CHAPTER 6

Future Works

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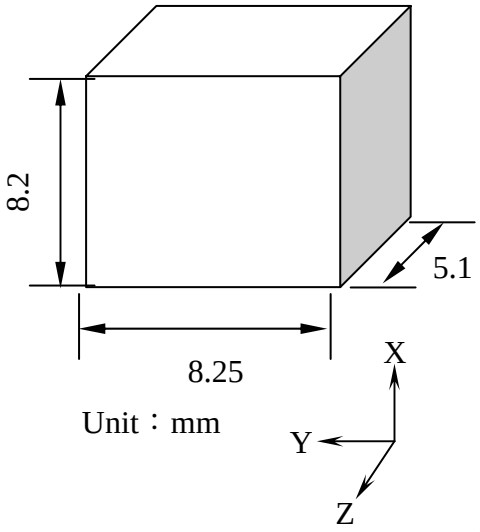
Low CTE Material

Aluminum Alloy (10XX)



Unit：mm

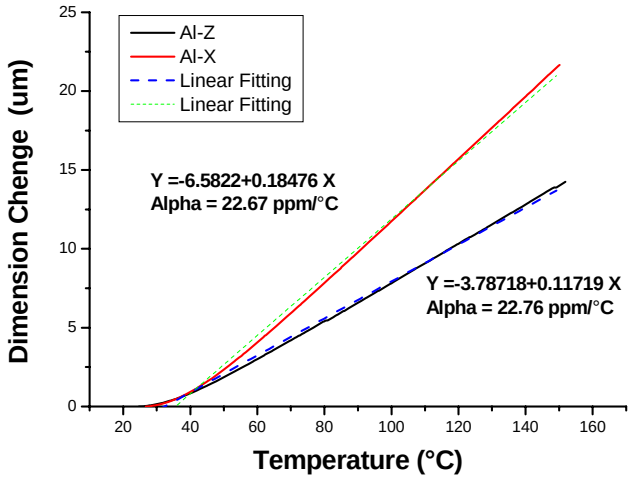
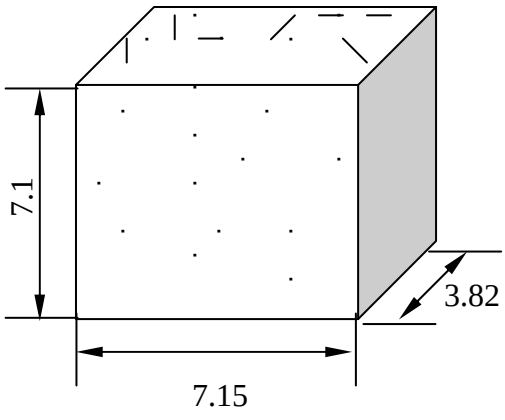
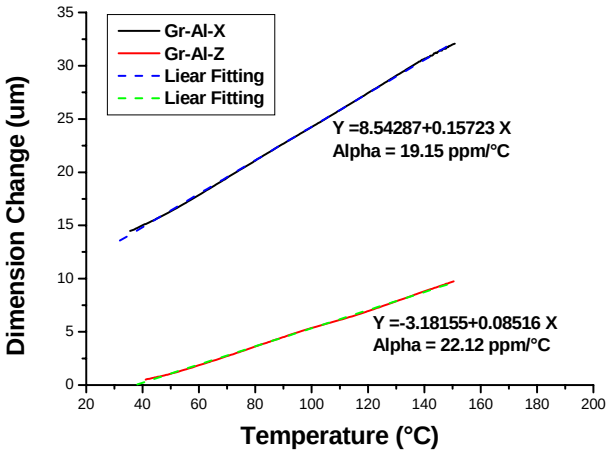


Fig. 1. Measurement of thermal expansion coefficient on aluminum from room temp. to 150 ℃

Density of Aluminum：2.72 g / cc

Graphite short fiber / Aluminum Composite

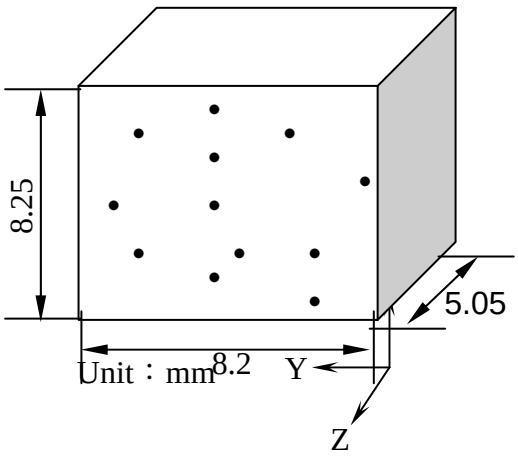


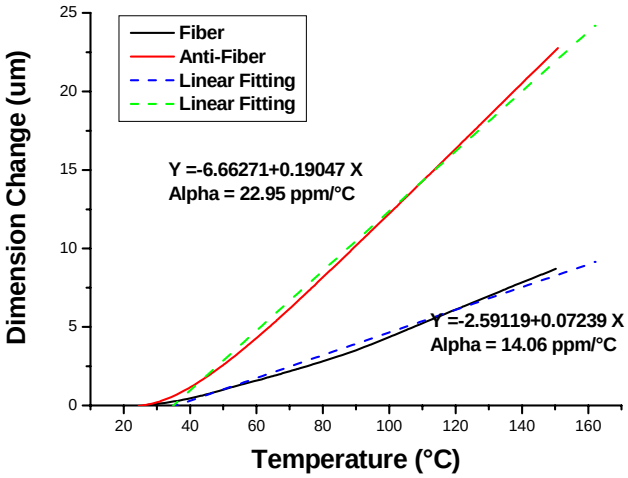


V_{Al} (%) = 95.11 and V_{Gr} (%) = 4.88

Fig. 2. Measurement of TEA on Gr/Al composite from room temp. to 150 ^{o}C

Graphite/Aluminum Composite





V_{Al} (%) = 92.19 and V_{Gr} (%) = 7.81

Fig.3. Measurement of TEA on Gr/Al composite from room temp. to 150 ^{o}C

But another CTE measurement was made with hi-modulus graphite manufactured by TOSHIBA Ltd., Company.

