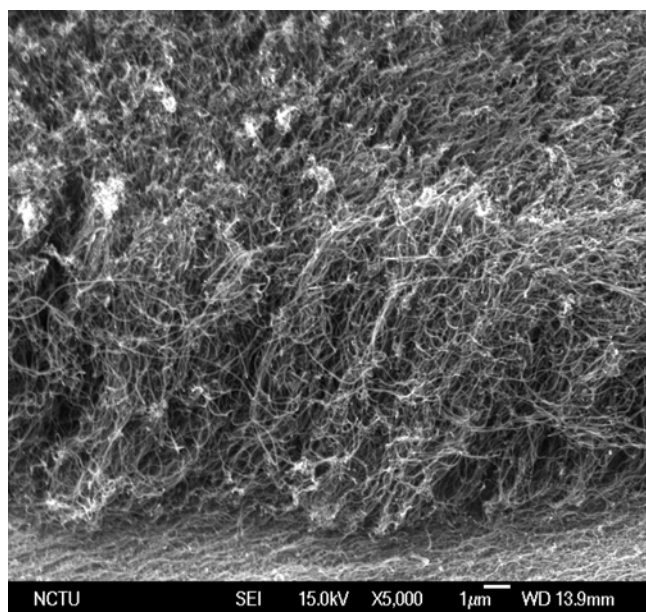
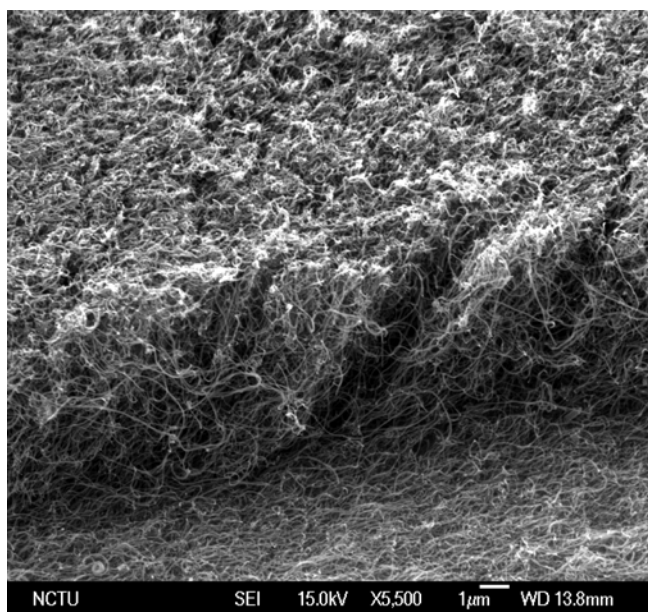


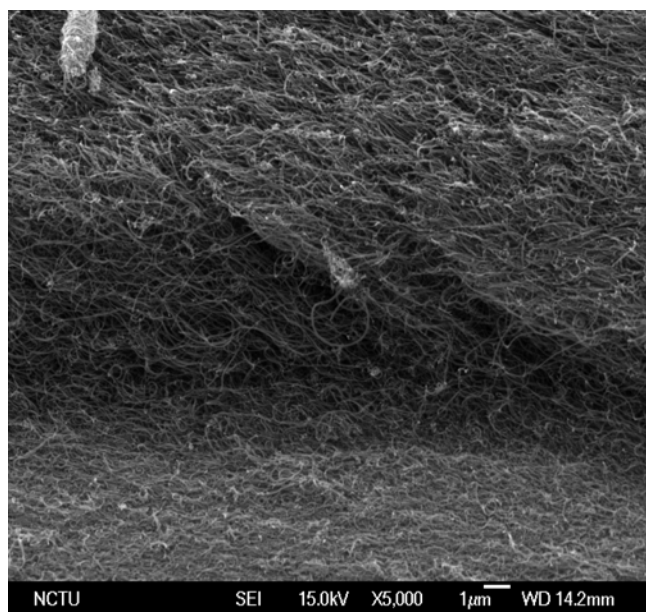
(a)



(b)



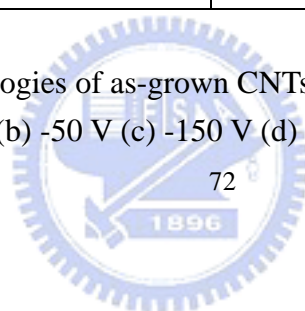
(c)

