

(technical textile)

(1)

1.

가

가

가 가 가 가 가

가 가 .

가

,

.

2. 가

2.1

2.1.1 가

(nm)

 (μm)

가 . , 1 100nm

가 . , 2000 2 가 . . 2.1.2 , , . . , (,) . ‘ ’ PET 가 가 ‘ ’ E 가 . 가 1 100nm 가 , .

2.2 (carbon nanotube : CNT)

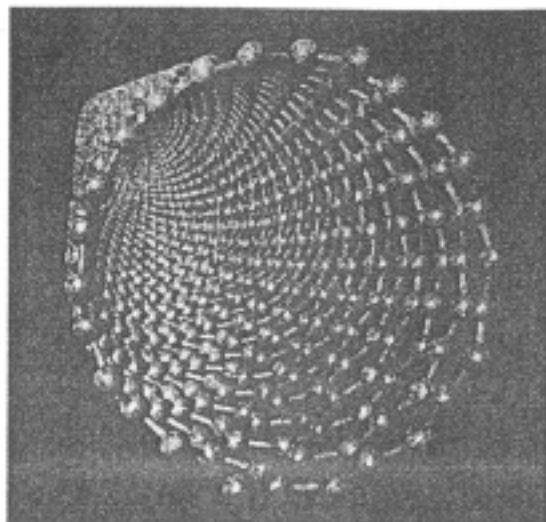
2.2.1

CNT 1991 飯島
(氣相成長法)

飯島

CNT

, 가 가
,



< 1> CNT

2.2.2

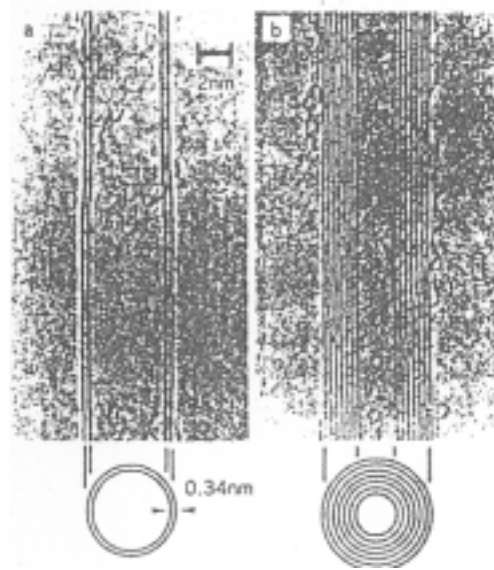
nm , μm 가 가 < 1>

< 2>. , CNT가

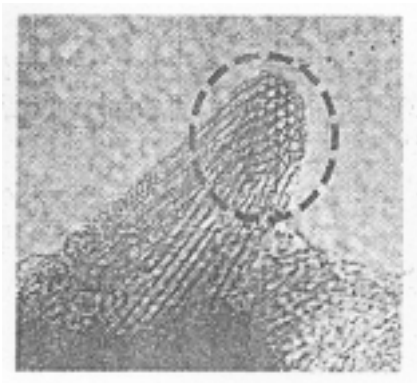
< 3 a>

< 3 b>

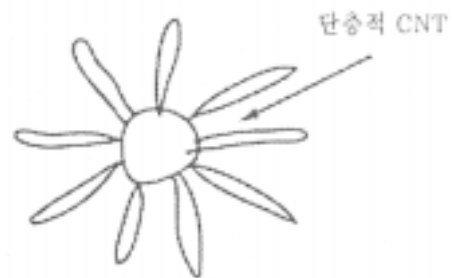
.



