Diamond Coated PointProbe® Plus

Silicon-SPM-Probes

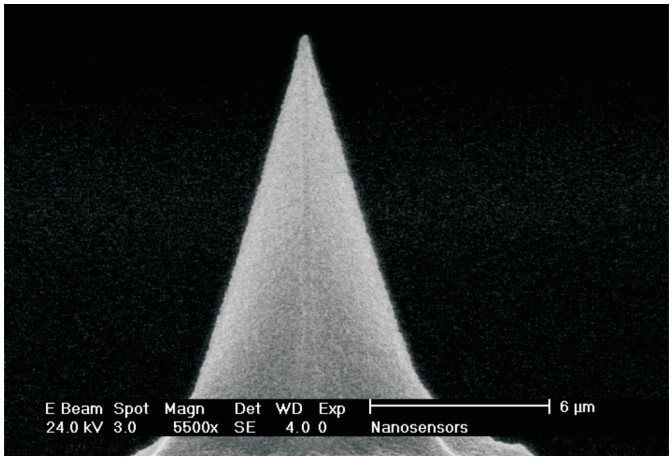
The Diamond Coated tips (DT) and Conductive Diamond Coated tips (CDT) realized by coating probes with real diamond were developed to meet the demands of a wide field of applications. All these probes are based on the well-known PointProbe® Plus silicon SPM probe.

Tip Features at a Glance

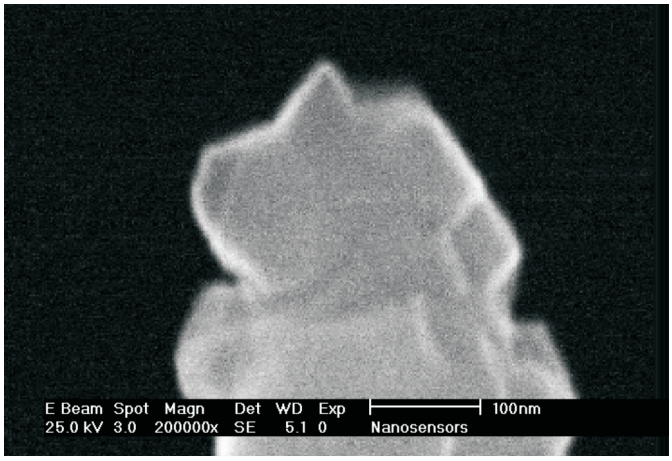
- Unsurpassed tip hardness due to real polycrystalline diamond coating on the tip-side of the cantilever
- Excellent electrical conductivity for all CDT types
- Microscopic tip radius in the 10 nm regime (macroscopic tip radius of ~100 nm)
- Thickness of the diamond layer around 100 nm
- General tip features like the PointProbe® Plus tip

Diamond Coated Tip

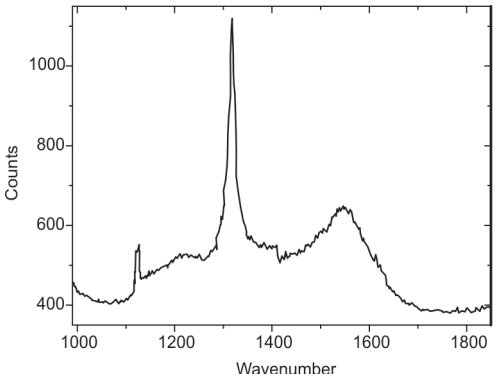
For Scanning Probe Microscopy tasks that require a hard contact between probe and sample we recommend our Diamond Coated probe (order code: DT).
Some applications which can be performed are friction measurements, wear measurements and the measurement of elastic properties. Even on hard materials the structuring on the nanoscale is possible because all probes benefit from the hardness of the hardest material in the world.