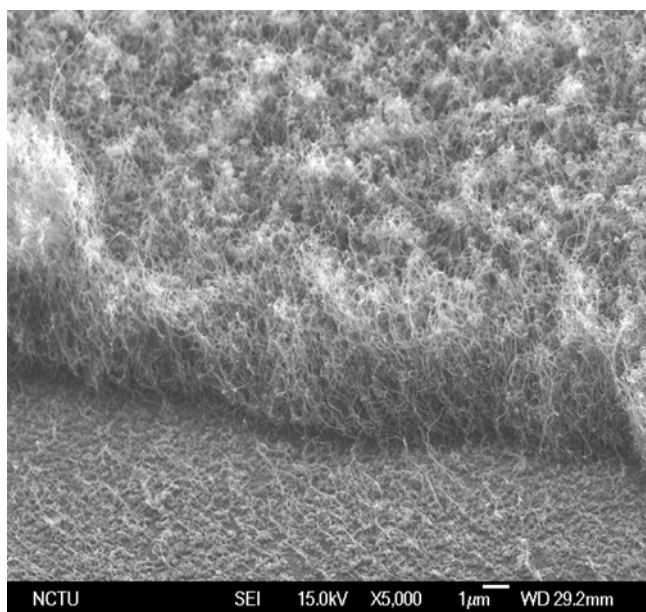


(d)

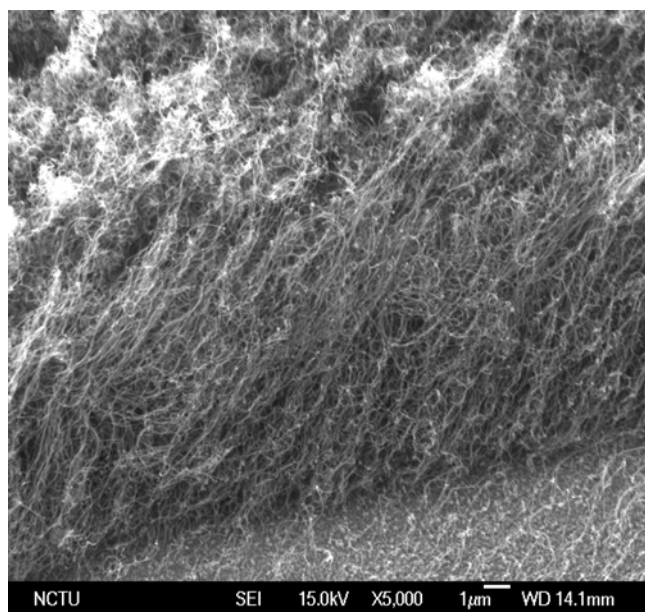
(a) Specimen A5 0V	(b) Specimen A7 -50V
(c) Specimen A8 -150V	(d) Specimen A9 -250V

Figs.4-7 Morphologies of as-grown CNTs under different applied bias
(a) 0 V (b) -50 V (c) -150 V (d) -250 V

