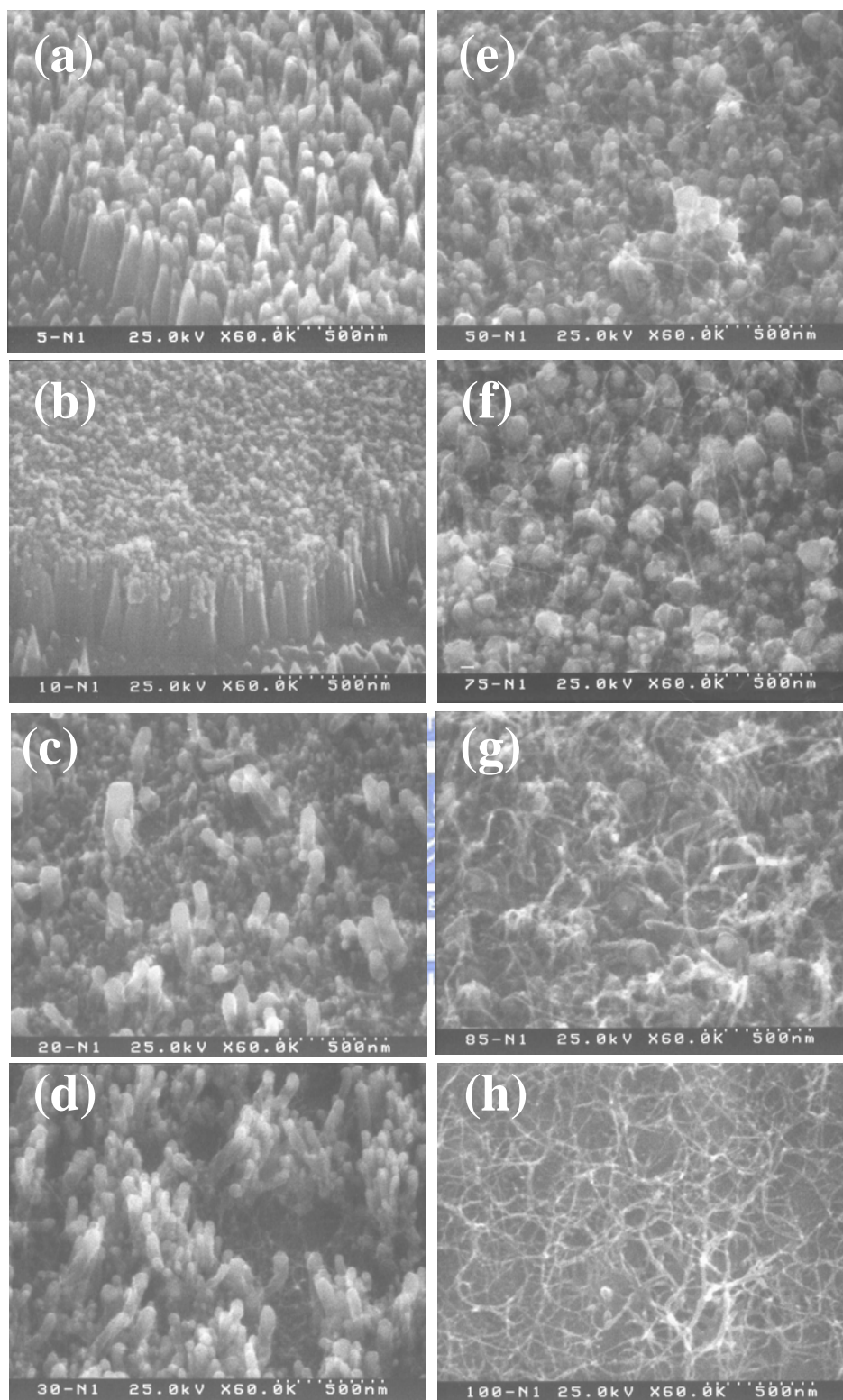
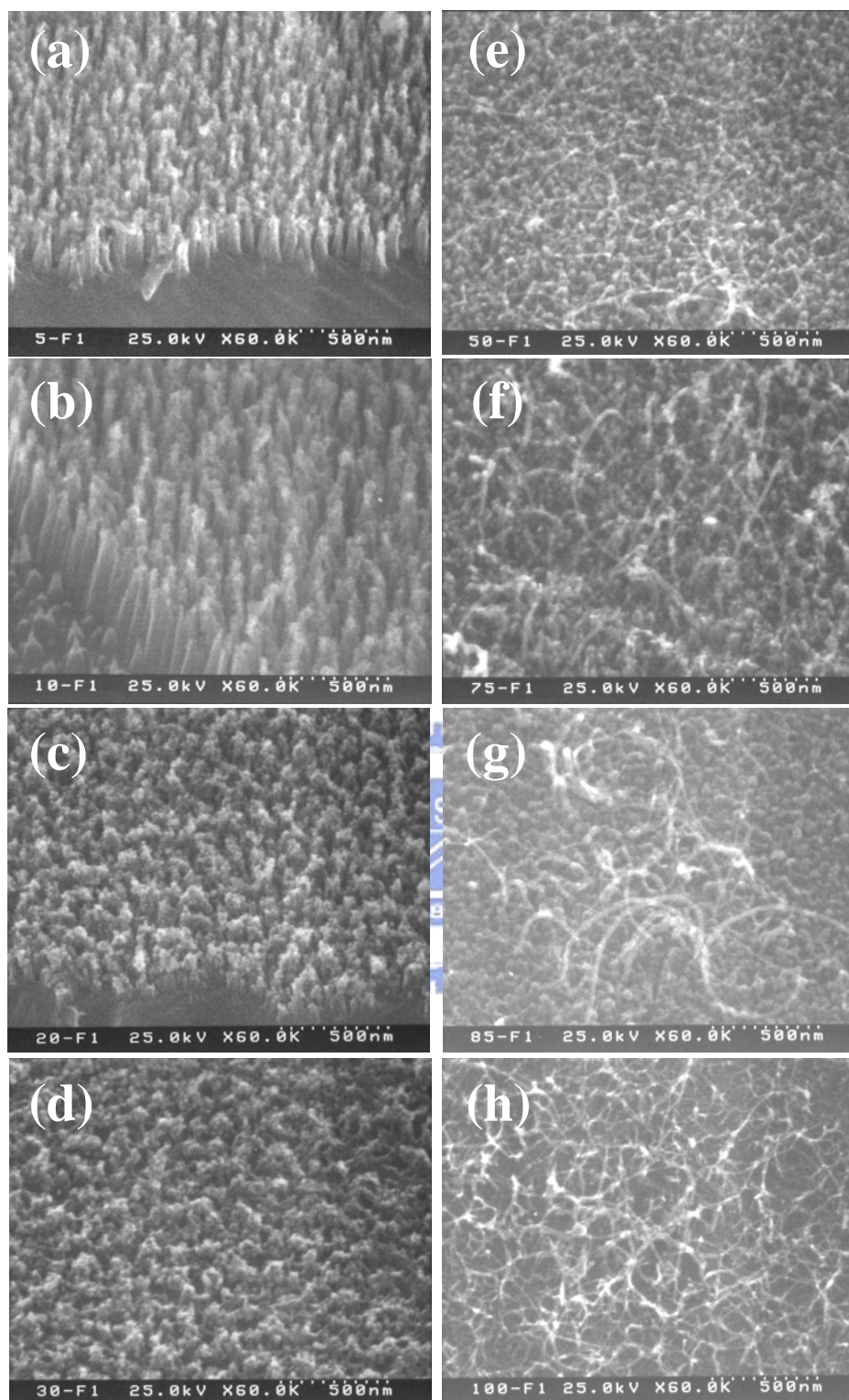


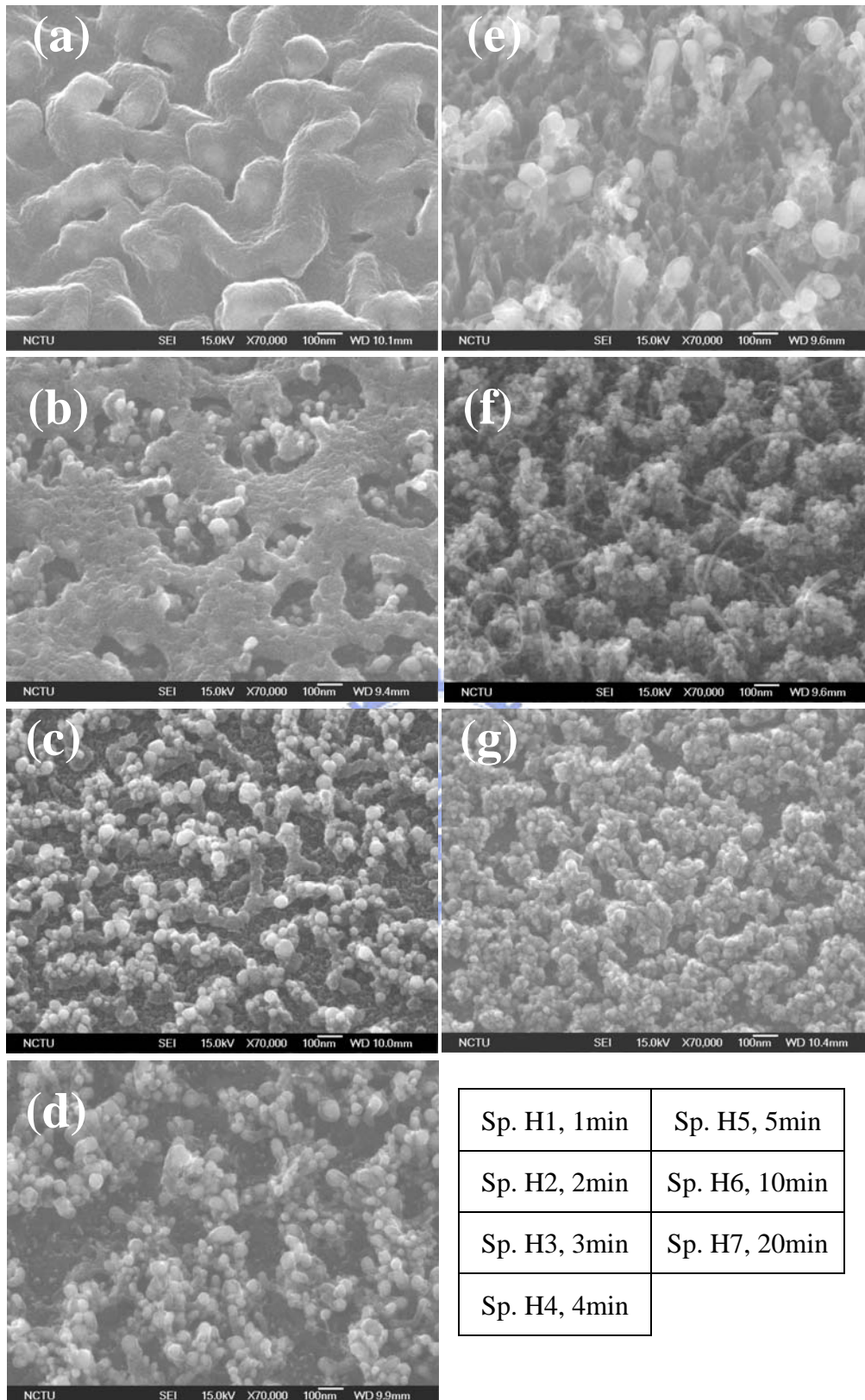
**Fig. 4-13** Effect of different  $H_2/CH_4$  flow ratios on SEM morphologies of the as-deposited Co-assisted carbon nanostructures: (a) 100/5, (b) 100/10, (c) 100/20, (d) 100/30, (e) 100/50, (f) 100/70, (g) 100/85, and (h) 100/100 sccm/sccm for Specimens E1, E2, E3, E4, E5, E6, E7 and E8, respectively.



