

(b)

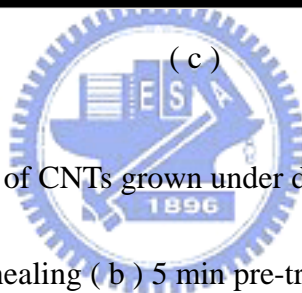
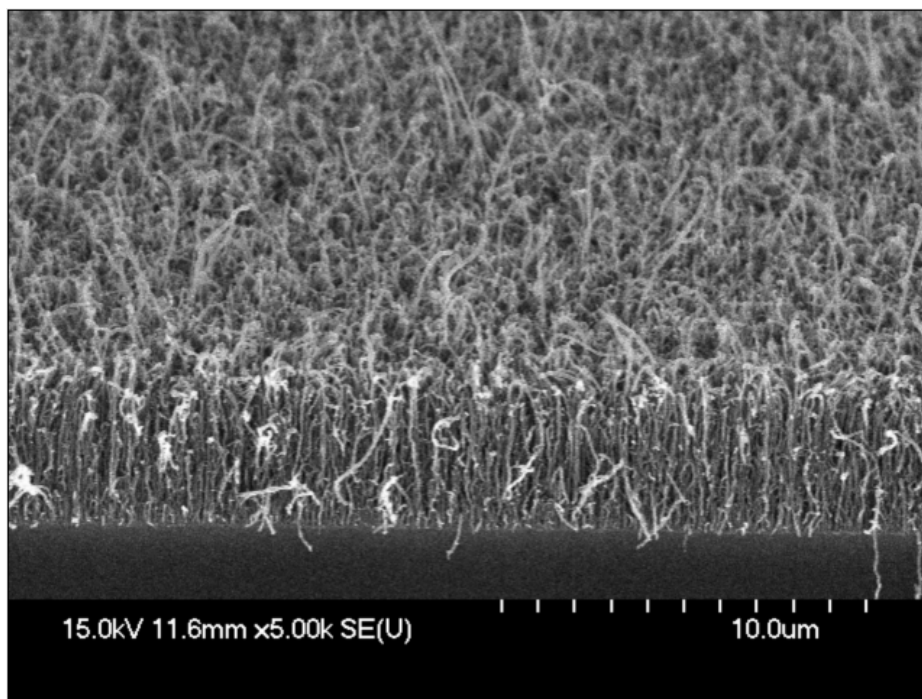
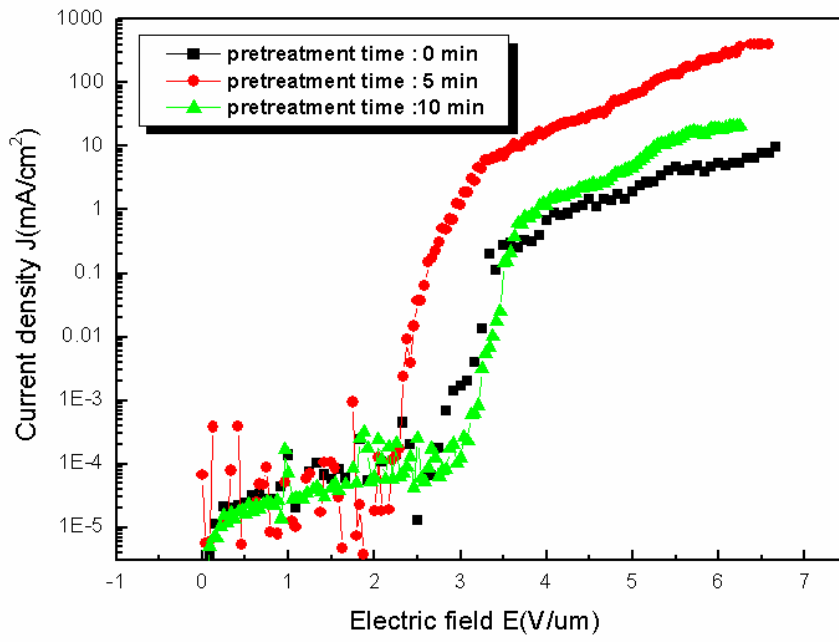