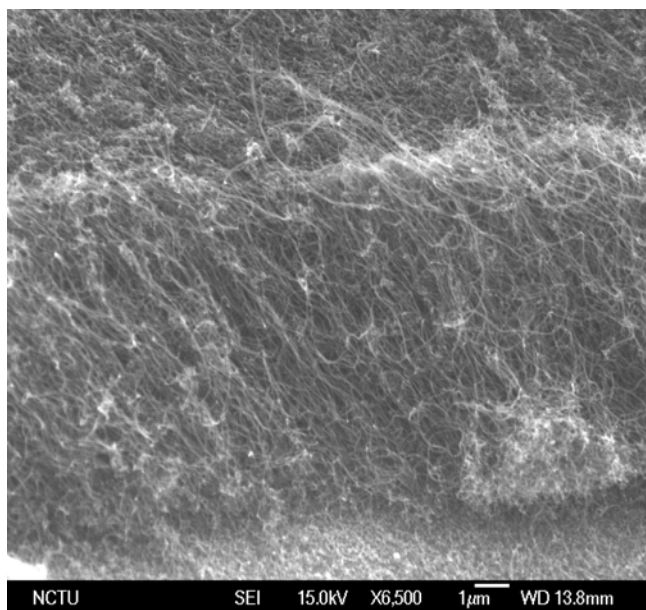




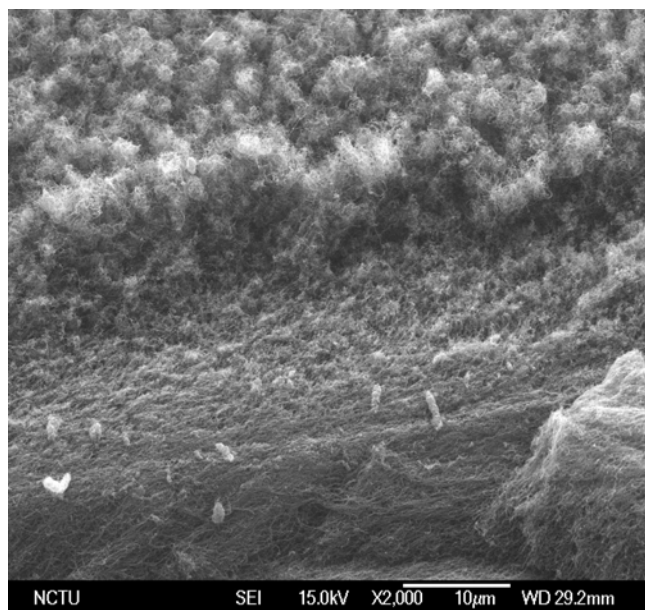
(a)



(b)



(c)



(d)

(a) Specimen A4 5 min	(b) Specimen A5 10 min
(c) Specimen A6 15 min	(d) Specimen A6 15 min

Figs. 4-8 Morphologies of as-grown CNTs under different grown time
(a) 5 min (b) 10 min (c) 15 min (d) 15 min

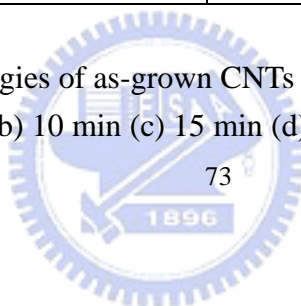
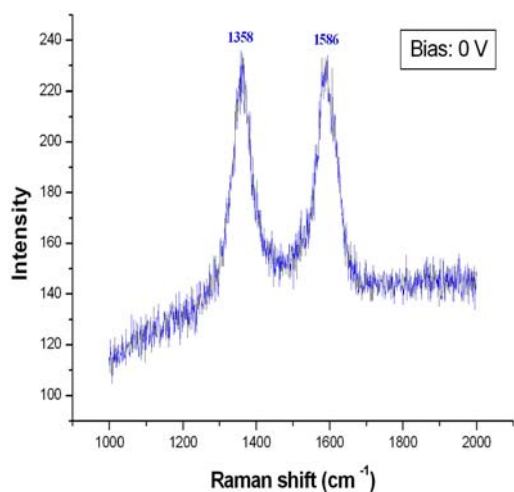
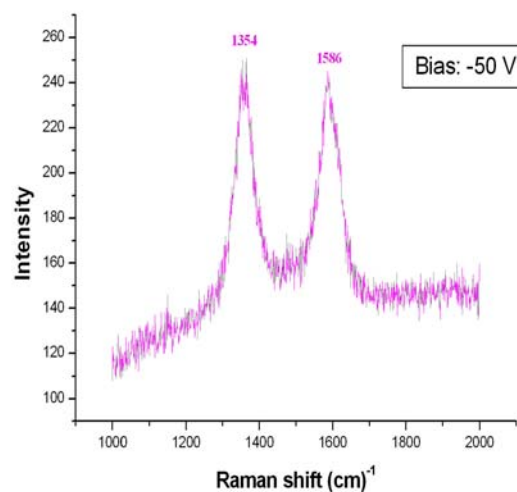