< 2> CNT CNT()



(a): CNT



b): CNT CNT

< 3>

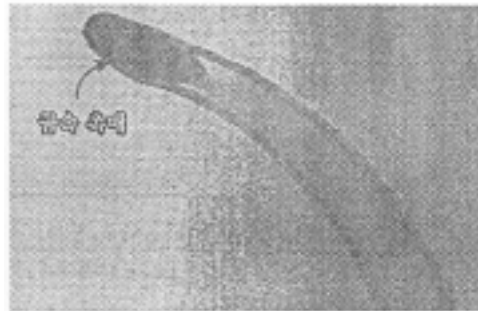
2.2.3

(Fe, Ni, Co)

CNT , ,

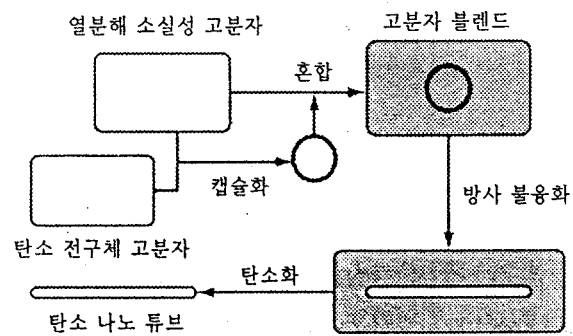
CVD . , ()
) 가 , 가

4> CNT () 가 <



< 4> CNT

, 大谷 / CNT
 . < 5>



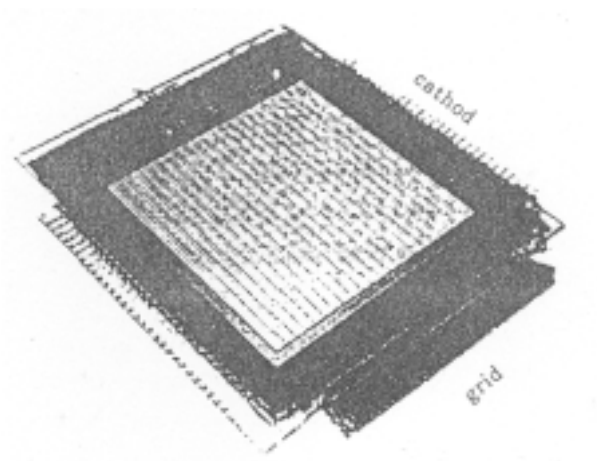
< 5> / CNT

2.2.4

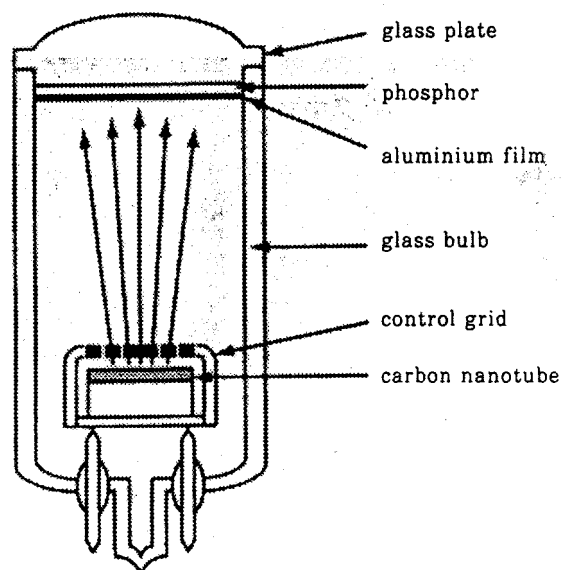
CNT (Young's modulus) 4 TPa (0.4 TPa)
 1,000

2.2.5

a : , b : < 6>, c :
 , d : < 7>, e : , f :
 , g : , h : .



< 6> CNT :



< 7> CNT :

NEC, . ,

CNT . CNI CVD 1 200g

(pilot-plant) 住友商社

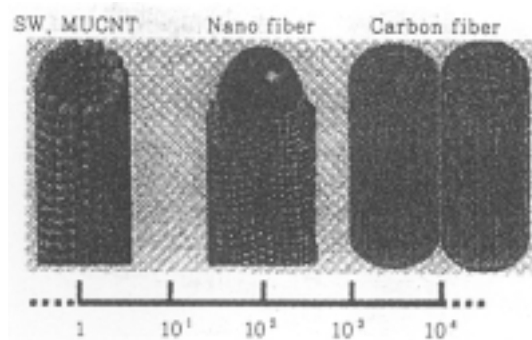
CNT . 가 1g 500 \$.