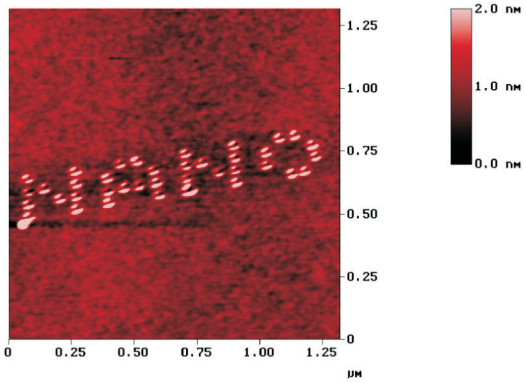
SEM image of a Diamond Coated PointProbe® Plus tip - Front view.



SEM image of the polycrystalline structure of the Diamond Coated tip.



Raman Spectrum of the Diamond Coating.



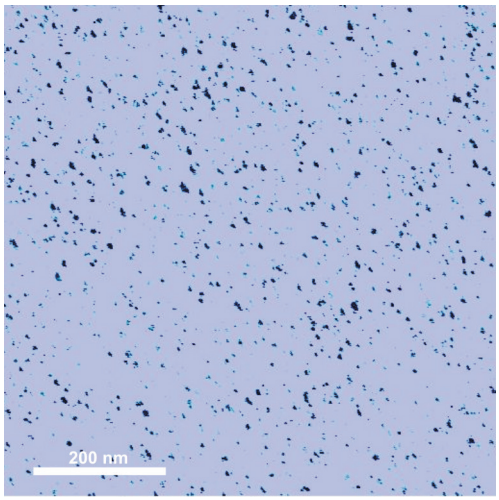
Application Example: Letters composing the word "NANO" made by indentation in Si <100> surface with a DT-NCHR probe. The AFM image was taken with the same probe after the indentation.

Conductive Diamond Coated Tip

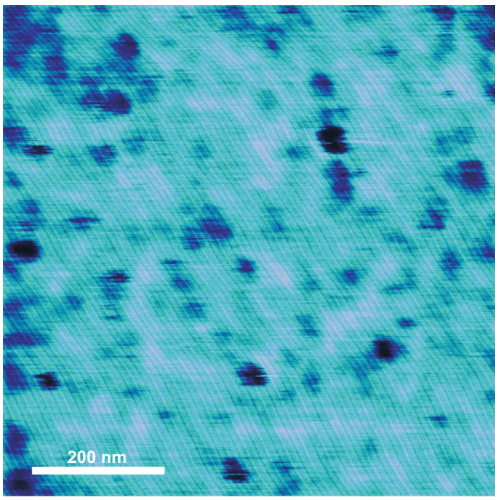
The NANOSENSORS™ Conductive Diamond Coated tip probe (order code: CDT) is designed for applications that require a high performance, mechanically stable and excellent electrically conductive tip. The diamond coating is highly doped (3 - 5 mΩcm). The total resistance measured in contact with a gold or platinum surface is less than 10 kΩ. The overall conductivity depends on the force acting between tip and sample. A minimum force of 6 μN is necessary to achieve a sufficient conductivity. Usually the microscopic tip radius is in the regime of 10 nm owing to sharp edges of single diamond crystals at the very end of the tip. This improves the lateral and height resolution when flat samples are analysed. The macroscopic tip radius of curvature is around 100 nm.

Some applications are for example the Tunneling AFM method (Conducting AFM, see below) and the Scanning Capacitance Microscopy (SCM). Of course, many more operation modes and applications are possible.