Table.4-1 I_G/I_D ratios of as-growth CNTs under different applied bias

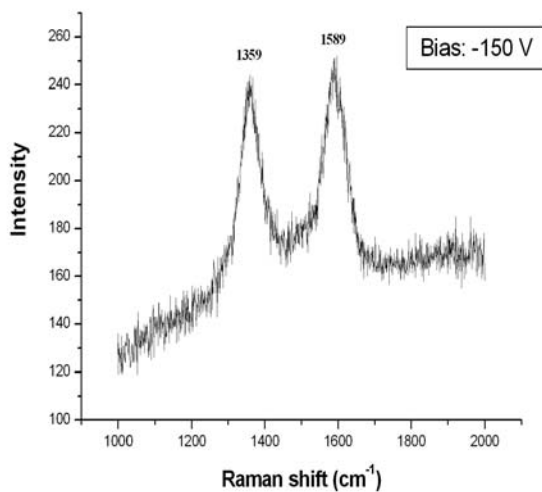
Remarks	Specimen	Applied bias	I_G/I_D ratio
a	A5	0 V	0.98
b	A7	-50 V	0.98
c	A8	-150V	1.02
d	A9	-250 V	1.02



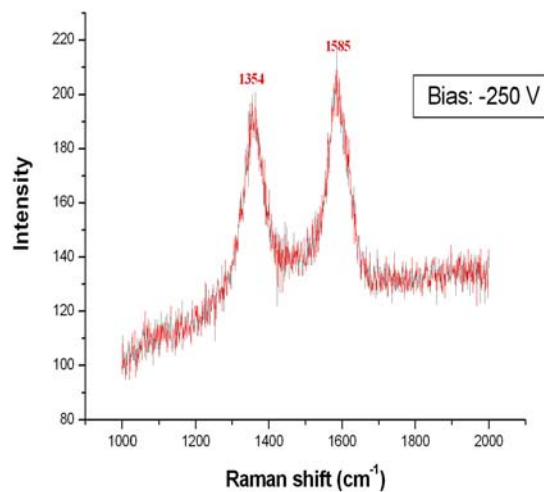
(a)



(b)



(b)



(d)

Figs.4-9 Raman spectra of as-growth CNTs under different applied bias

(a) 0 V (b) -50 V (c) -150 V (d) -250 V

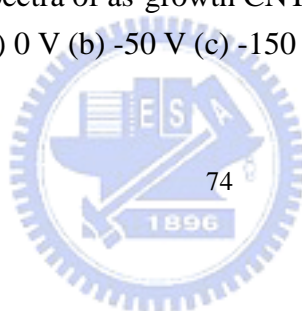


Table 4-2 FE properties of different negative bias applied on CNTs growth

Specimens	Applied bias (V)	$E_{\text{turn-on}}$ at $10\mu\text{A}/\text{cm}^2$ ($\text{V}/\mu\text{m}$)	$E_{\text{threshold}}$ at $10\text{mA}/\text{cm}^2$ ($\text{V}/\mu\text{m}$)	Current density at $10\text{V}/\mu\text{m}$ (mA/cm^2)
A5	0	4.4	8.26	88.7
A7	-50	5.57	9.26	40.4
A8	-150	6.5	9.03	18.8
A9	-250	6.7	9.30	15.7