Gr/Al composite Fiber vol %	100℃	200℃	
12	13.89	14.77	(CTE)
24	4.89	4.96	(CTE)
36	3.98	4.11	(CTE)

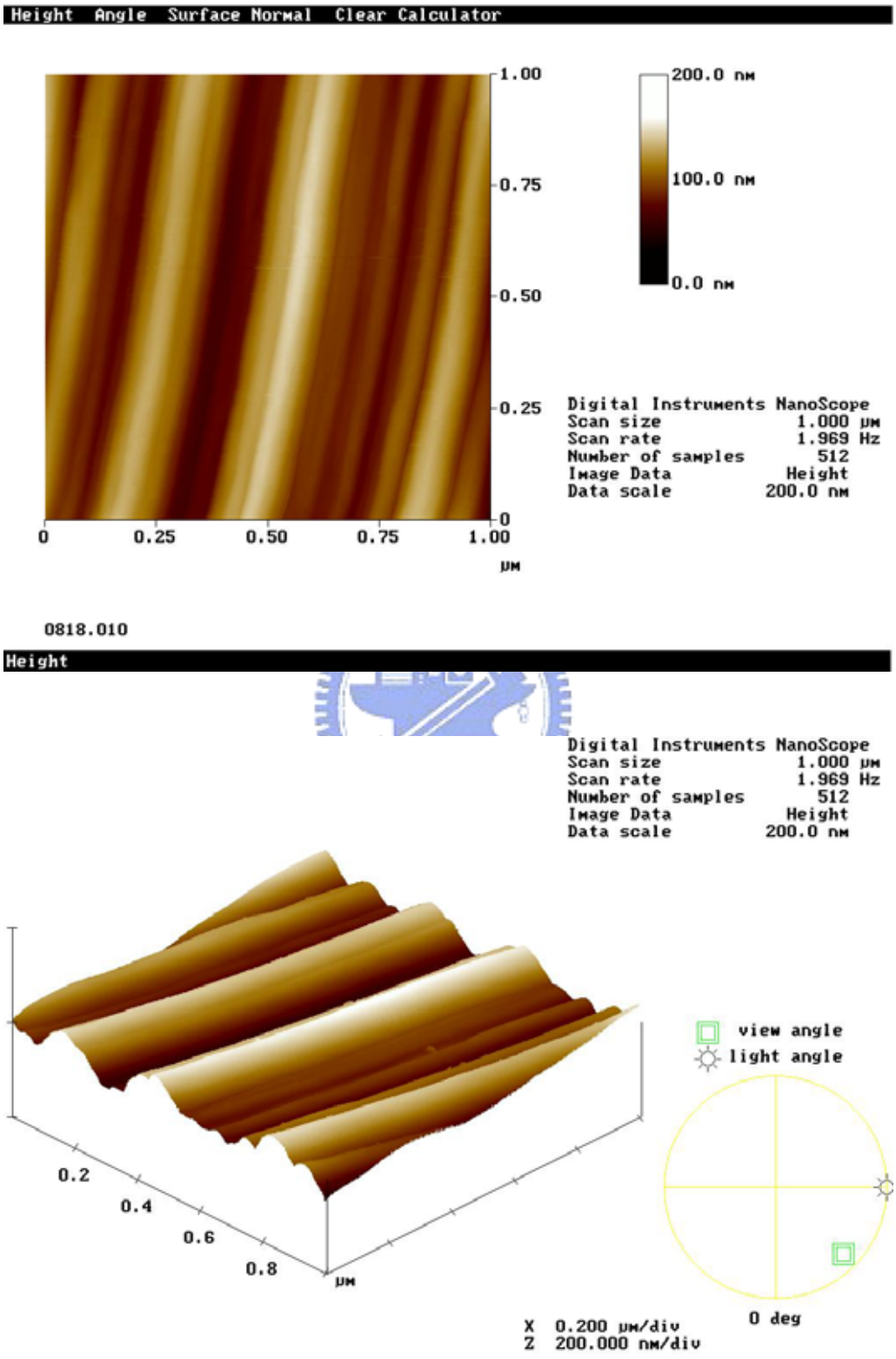


Fig. 4. AFM images showing the surface morphology of the carbon fiber

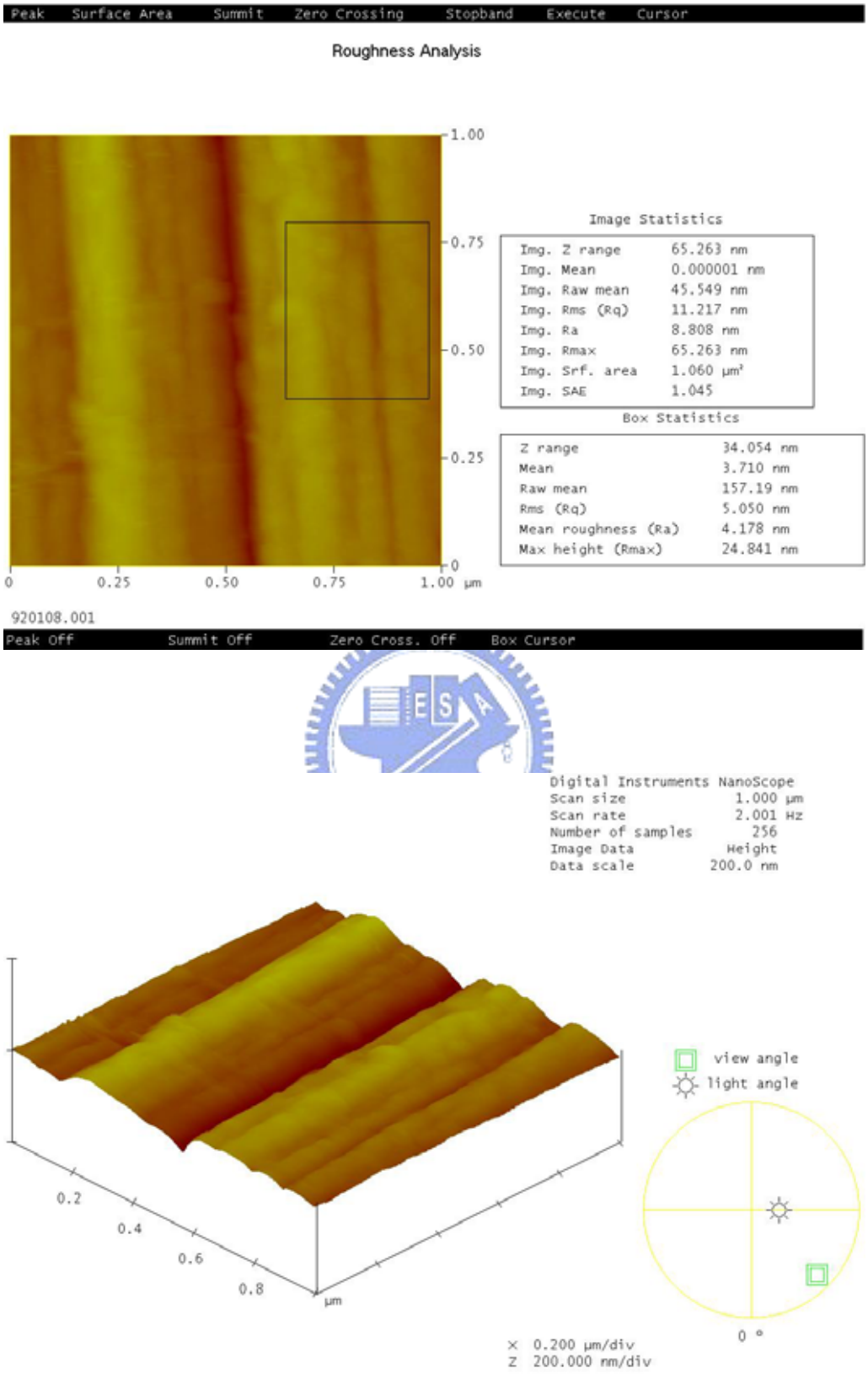


Fig.5. AFM images showing the surface morphology of Ni-coated carbon fiber

