will determine the scan line profile as in the illustrations below.

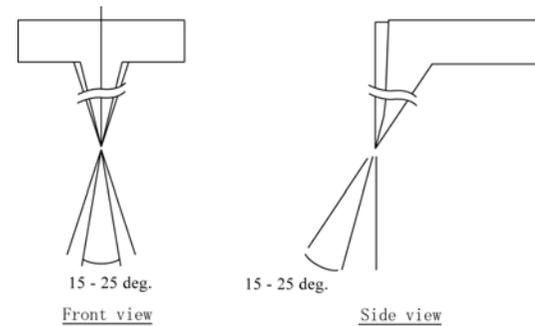
The tip profile is symmetric with a half tip angle of 18 degrees macroscopically (see left below).

The side tip profile is asymmetric with a tip angle of 35 degrees. Then the cantilever chip is attached to a chip holder in your AFM with an angle, about 10 degrees, the asymmetry is improved (see right below).



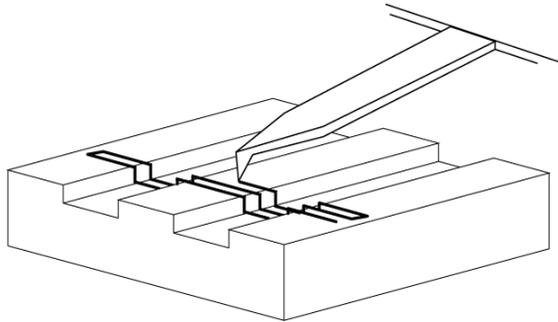
Tip shape and scan line profile

The apex of the tetrahedral tip becomes sharper due to an oxide sharpening process. The tip angle around a few hundreds nano meter down from the apex, is about 15 to 25 degrees (see below).



Sharpening effect around tip apex

When you set your samples to your instrument, please consider the unique shape of the tetrahedral tip, that is 'good symmetry', when viewing from its front side and choose the direction of the sample. When measuring long grooves, you can get an idea of what angle of the cut will be quickly by aligning the cantilever along the grooves and scanning across at right angles against grooves (see below).



Cantilever, sample and fast scan direction

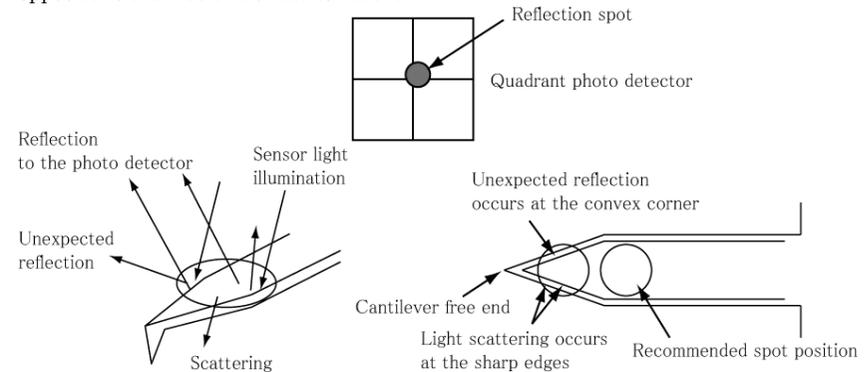
5 | Trouble-shooting Guide

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

Case: 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.



6 | Information

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

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 Microtechnology R&D Division
 2-3 Kuboyama-cho Hachioji-shi Tokyo 192-8512 Japan
 email : probe@olympus.co.jp

Please access to the web page of OLYMPUS micro cantilevers.

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