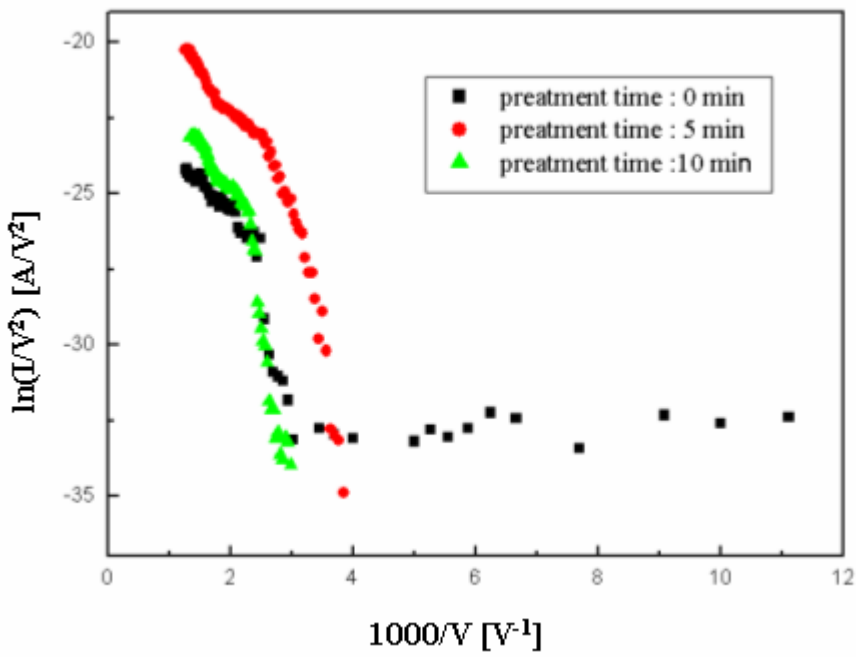
Figure4-3 SEM images of CNTs grown under different pre-treatment times

( a ) only annealing ( b ) 5 min pre-treatment

( c ) 10 min pre-treatment

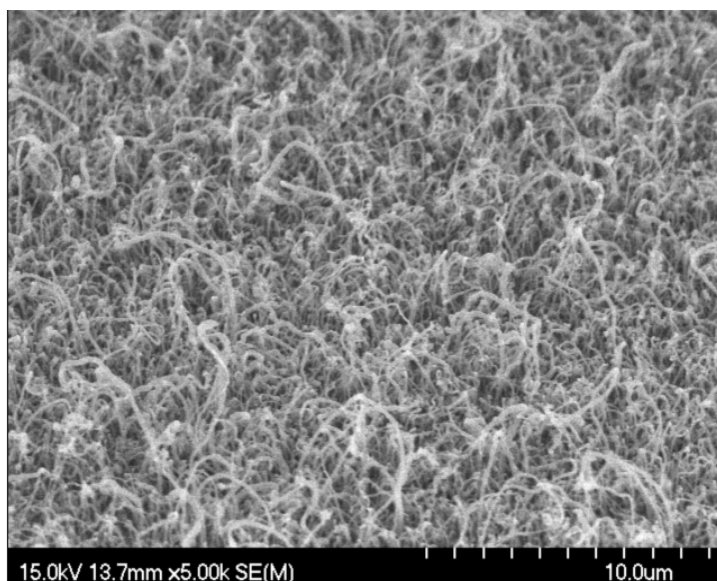


( a )



( b )

Figure4-4 Field emission characteristics of CNTs grown under different pre-treatment time. (a) Field-emission current density vs applied electric field. (b) Corresponding F-N plot

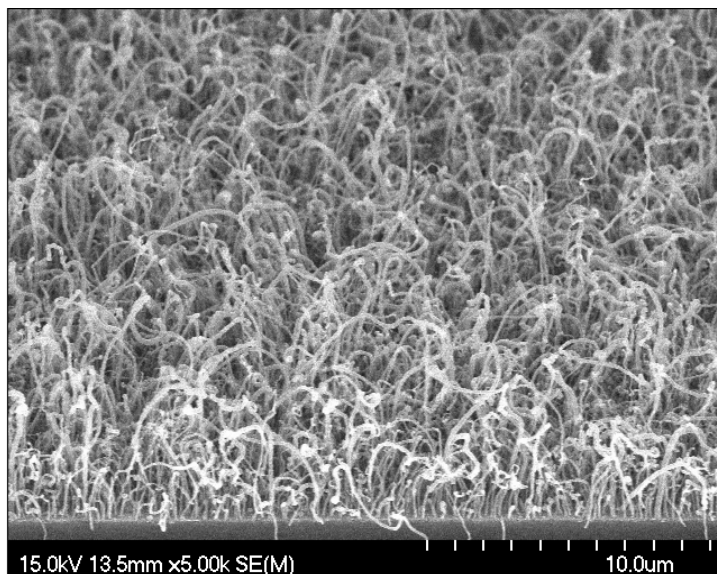


( a )

