A FRONT CARBON NANOTUBE PROBE POSSESSES THE ABILITY OF SPEEDY APPROACH FOR AMF IMAGE

Wei-Chih Lin, Gen-Wen Hsieh, Ching-Hsiang Tsai, Chao-Chiun Liang and Yuh-Wen Lee
Electronics Research Service Organization, Industrial Technology Research Institute, Taiwan
E-mail: WeiChihLin@itri.org.tw
Tel. +886-3-5913149, Fax. +886-3-5820266

This paper maily analyses two topics: one is the Front Carbon Nanotube Probe (FCNT Probe) manufactured technique which processes the ability of speedly approach for Atomic Force Microscoope (AFM) image; the other is its measured date and images successfully. Based on FCNT probe, it can provide reliable and speedy capabilities to approach the samples.

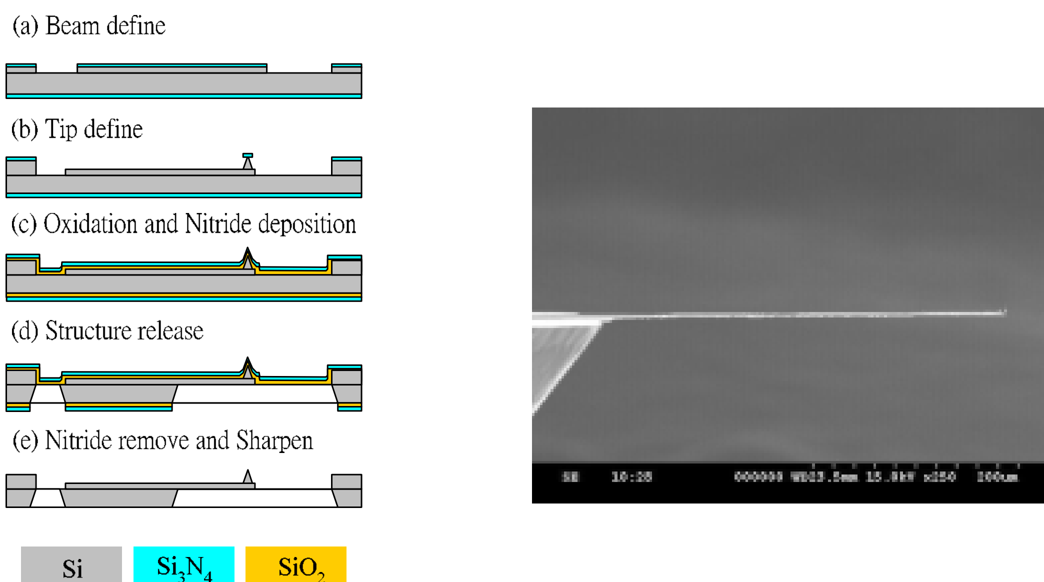
According to FCNT probe manufacture technology, it adopts Micro Electronic Mechanical system (MEMS) [1] (refer to Figure 1) and electrophoresis technology [2] [3] (refer to Figure 2) to let CNT attach to the front edge of cantilever beam and in the front of the tip (refer to Figure 3). In doing this, we can use the FCNT to approach the sample quickly and reduce the testing time because the function of the tip can be used as a reference way of setpoint. Compared with FCNT probe, using the way of CNT probe [4] would bring any bending or damage owing to the fact that the tube is on the tip of probe which cannot offer a good reference for approach.

However, when using the FCNT probe technique for AFM image, the tube would only case tiny bending and could easily reach the approach. Besides, this paper also provides a variety of measured date, including the resolution of topography and measured parameters, to approve that using the FCNT probe could be adpoted on the AFM image (refer to Figure 4) [5] [6].

References:

[1] T. R. Albrecht etc., J. Vac. Sci Technol. A., 8, 1990, 3386
[2] H. Nishijima etc., Appl. Phys. Lett. 74, 1999, 4061~4063
[3] R.M.D. Stevens etc., Nanotechnology, Vol. 11, 2000, pp. 1~5
[4] H. Dai etc., Nature, Vol. 384, 1996, pp. 147~151
[5] Lian Zhang etc., Micro Electro Mechanical Systems 2004, The Seventeenth IEEE International Conference, 2004, pp. 438~441
[6] T. Larsen etc., Appl. Phys. Lett. 80, 2002, 1996~1998

Figures:



Figures 1. The manufactured processes of AFM probe and SEM photography.