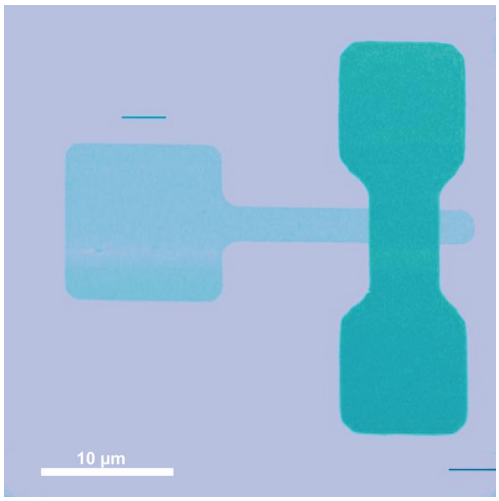
Application Example



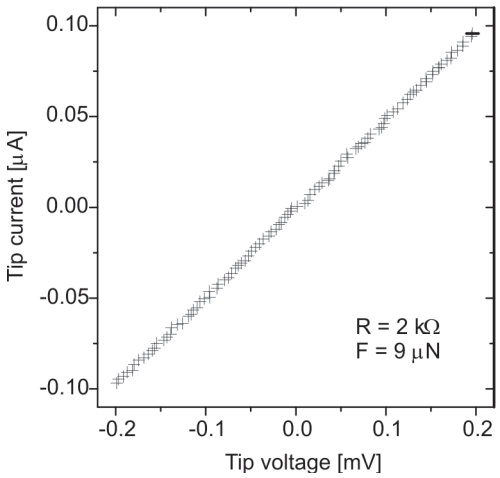
Tunneling AFM (TUNA) of a hafnium-silicate dielectric layer after an annealing step in oxygen. Small dark spots are weak spots (dielectric breakdown). Image data: TUNA-current 20 pA - data by courtesy of FHG-IISB, Erlangen.



Tunneling AFM (TUNA) of a hafnium-silicate dielectric layer after an annealing step in nitrogen. Large dark areas are weak spots (dielectric breakdown). Image data: TUNA-current 20 pA - data by courtesy of FHG-IISB, Erlangen.



Scanning Capacitance AFM image. High dose ion implantation (dark green), medium dose ion implantation (light green) on silicon substrate. Image data: dC/dV scale 0.8 V - data by courtesy of FHG-IISB, Erlangen.



I/V - characteristic of a CDT-NCHR probe in contact with a gold evaporated sample.

Available Probe Types

For the various possible applications of the probes with diamond coating we offer several types with different mechanical properties based on the PointProbe® Plus Silicon-SPM-Probe:

Force Modulation Mode Probe

The fairly soft cantilever of the DT-FMR and CDT-FMR probe is tailored for applications that require contact to the surface without destroying it. The force constant which lies in between the values for Contact and Non-Contact Mode allows Contact Mode measurements with medium forces as well as Non-Contact or Tapping Mode measurements.

Non-Contact / Tapping Mode Probe

For applications that require extremely high forces between tip and sample we recommend the DT-NCHR and CDT-NCHR types. A force constant of 48 N/m (basically up to 130 N/m) allows the indentation even into hard materials like silicon or silicon oxide.

Non-Contact / Tapping Mode Probe - Long Cantilever

The probe types DT-NCLR and CDT-NCLR could also be used for the applications mentioned above. This type is recommended if the feedback loop of the microscope does not accept high frequencies (400 kHz) or if the detection system needs a long cantilever (225 μm).

Contact Mode Probe

The probe types DT-CONTR and CDT-CONTR are designed for Contact Mode applications if low force constants of the cantilever are needed.

Reflex Coating

The detector side of the cantilever is covered by our standard aluminum reflex coating to improve the reflectivity.

Product List

	Type	Application	Force Constant [N/m] (nominal)	Res. Frequency [kHz] (nominal)	Coatings (tipside/backside)
Contact	DT-CONTR	Contact Mode	0.5	20	Diamond / Reflex
	CDT-CONTR	Contact Mode	0.5	20	Conductive Diamond / Reflex
Non-Contact	DT-NCHR	Non-Contact / Tapping Mode (high frequency)	80	400	Diamond / Reflex
	DT-NCLR	Non-Contact / Tapping Mode (long cantilever)	72	210	Diamond / Reflex
	CDT-NCHR	Non-Contact / Tapping Mode (high frequency)	80	400	Conductive Diamond / Reflex
	CDT-NCLR	Non-Contact / Tapping Mode (long cantilever)	72	210	Conductive Diamond / Reflex
Special	DT-FMR	Force Modulation Mode	6.2	105	Diamond / Reflex
	CDT-FMR	Force Modulation Mode	6.2	105	Conductive Diamond / Reflex

For more details please refer to the product datasheet on our website
www.nanosensors.com
info@nanosensors.com