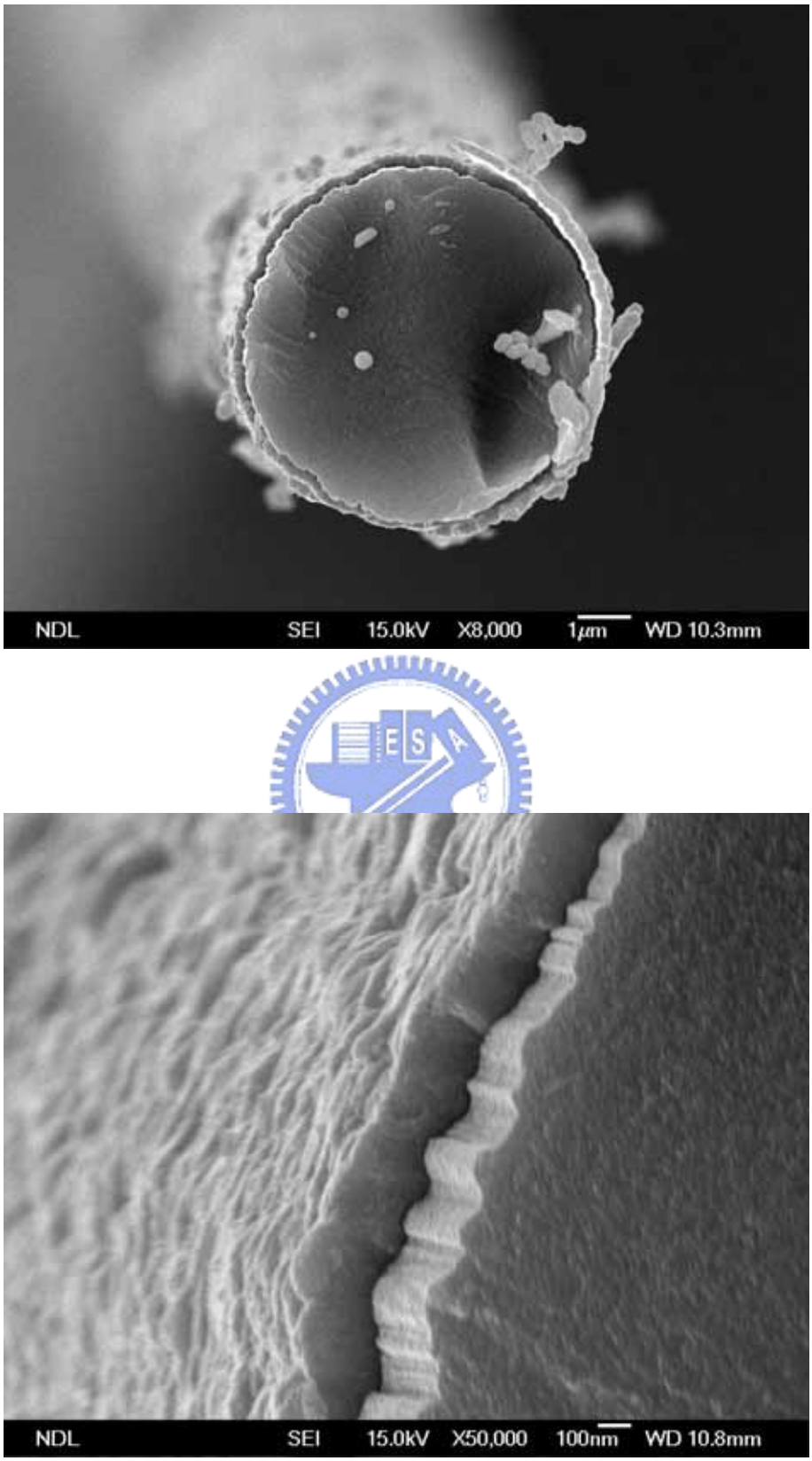


Fig. 6. SEM images showing the cross-section of the Ni-coated carbon fiber

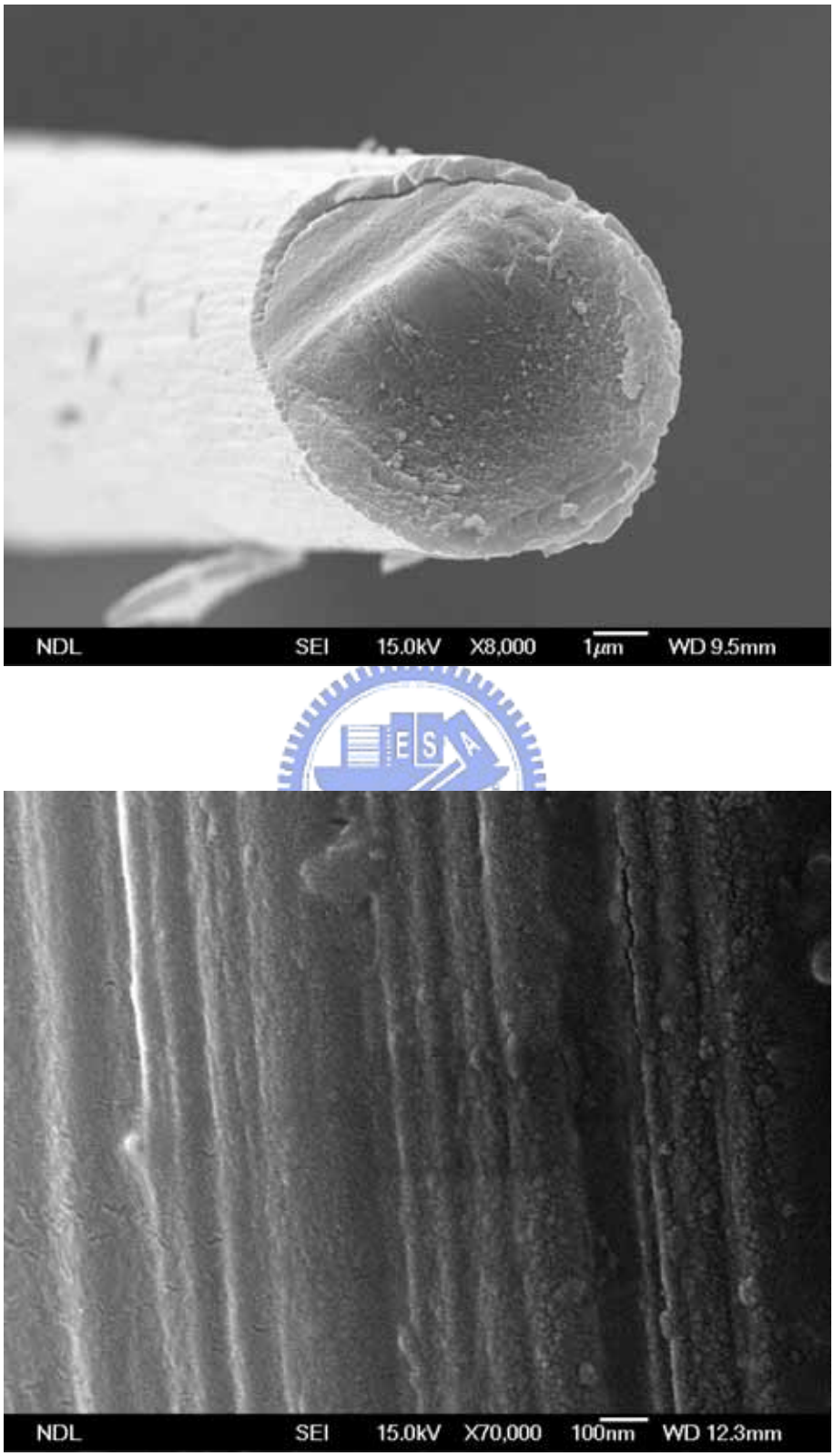


Fig. 7. SEM images showing the cross-section and the morphology of the SiC-coated carbon fiber

