USF Available Technologies

Technology Transfer Office

High Aspect Ratio Tip Atomic Force Microscopy Cantilevers and Method of Manufacture

Researchers at the University of South Florida have developed a method for the selective growth of single carbon nanotubes (CNT) on the tip apex of a conventional cantilever. Selective CNT growth is established by coating the backside of a cantilever, having a through-hole at a tip apex, with a catalyst material followed by a cover layer. The exposed catalyst at the bottom of the hole at the apex of the cantilever induces growth of a single CNT at this location.

Tip-derived artifacts remain one of the chief limitations of atomic force microscopy (AFM) when attempting to measure sub-nanometer structures. Atomic force microscopes (AFM) are widely used to image and characterize various surfaces and also by the integrated circuit industry as a metrology tool. However, the large cone angle of the tip (30–35 deg.) makes it difficult for probing narrow and deep features such as trenches in integrated circuit manufacturing and also the tip is brittle thus its use in applications is limited.

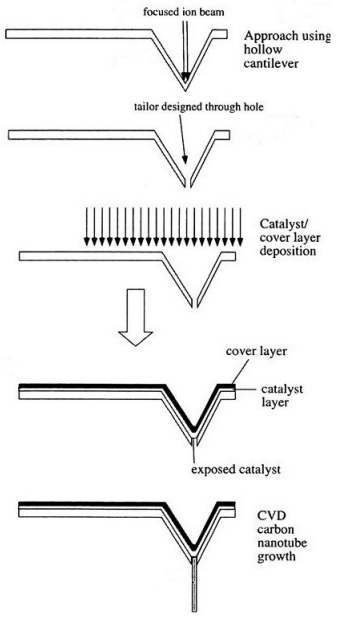
Carbon nanotube (CNT) probes have become an attractive alternative to AFM cantilevers. The CNT probe not only offers extraordinary nanometer scale resolution but is also robust, due to its high strength and the ability to retain structural integrity even after deformation within elastic limit. Carbon nanotube probes known in the art are provided either by manual attachment of a carbon nanotube to the tip of the AFM cantilever or by growing a carbon nanotube through a lithography and chemical vapor deposition process from the ends of the silicon tip of the AFM probe. The process of manually attaching carbon nanotubes to the tip of an AFM is time consuming and selects against the smallest nanotubes, limiting the quality of tips.

USF inventors have invented a method for the selective growth of single carbon nanotubes (CNT) on the tip apex of a conventional cantilever, which can be manually attached or grown through a lithography or a chemical vapor density process.

ADVANTAGES:

- **High aspect ratio**
- **High strength**
- **Extraordinary nanometer scale resolution**
- **Very much robust**

High Aspect Ratio, High Strength And Inexpensive CNT-AFM Cantilever



Schematic of CNT growth process from NSOM probe

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