

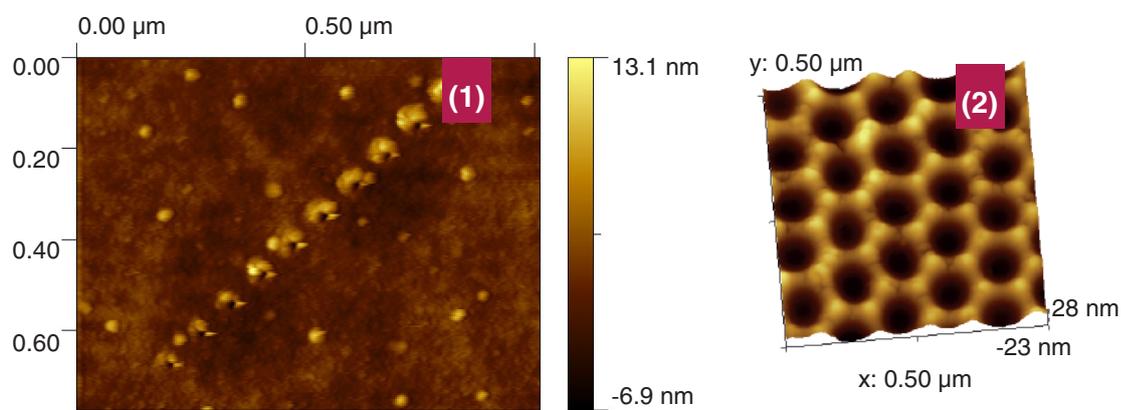
Long Life Diamond AFM Probe

Single Crystal diamond probes are remarkable for their long life in contact or dynamic AFM regimes. The tip is quite robust and forgives operation mistakes, for instance, it remains sharp when meeting an obstacle on surface the feedback loop cannot process quickly. The high resistance to wear is especially useful when the fast scanning speed is needed, or when the surface contains sharp and rigid edges.

Still SCD tip is sharp to provide high resolution imaging on DNA or lamellar structures easily.

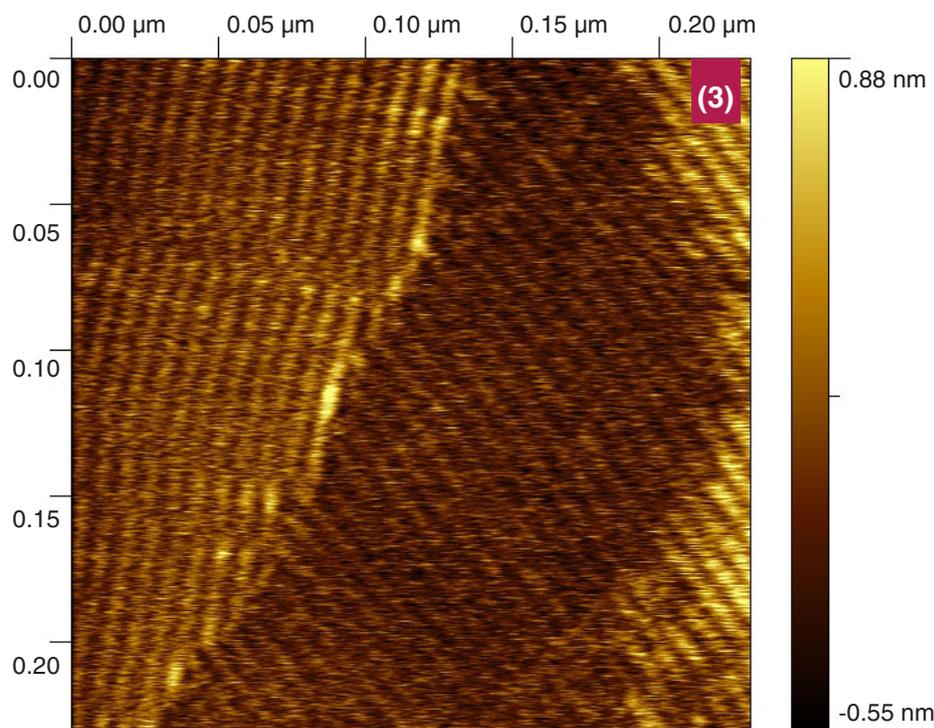
The hardness of diamond allows using the tips for nanoindentation on metals, silicon, glass, and hard coatings.

The series of images below was made using a single SCD tip. The order of the images **(1)** **(2)** **(3)** is the same as the order of experiments.



(1) Traces of indents made by SCD tip on Platinum film. The scan was made by the same tip that made the indents.

(2) Next image of porous Al surface made by the same tip.



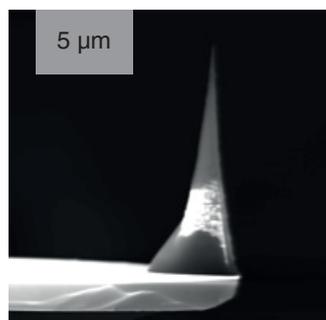
(3) Next image of the lamellar structure of Melissa acid made by the same SCD tip.

Images courtesy of Alexei Temiryazev, IRE RAS. AIST-NT SmartSPM.