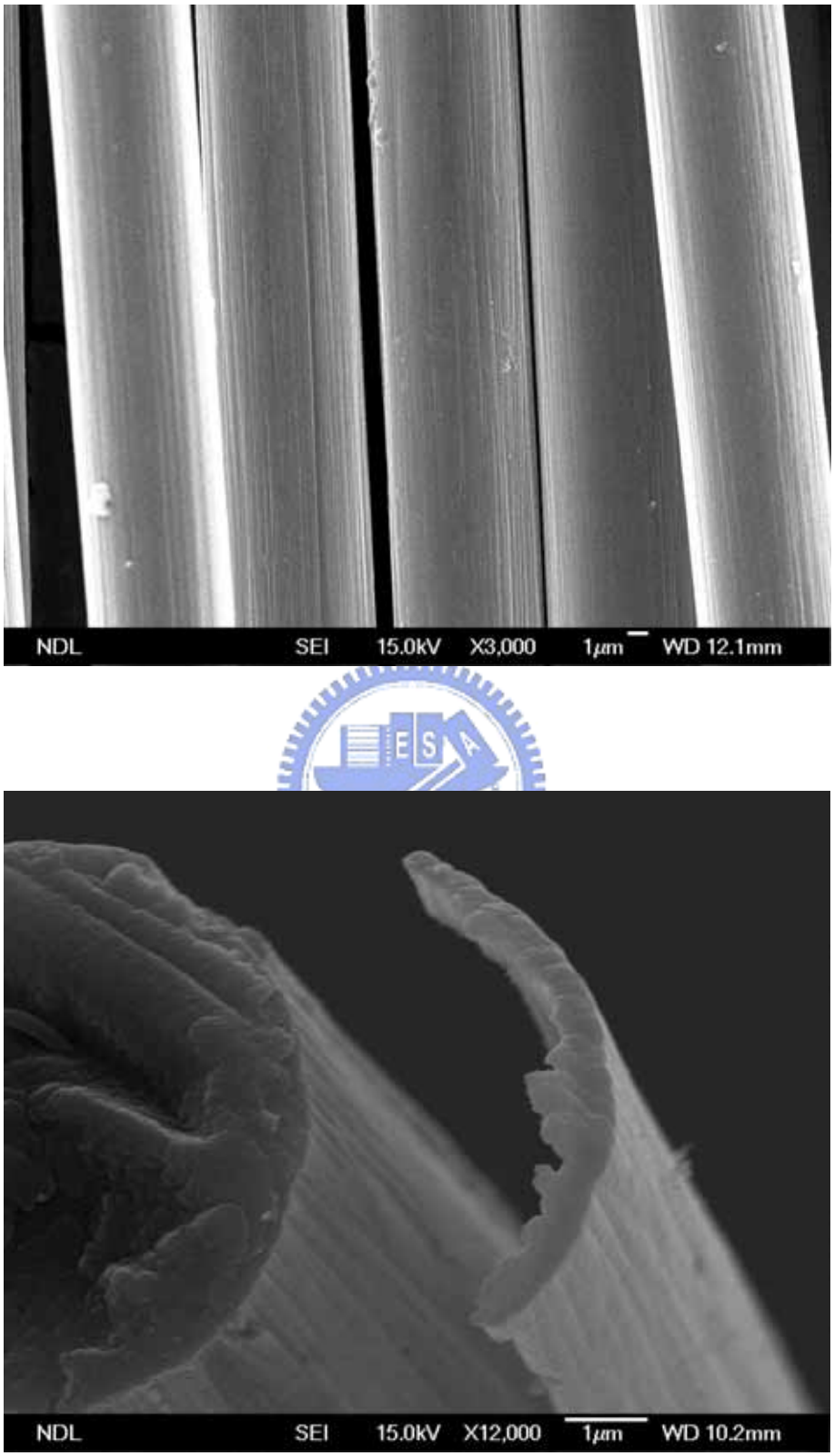


Fig. 8. SEM images showing the cross-section and the morphology of the SiC-coated carbon fiber