昭和電工 ()

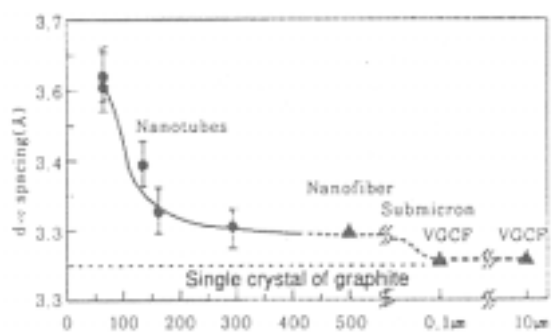
. 三井物産

, 日機装 .

가 .



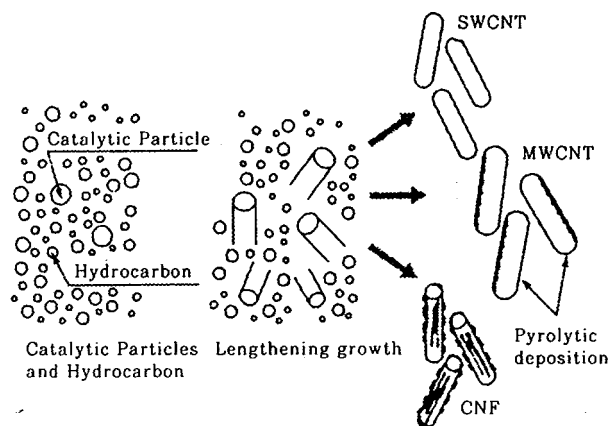
(a) CNT, CNF,



(b)

2.3.1 (carbon nano fiber : CNF)

CNF 15 100nm < 8 a, b>.
 < 9>
 , 가 , HC 가 ,
 CNT, CNT, CNF .
 CNF CNT 가
 . CNF 가 ()
) . 昭和電工 150nm CNF
 40t .



< 9> ,

2.3.2 (electro spinning : ESP)

(1) ESP

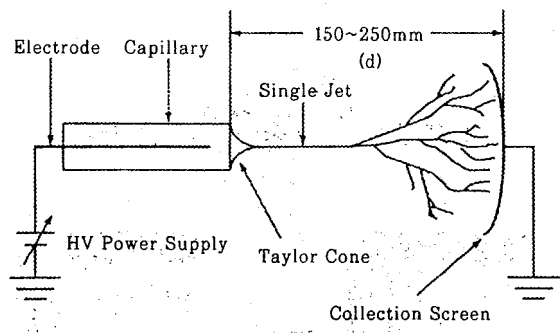
ESP 1930 . 1970 가
 . 가
 가 , 2002 ‘The
 Fiber Society’ 9 가 , 2003 10

·
·
, ESP (electrospray)
, 田中耕一 2002
가 ·

(2) ESP

· , ·
·
가 · < 10>
, < 11> ·
,
·

Ding PVA



< 10> ESP

2.3.3

東大 相田

30

(擔持)

10

가

<

12>

30nm

PE

.

95%

가

.