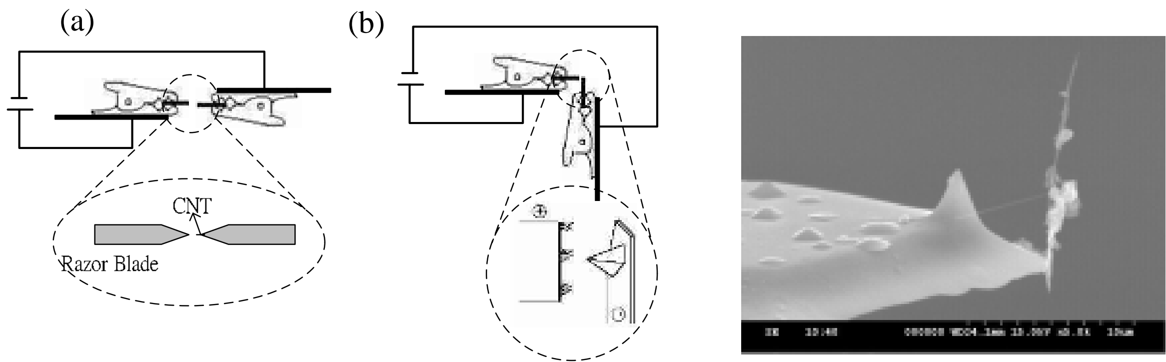


Figure 2. The schematic of attachment apparatus and SEM picture: (a) The CNTs is attached on a conductive razor blade by using the electrophoresis that creates a 40 AC voltage and remains 1 minute. (b) Using the Arc discharge of 10 DC voltage translates from the razor blade with nanotubes into the AFM probe. (C) The SEM picture of FCNT probe

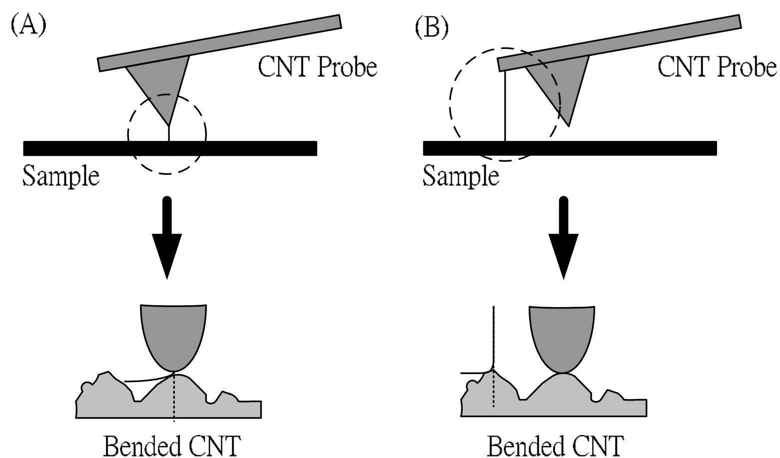


Figure 3. The illustration of instant approach between CNT probe and FCNT probe: (A) An unsuitable setpoint causes the CNT on tip bending or damage substantially. (B) The tip of FCNT probe could be referred to setpoint to avoid the front edge of CNT considerable bending.

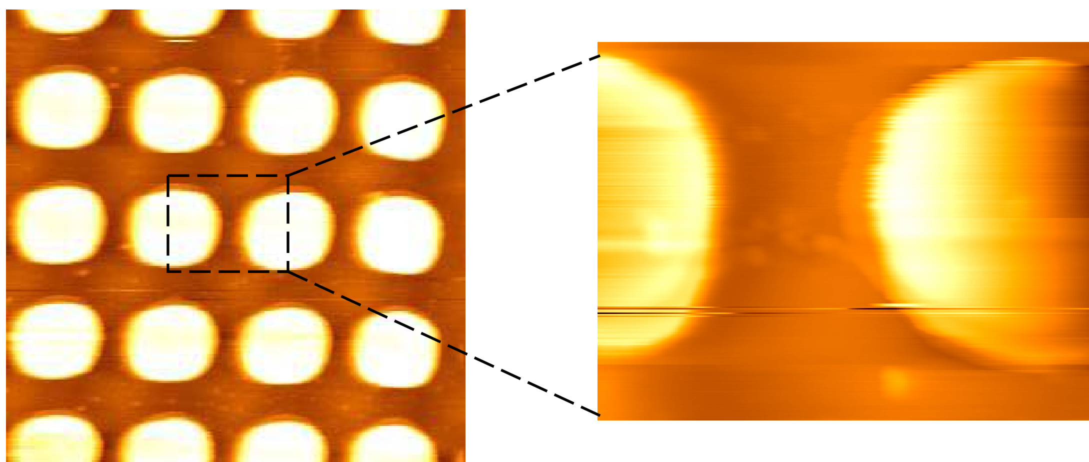


Figure 4. The image of the FCNT probe:
Measured parameter: scan size 8μm×8μm and 2μm×2μm, setpoint 0.1nN.