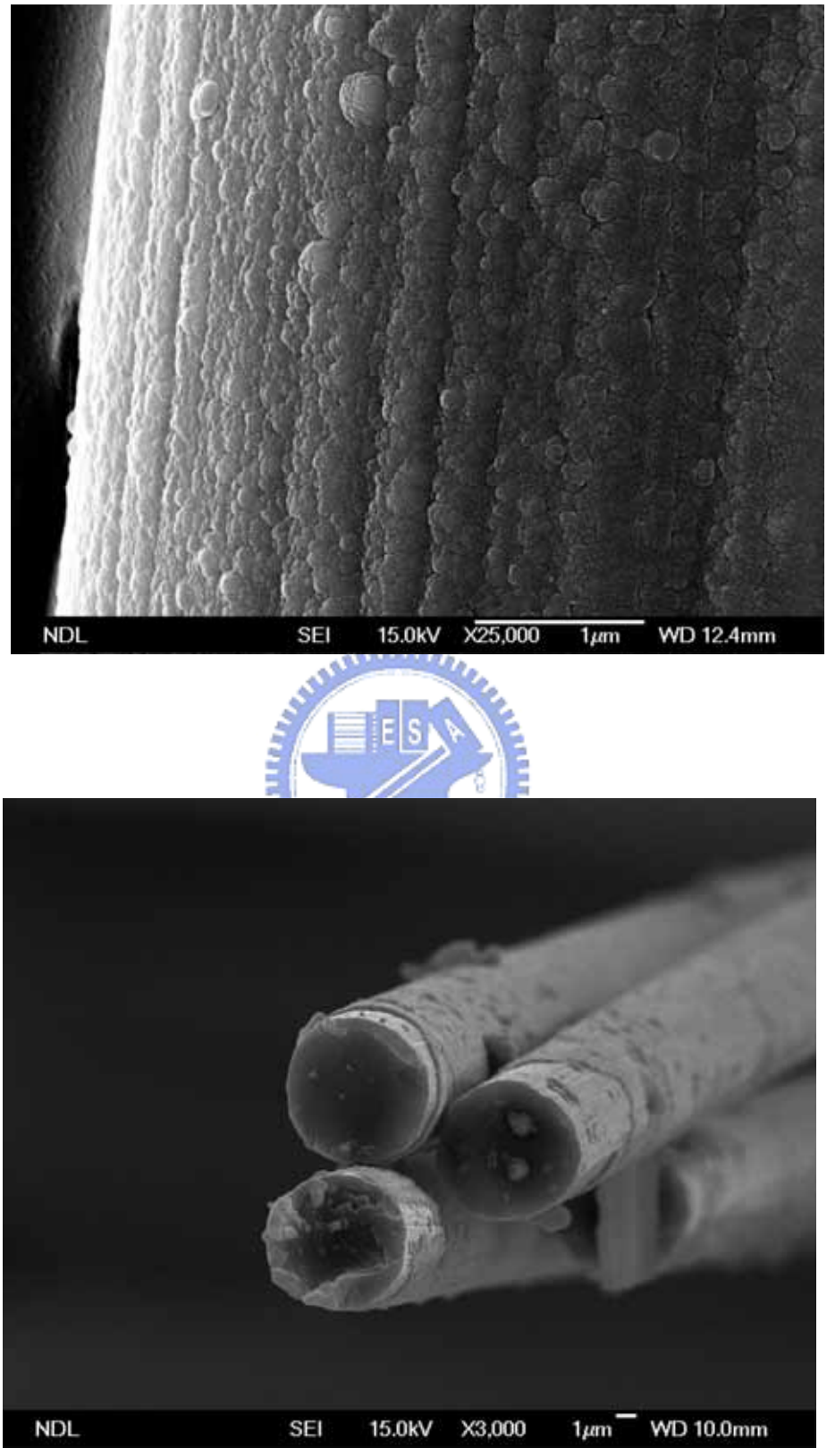


Fig. 9. SEM images showing the cross-section and the morphology of the composite coating (Ni-SiC) on carbon fiber

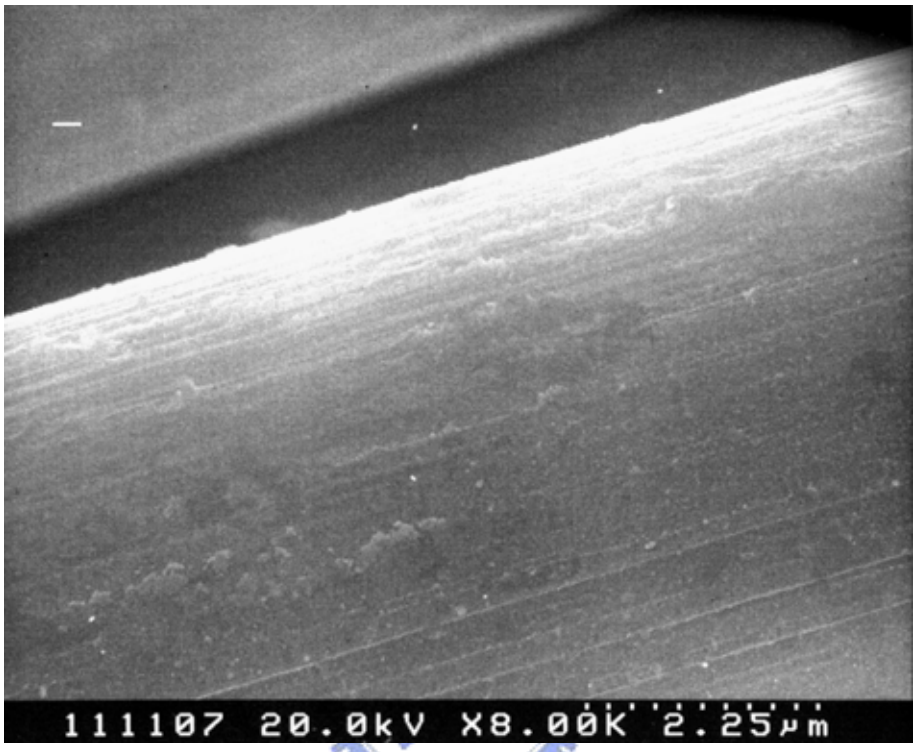
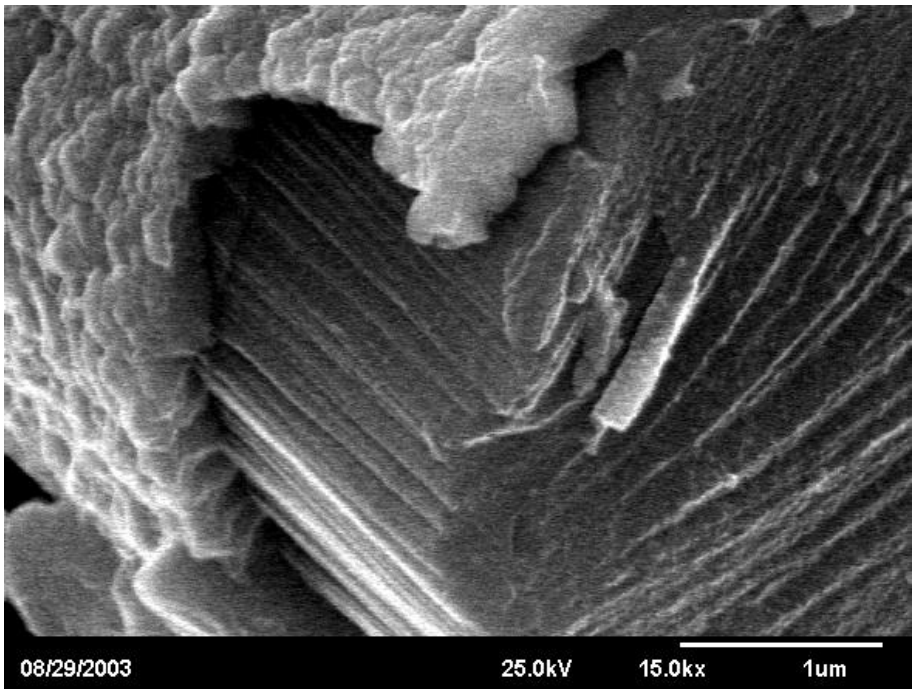


Fig. 10. SEM images showing the the morphology of Ta-coated carbon fiber



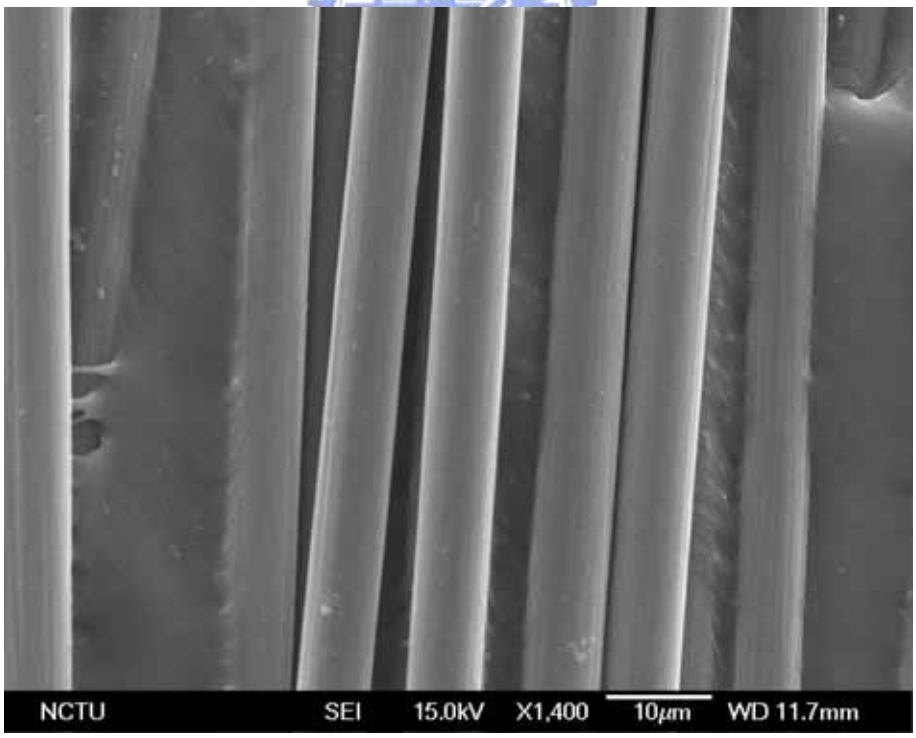


Fig. 11. SEM images showing the cross-section and the morphology of the Al-coated carbon fiber