,

,

(dope chemical)

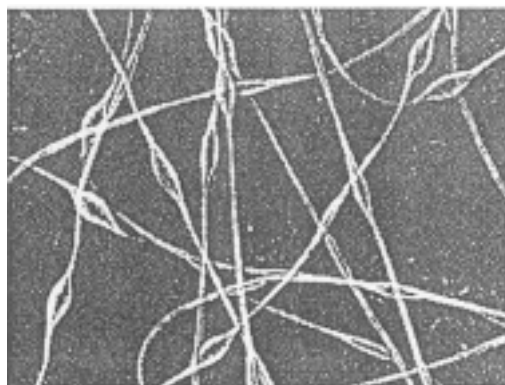
<

13>

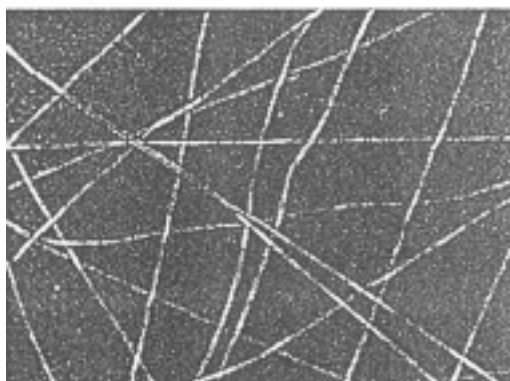
/

.

.



1.23 Coulomb/liter

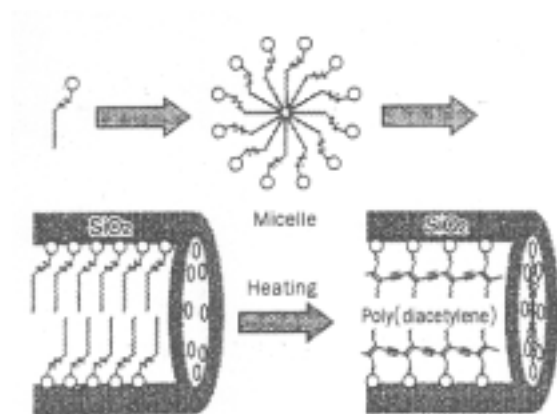


28.8 Coulomb/liter

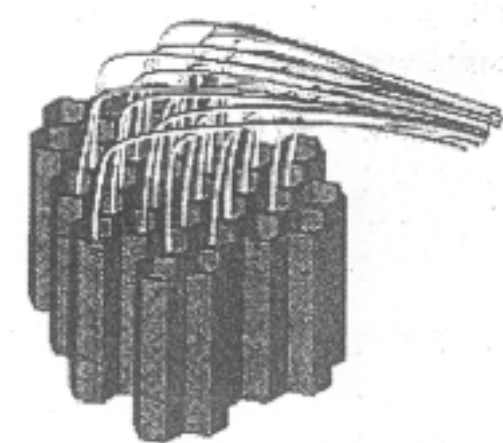
<

11> ESP

PEO



< 12> PE



< 13>

2.3.4

가

(會合)

信州大 英

< 14>

2.3.5

, 가

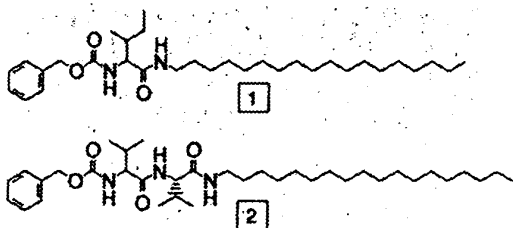
(海)

1970

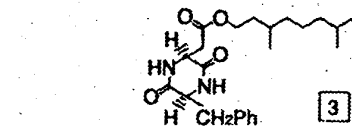
140

40d

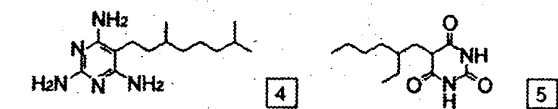
아미노산 유도체



환상 디펩티드 화합물

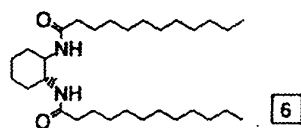


2성분형 겔화제

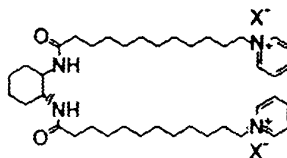


< 14 >

사이클로헥산디아민 유도체



피리디움기 도입 사이클로헥산 유도체



7 : $X^- = PF_6^-$, (1R, 2R)