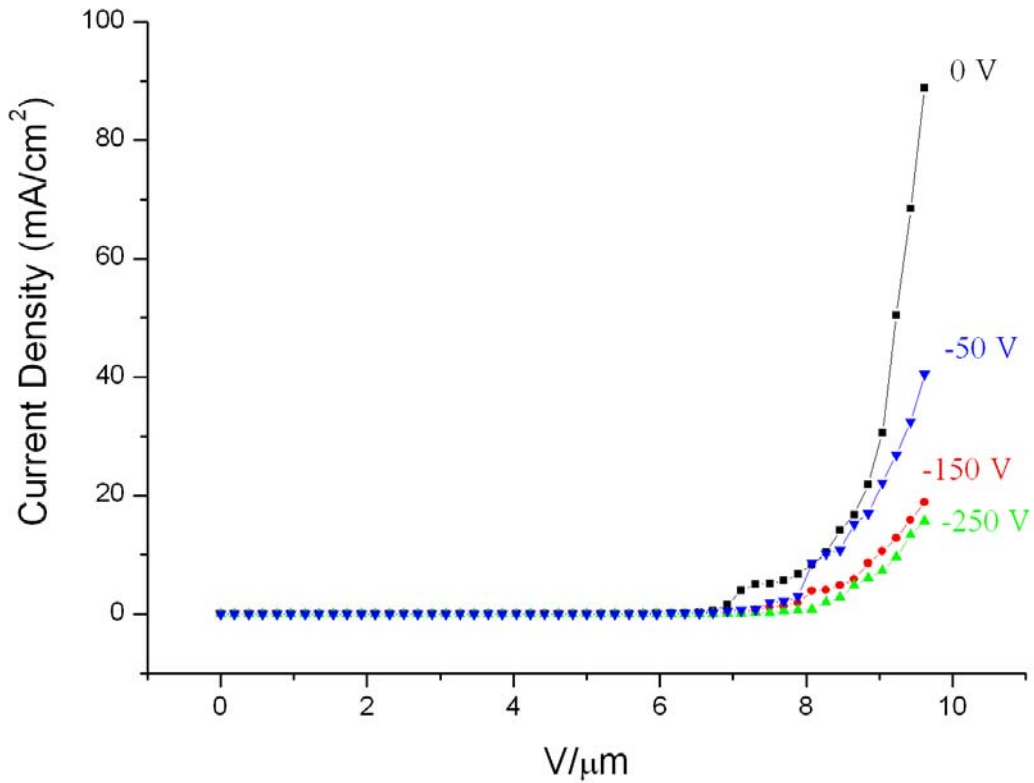
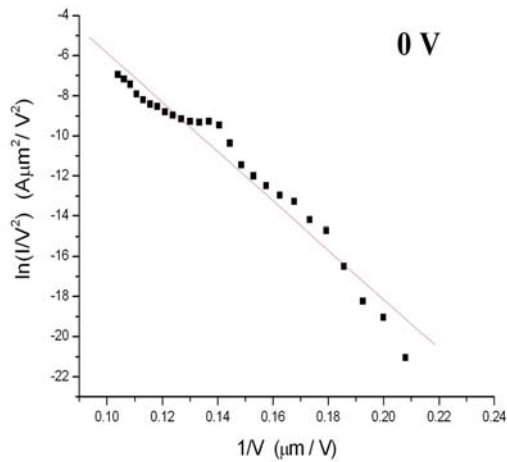


Fig.4-10 J-E curve of different negative bias applied on CNTs growth

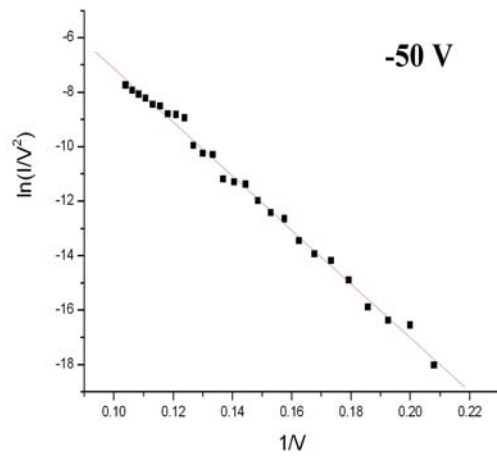


Table 4-3 The field enhancement factor β of different negative applied bias on CNTs growth

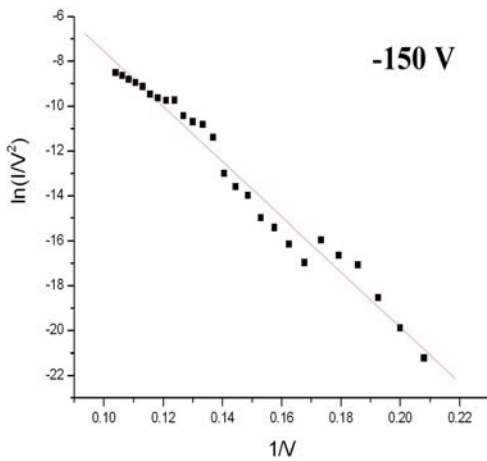
Remarks	Specimen	Applied bias (V)	Field enhancement factor β
a	A5	0	4096
b	A7	-50	2816
c	A8	-150	2767
d	A9	-250	2481



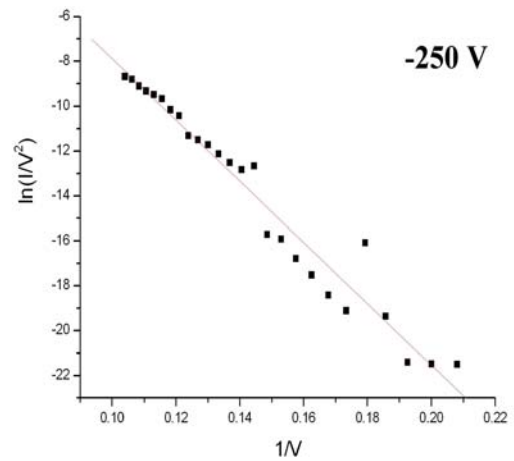
(a)