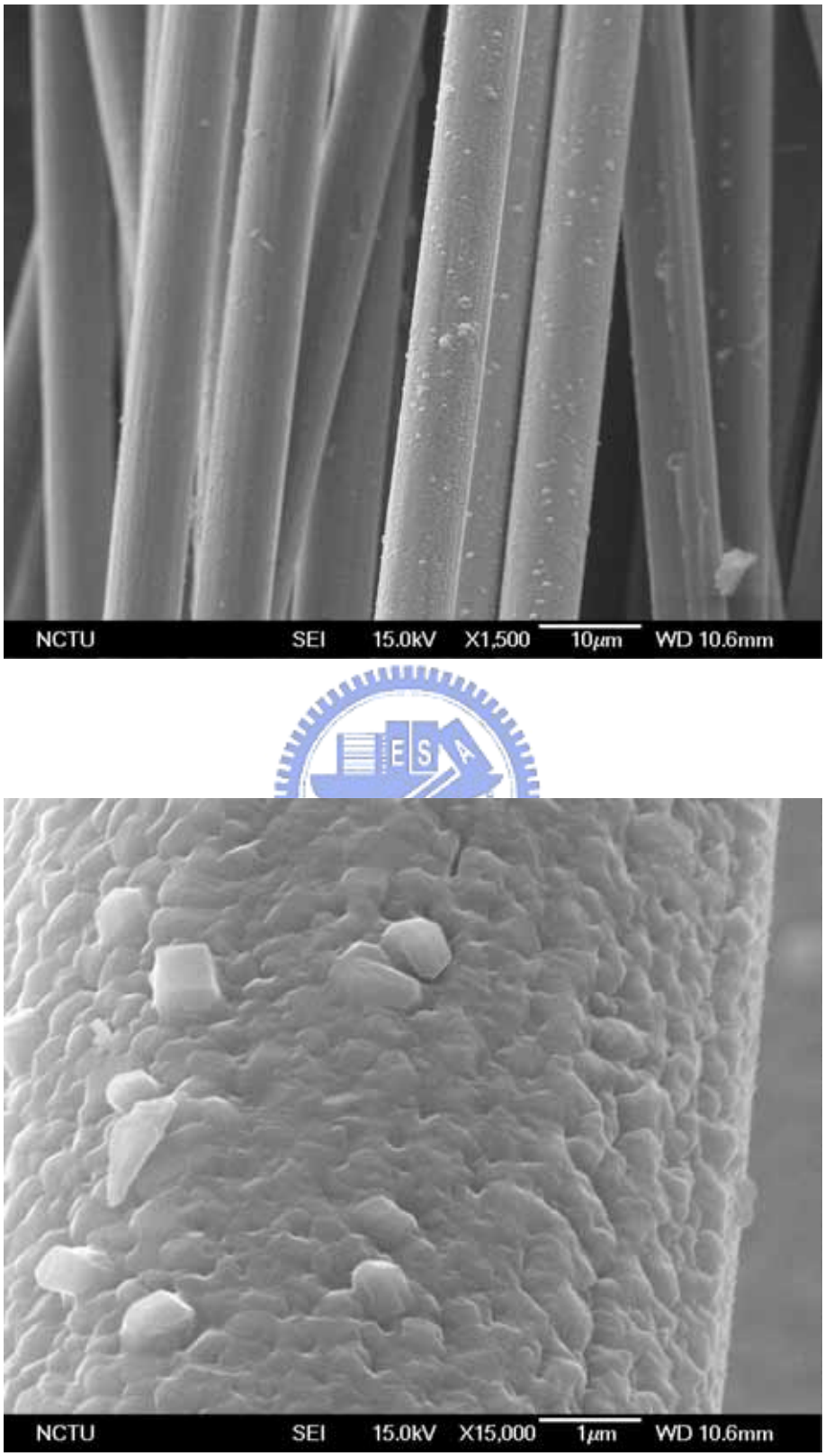


Fig. 12. SEM images showing the morphology of the Al-coated carbon fiber

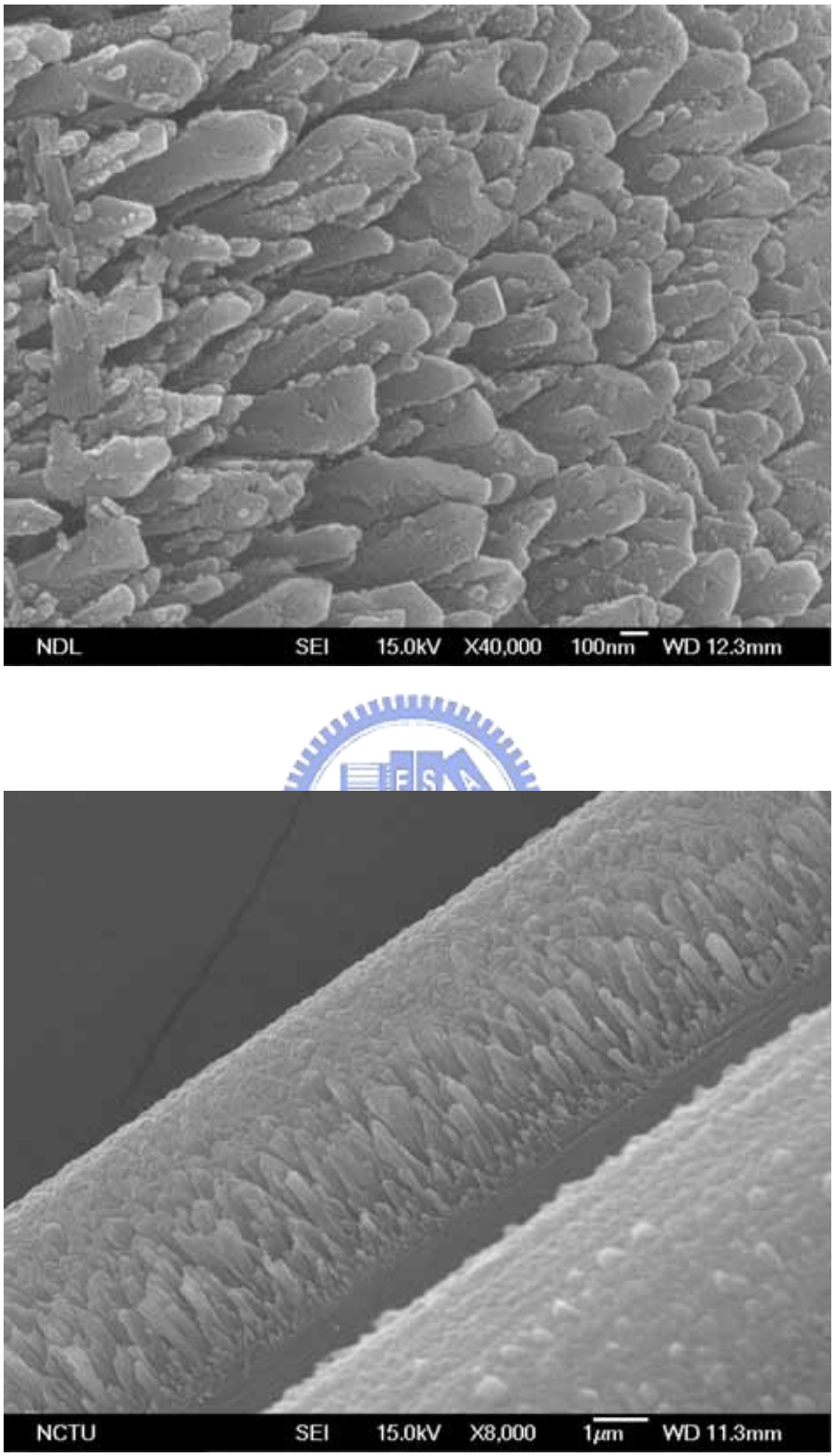


Fig. 13. SEM images showing the micro-structure of the AAO on carbon fiber

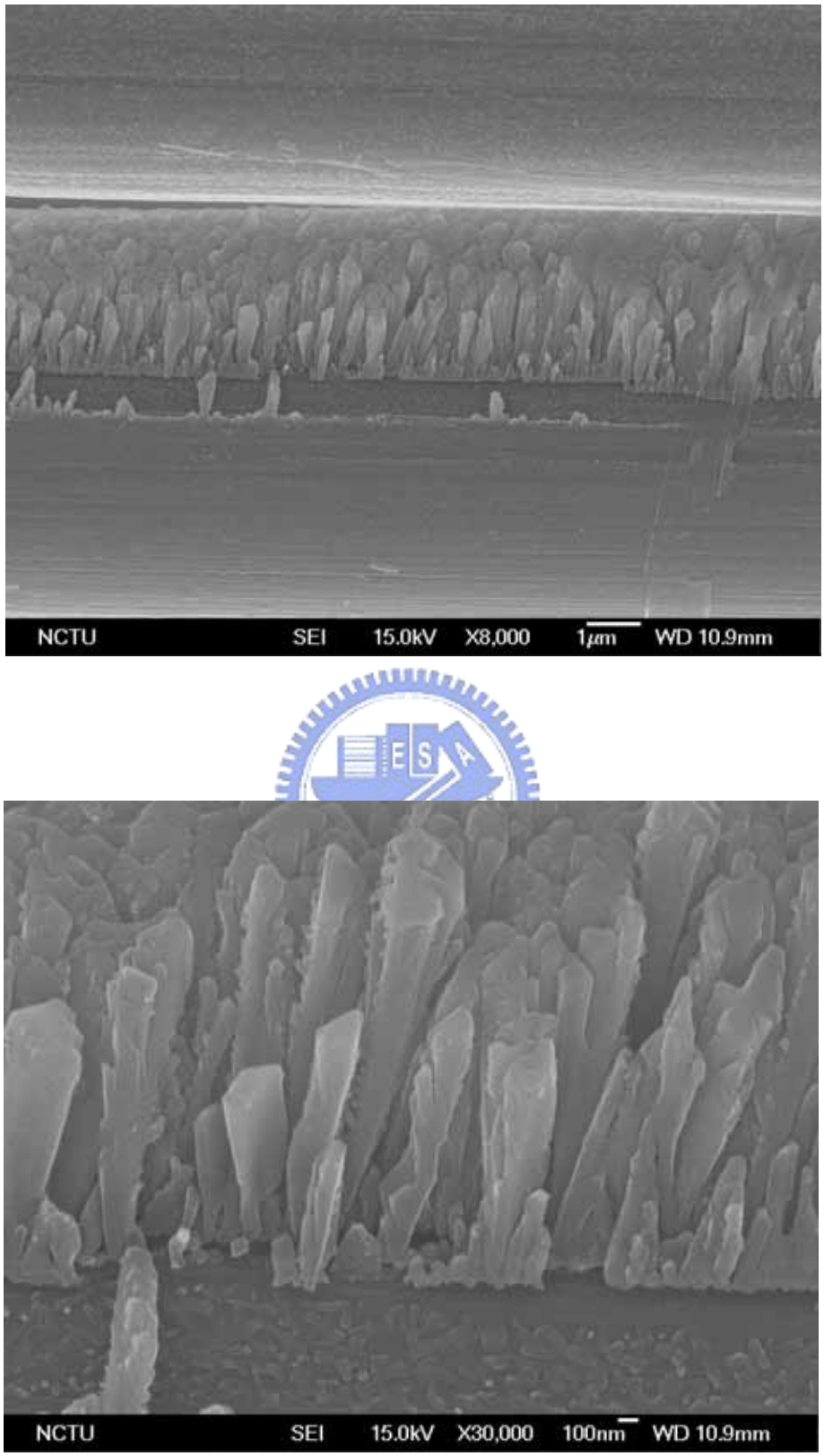


Fig. 14. SEM images showing the micro-structure of the AAO on carbon fiber

Characters of CNT

Electrical conductivity -- probably the best conductor of electricity on a nanoscale level that can ever be possible.

Thermal conductivity -- comparable to diamond along the tube axis.

Mechanical -- probably the stiffest, strongest, and toughest fiber that can ever exist.

Chemistry of carbon -- can be reacted and manipulated with the richness and flexibility of other carbon molecules. Carbon is the basis of most materials we use every day.

Self-assembly -- strong *van der Waals* attraction leads to spontaneous roping of many nanotubes. Important in certain applications.

Electrical conductivity

Conductance Quantization	$(12.9\ k\Omega)^{-1}$
Resistivity	$10^{-4}\ \Omega$-cm
Maximum Current Density	$10^{13}\ A/m^2$

Mechanical property

Elastic Behavior

Young's Modulus (SWNT)	~ 1 TPa
Young's Modulus (MWNT)	1.28 Tpa
Maximum Tensile Strength	~ 100 GPa