8a : $X^- = ClO_4^-$, (1R, 2R)

8b : $X^- = ClO_4^-$, (1S, 2S)

2.4

< 15 >

가

가

가

가

가

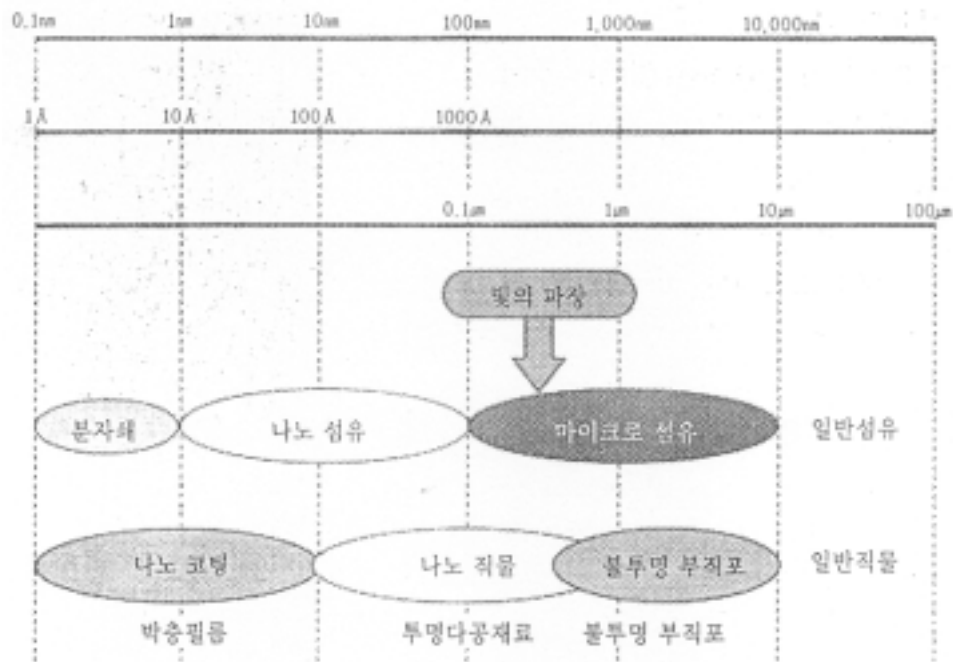
가

가

가 가

가 . 3가

가



< 15>

2.4.1 CNT 가

CNT

가

CNT 가

가 . CNT가

.

2.4.2 가

CNF CNT 가

.

4 가 .

가

가 , 가

가 , , .

, . , , , 가

가 .

ESP 가 .

가 . ,

3가 .

, , ,

, CNT

2.4.3 가

, PP .

CNT

.

(1) CNT

CNT 2.5%

2

1

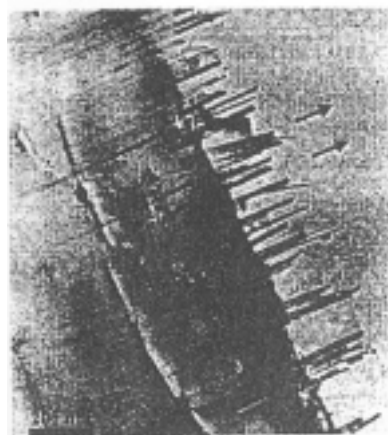
가 가 , CNT
가 .

(2) CNT

CNT 가 , CNT

가 . < 16> . ,

.



< 16> CNT - ()

(3) CNT

CNT ,

CNT 가 .

, . <

17> PVA 15μm CNT . ESP CNT

. (美, Drexel大 F.Ko)



< 17> CNT PVA

(4) -

CNF

가

,

2.3.1

C-C

. ♣