(b)



(c)



(d)

Figs.4-11 F-N plots of different negative substrate bias applied on CNTs growth

(a) 0 V (b) -50 V (c) -150 V (d) -250 V

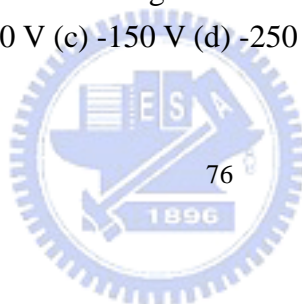


Table 4-4 FE properties of CNTs grown on different growth time

Specimen	Growth time	$E_{\text{turn-on}}$ at $10\mu\text{A}/\text{cm}^2$ ($\text{V}/\mu\text{m}$)	$E_{\text{threshold}}$ at $10\text{ mA}/\text{cm}^2$ ($\text{V}/\mu\text{m}$)	Current density at $10\text{ V}/\mu\text{m}$ (mA/cm^2)
A4	5 min	4.2	8.84	50.1
A5	10 min	4.4	8.26	88.7
A6	15 min	4.7	8.26	21.7

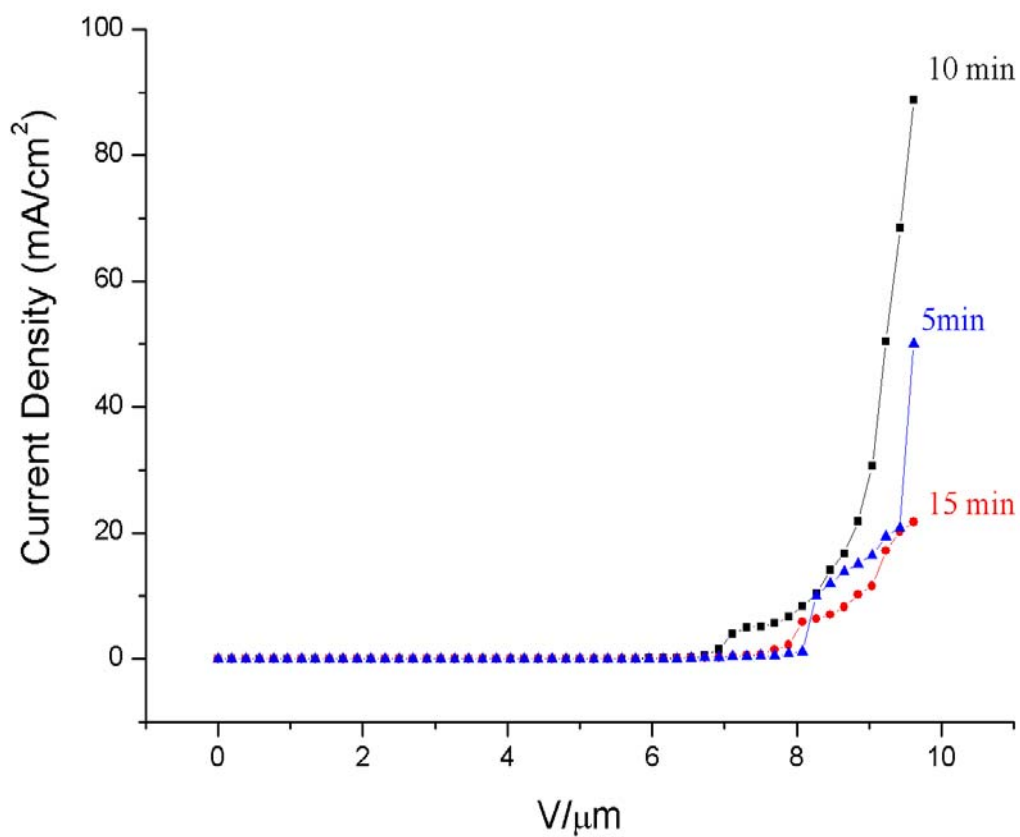
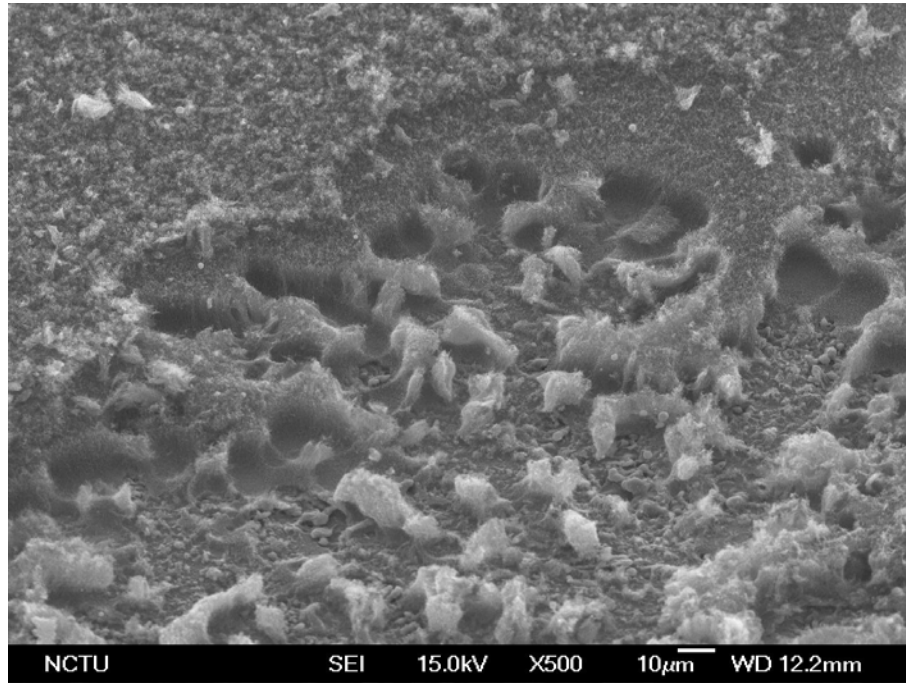
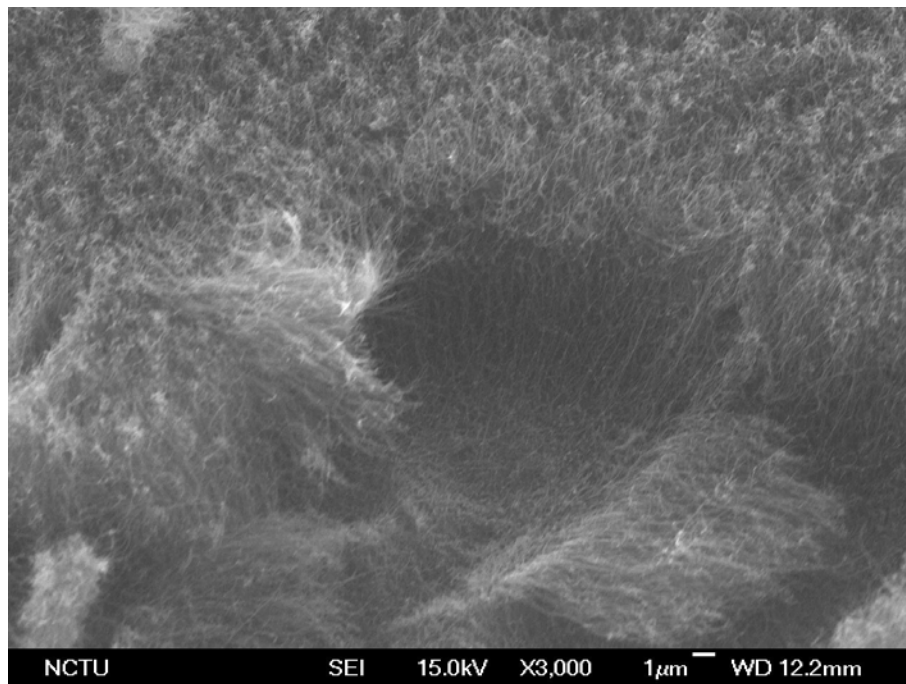


Fig.4-12 J-E curves of different growth time of CNTs





(a)



(b)

Figs. 4-13 Morphologies of stripped CNTs after I-V measurement. The image (b) is corresponding to the image (a) in high magnification.