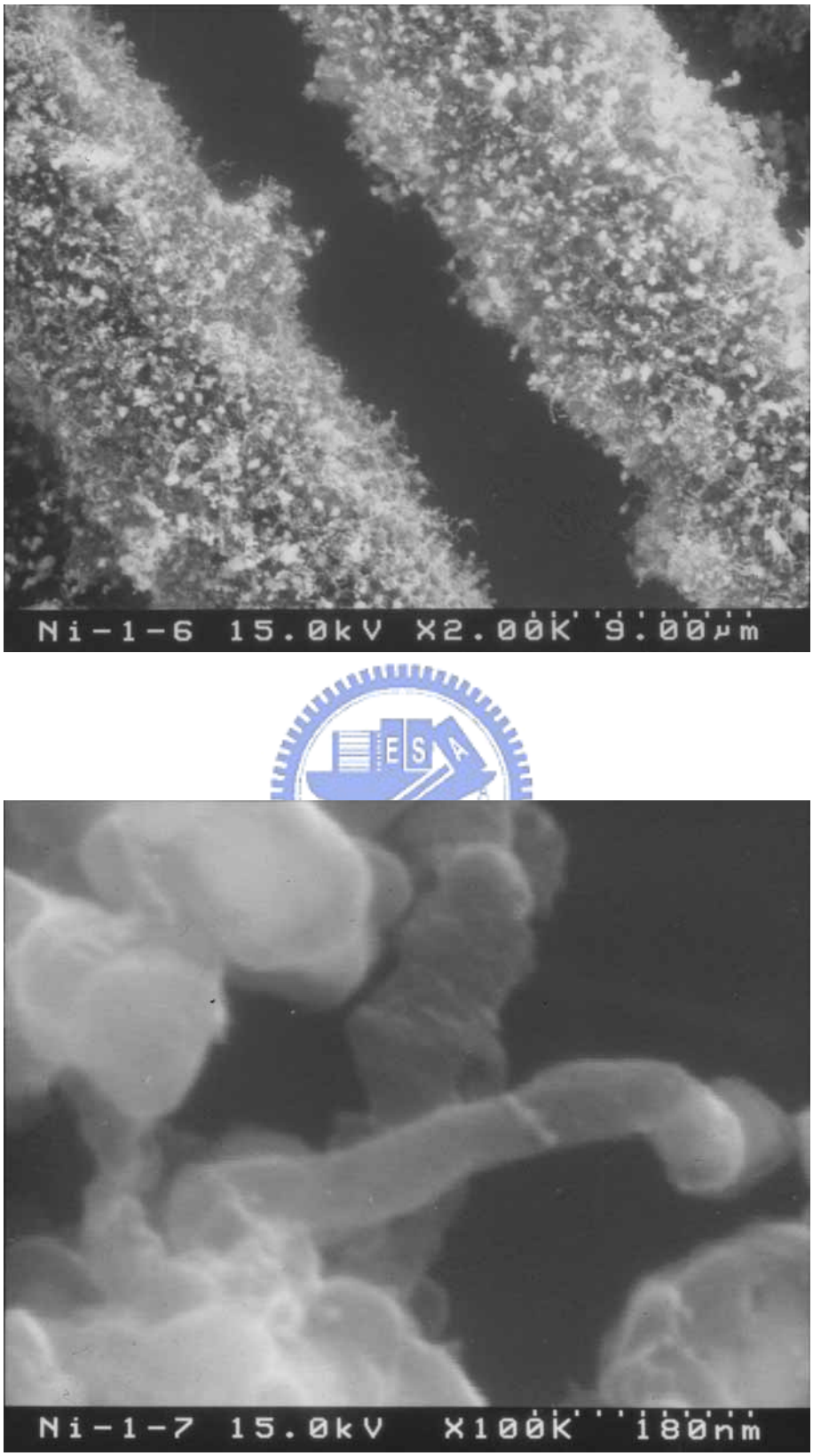


Fig. 15. SEM images showing the micro-structure of the CNT on carbon fiber

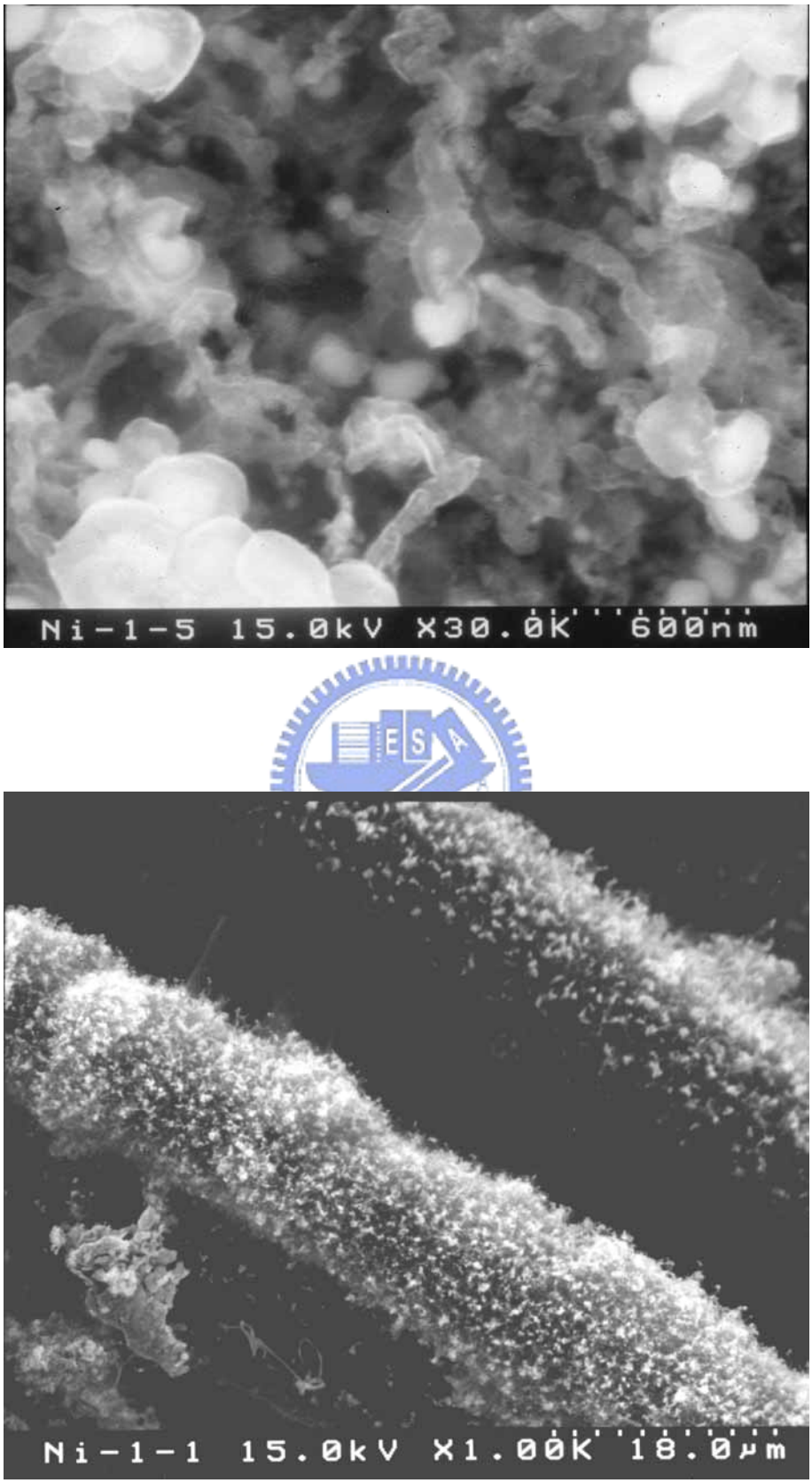


Fig. 16. SEM images showing the micro-structure of the CNT on carbon fiber