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## A Carbon Nanotube Sample for the Fabrication of Nanotweezer

Choi Jai Seong, Lee Junsok, Kang Gyung Soo, Kwak Yoon Keun, Kim Soo Hyun

**Key Words :** Carbon nanotube( ), dielectrophoresis( ), nanotweezer( )

### Abstract

This paper introduces our basic research about a carbon nanotube(CNT) sample for the fabrication of nanotweezer. We have made the nanotweezer through the physical adhesion of multi-walled carbon nanotubes(MWCNTs) on two sharp tungsten tips. Thereby we needed the CNT sample which is proper to this fabrication process. And we applied the dielectrophoretic methods to the fabrication of the CNT sample. During the basic experiment, we used a sharp edged electrode and a flat electrode as electrodes for dielectrophoresis and just a function generator as a voltage source for the generation of electric field.

(atomic force microscope) dielectrophoresis( DEP)[1]

100 nm

$\phi$  :  
wt% :

1.

$\mu\text{m}$  nm

1.1

(nanotechnology) 90

(microgripper)

(SPM, scanning probe microscope) (imaging)

$\mu\text{m}$  nm

(manipulation)

(nanomanipulation)

Philip Kim

CNT

[2] Seiji Akita SPM

[3] J.S.Lee

CNT

[4] CNT

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E-mail : [sant@kaist.ac.kr](mailto:sant@kaist.ac.kr)

TEL : (042)869-3252 FAX : (042)869-5201

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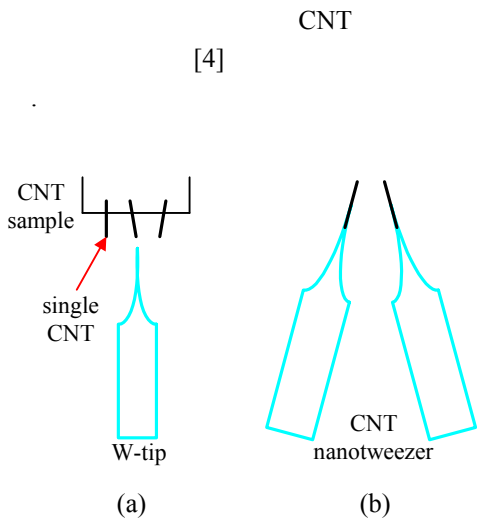
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1.2 CNT ( ) [4]  
 CNT (suspension)  
 CNT AC  
 DEP

1.3 CNT  
 Y. Nakayama DC [5]  
 (knife edge) RF AC  
 가 CNT  
 [3] Otto Zhou  
 CNT (CNF, carbon nanofiber)  
 [6]  
 CNT [7]

2. CNT

2.1



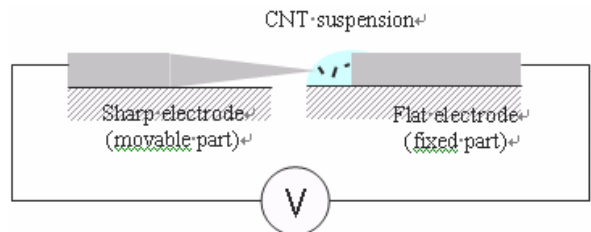
**Fig. 1** Fabrication process of the CNT nanotweezer; (a) fabrication of single CNT tip, (b) CNT nanotweezer assembly made by two CNT tips

가 nm (carbon tape)  
 CNT  
 CNT (fixation)  
 CNT (Fig. 1)  
 CNT  
 CNT  
 2.2 CNT AC DEP  
 CNT [7]  
 ( ) RF ( )  
 CNT AC , AC DEP  
 (flat)  
 AC DEP

2.2.1 CNT

$\mu\text{m}$  가  
 AC 가  
 CNT (Fig. 2)