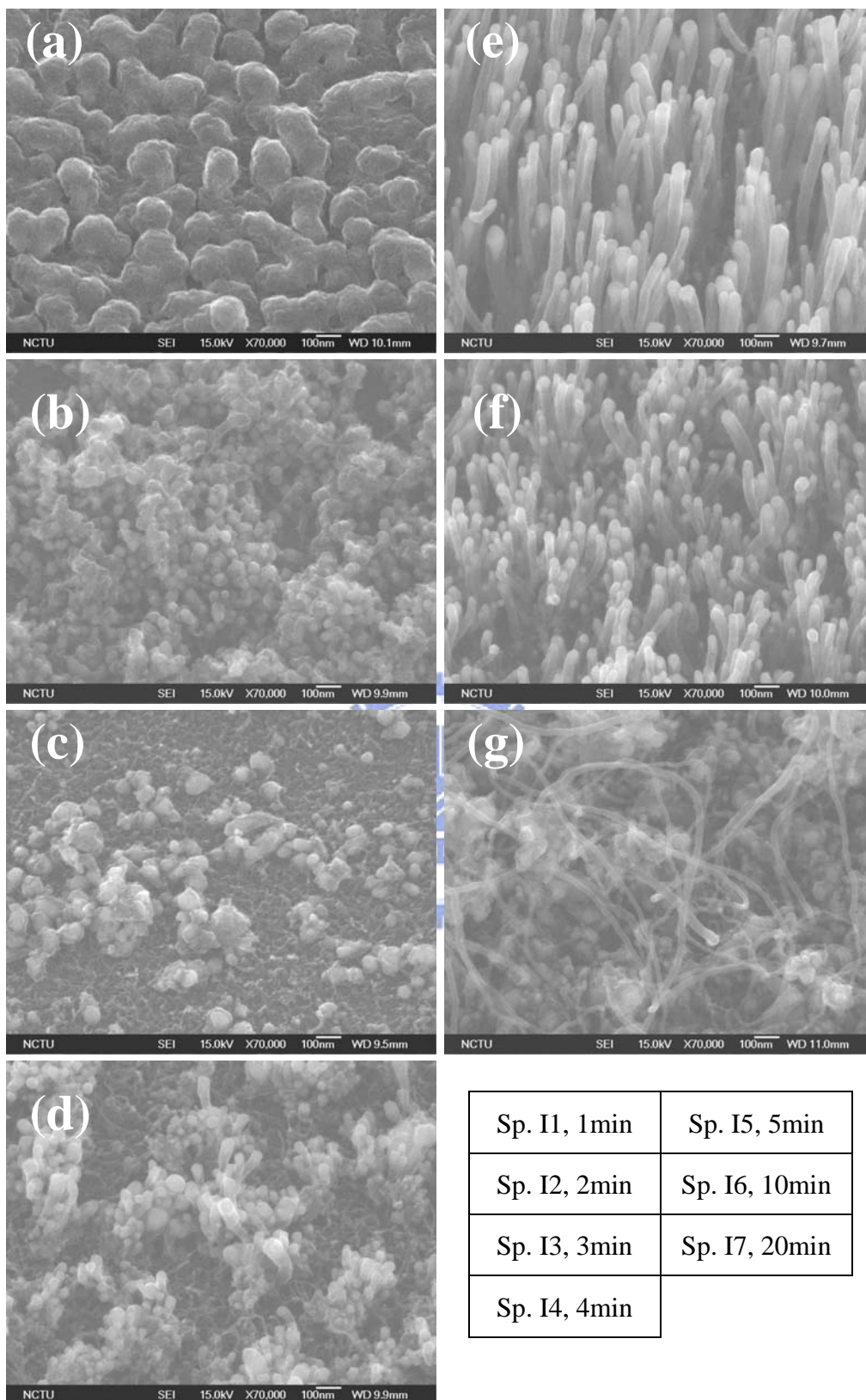
**Fig. 4-14** Effect of different  $H_2/CH_4$  flow ratios on SEM morphologies of the as-deposited Ni-assisted carbon nanostructures: (a) 100/5, (b) 100/10, (c) 100/20, (d) 100/30, (e) 100/50, (f) 100/70, (g) 100/85, and (h) 100/100 sccm/sccm for Specimens F1, F2, F3, F4, F5, F6, F7 and F8, respectively.