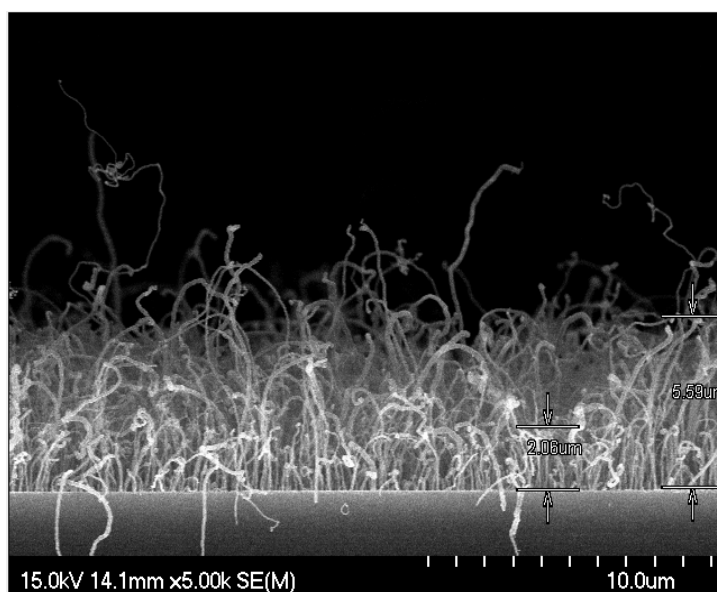


( b )

Figure 4-5 SEM images of CNTs grown under 10% hydrogen content during pre-treatment( H<sub>2</sub>/N<sub>2</sub>: 100sccm/900sccm). (a) 60° top view and (b) the cross-sectional view.



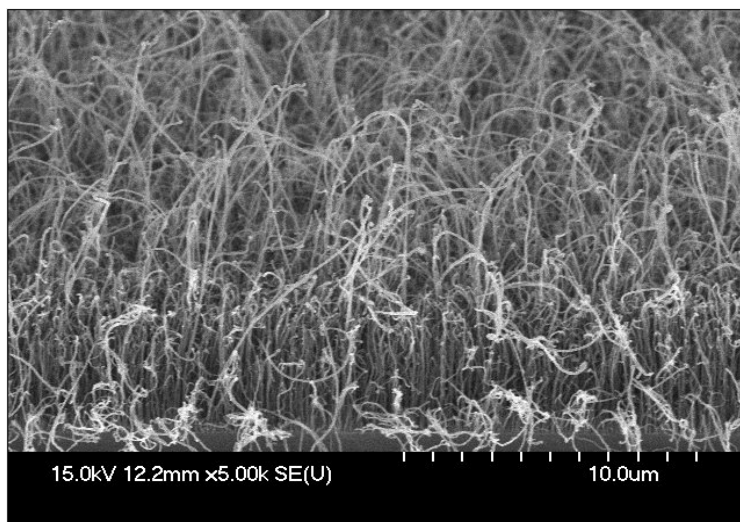
( a )



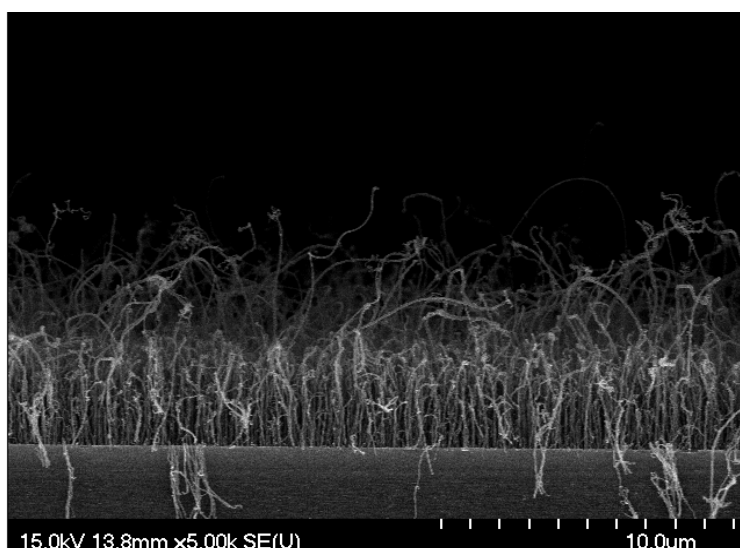
( b )

Figure 4-6 SEM images of CNTs grown under 30% hydrogen content during pre-treatment( H<sub>2</sub>/N<sub>2</sub>: 300sccm/700sccm). (a) 60° top view and (b) the cross-sectional view.