2.2.2 CNT



**Fig. 2** Schematics of the CNT sample fabrication

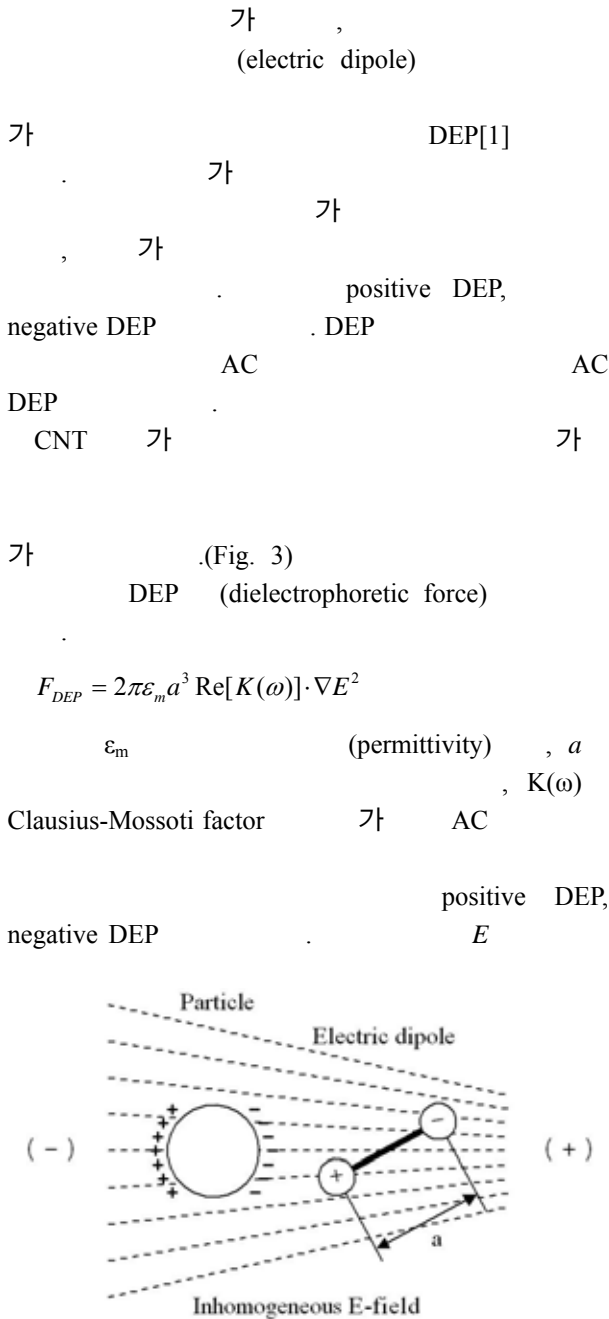


Fig. 3 Principle of DEP

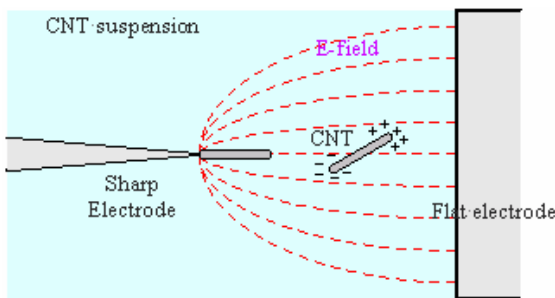


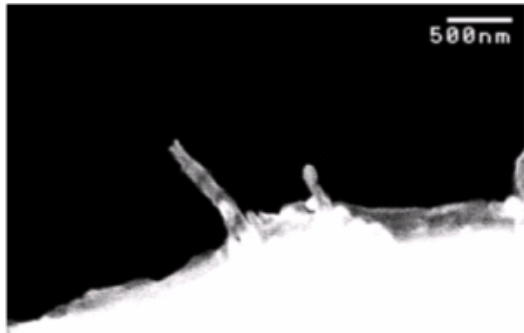
Fig. 4 Electric field distribution and the movement of CNTs in CNT suspension.

AC 가 ( 10 MHz, 20 Vpp ) 가 AC DIW MWCNT Fig. 4

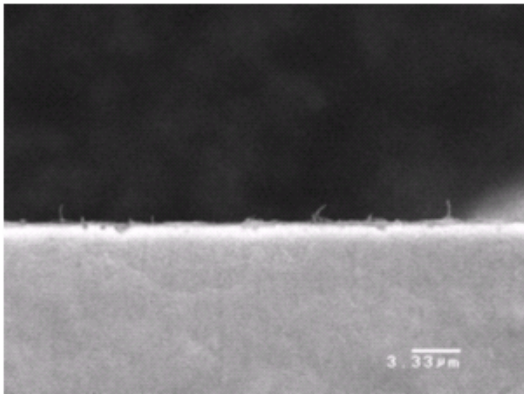
2.3 CNT 20 MHz 가 DIW MWCNT Clausius-Mossoti factor가 가 positive DEP가 CNT  $F_{DEP}$  CNT 가 CNT

2.3.1 (set-up) 100 nm  $\mu\text{m}$  CNT( , MWCNTs grown on  $\text{Al}_2\text{O}_3$  substrate by CVD) (Agilent社, model no. 33220A) . 2 wt% CNT CNT 가 DIW(deionized water) , (ultrasonication) 400  $\mu\text{m}$  (Topcon社, model no. SM-300)

2.3.2 CNT CNT CNT CNT 가  $F_{DEP}$  [3, 5-7] CNT CNT



(a)



(b)

**Fig. 5** SEM images for experimental results; (a) 5 Vpp at 10 MHz, (b) 10 Vpp at 10 MHz

가 , 가 .

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