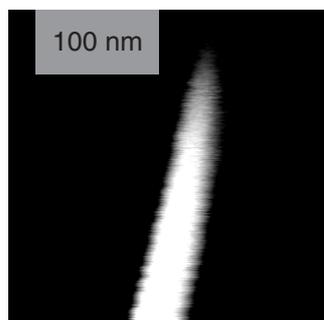
SCD Probe

ART™ tips are specially grown in CVD process and attached to silicon cantilevers for use in AFM. The probes have high aspect ratio and small tip radius.

The probe is highly resistant to wear, which is useful when fast scanning speed is needed, or when the surface contains sharp and rigid edges. Other applications are nanoindentation, scratching and nanolithography experiments.



SEM image of the SCD probe tip.



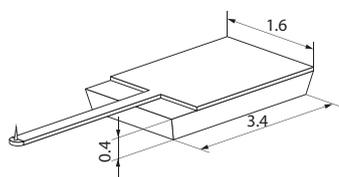
SEM image of the SCD tip end.

Tip material	Single Crystal Diamond (SCD)
Tip radius	5-10 nm
Tip aspect ratio*	about 5:1
Tip full cone angle*	about 10°
SCD orientation	<100> along the tip axis
Glue type	Non-conducting
Glue temperature stability	70°C (160°F)

*When measured at least on the last 200 nm of the tip end.

Cantilevers

ART™ diamond probes are glued onto rectangular (diving-board) silicon etched cantilevers. The range of spring constants and resonant frequencies of cantilevers available covers the Contact mode, Force Modulation, Non-Contact and Tapping mode. Cantilever backside is coated by Aluminium.



The chip holder size is 1.6 mm x 3.4 mm x 0.4 mm.

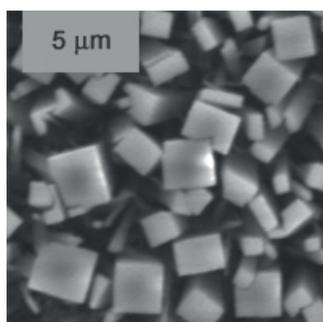
Part Number	Resonant Frequency, kHz	Spring Constant, N/m	AFM mode
D10	10	0.15	Contact mode
D80	80	3.5	Tapping mode. Force modulation. Contact mode.
D160	160	5	Tapping mode. Contact mode on hard surfaces.
D300	300	40	Tapping mode. Non-contact mode. Contact mode on hard surfaces. Nanoindentation. Force nanolithography.

Note: The glue used to attach the tip to the cantilever is not conducting, so the probe is not applicable for conductive AFM measurements. Values for resonant frequencies and spring constants are typical.

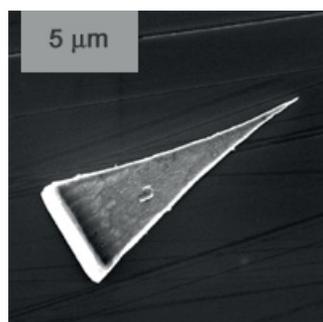
bAatch™ gRowth & aTtachment

ART™ stands for bAatch gRowth and aTtachment technology. ART™ probe for AFM consists of two parts that are manufactured separately: a cantilever on a chip-holder and a tip. The tips grow in batch in a specially designed process and then glued onto cantilevers using micromanipulation equipment and procedure.

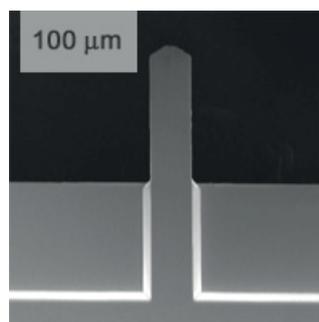
ART™ technique provides highly reproducible production at reasonable costs. Images below illustrate some of the key stages of the technology.



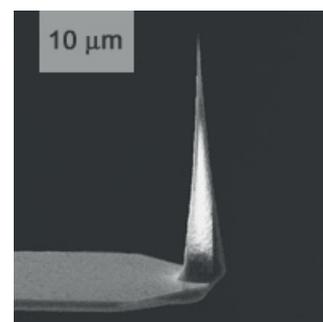
Film of diamond crystals.
SEM image.



Single crystal diamond tip of the needed size and shape separated from others.
SEM image.



Tipless silicon cantilever.
SEM image.



SCD tip mounted on silicon cantilever.
SEM image.

Diamond Tips

Diamond is a very promising material for making AFM tips because of its durability, hardness, outstanding chemical stability, high temperature conductivity and potential ability to conduct electric current. Besides application in AFM as a probes or indentors, the diamond tips can also be used as nanosized temperature sensors and X-ray detectors.

The tips are monocrystal diamond pyramids with the {001} facet in the basis having a controllable shape along the <001> axis.

Attachment

Attachment consists in positioning and gluing a the micro-sized object on a cantilever with high precision. This manipulation technique can be used to attach not only diamond tips and not only on silicon cantilevers. Our experience shows that other objects like carbon fibers or micro-sized particles can be handled the same way. For AFM, the objects can also be glued to silicon nitride cantilevers, piezo cantilevers or tuning forks.

Contact us if you have an idea how the diamond tips or micromanipulation technique can be used for your research.

Artech Carbon OÜ

Jõe 5, 10151 Tallinn, Estonia

phone: +372 630 77 00

fax: +372 630 77 99

email: info@scdprobes.com