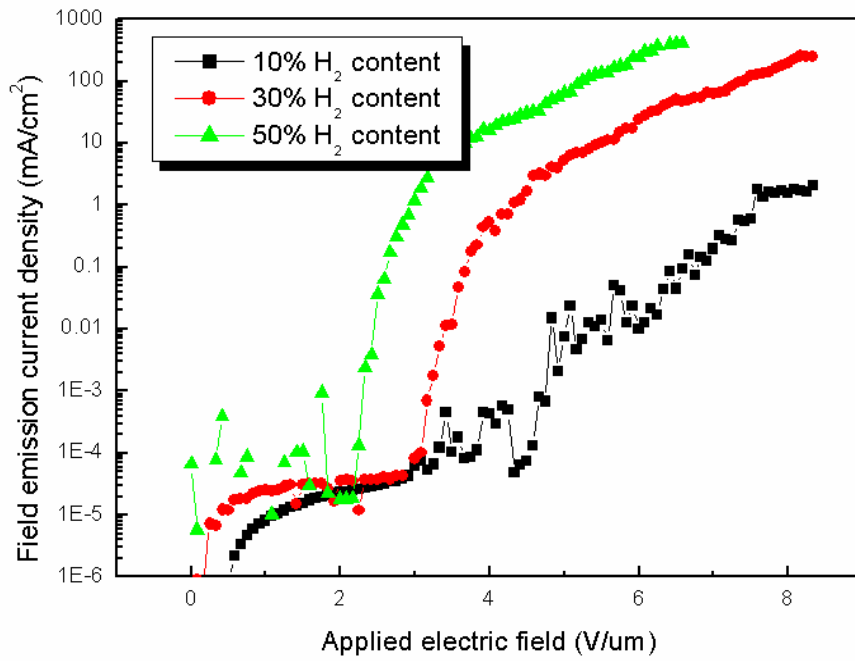


( a )

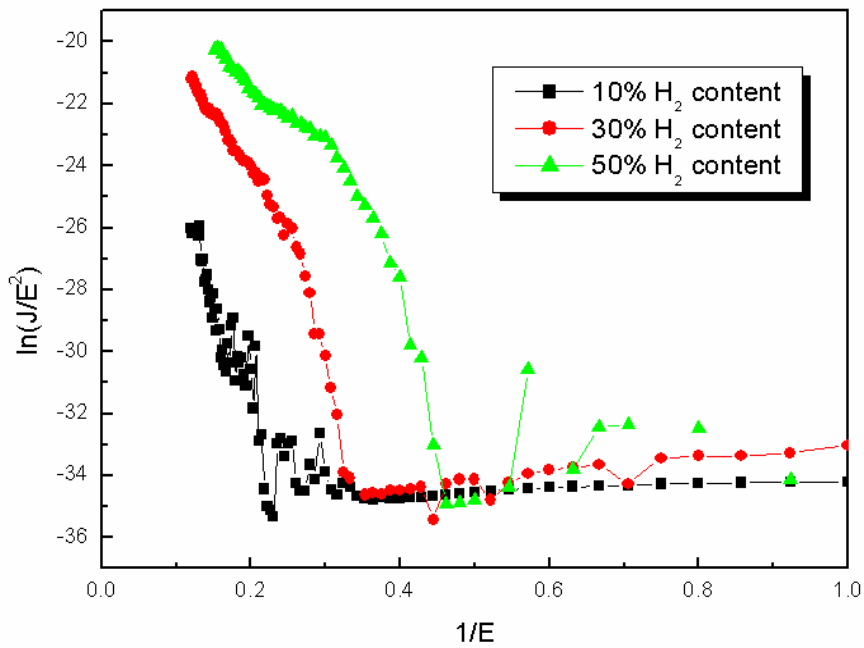


( b )

Figure 4-7 SEM images of CNTs grown under 50% hydrogen content during pre-treatment(  $H_2/N_2$ : 500sccm/500sccm). (a)  $60^\circ$  top view and (b) the cross-sectional view.



( a )



( b )

Figure4-8 Field emission characteristics of CNTs grown under different hydrogen content (a) Field-emission current density vs applied electric field. (b)

Corresponding F-N plot