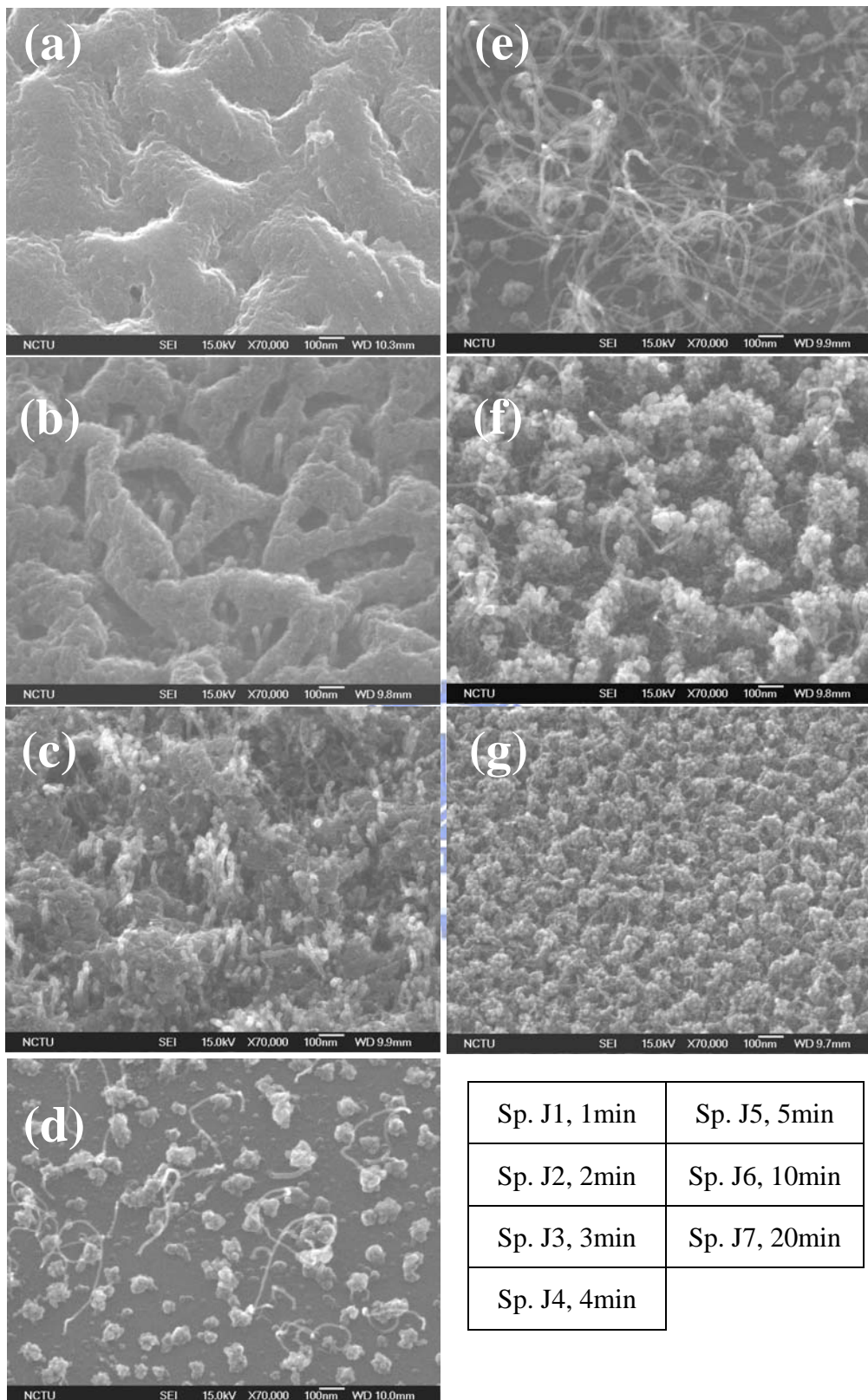
**Fig. 4-15** Effect of different  $H_2/CH_4$  flow ratios on SEM morphologies of the as-deposited Fe-assisted carbon nanostructures: (a) 100/5, (b) 100/10, (c) 100/20, (d) 100/30, (e) 100/50, (f) 100/70, (g) 100/85, and (h) 100/100 sccm/sccm for Specimens G1, G2, G3, G4, G5, G6, G7 and G8, respectively.



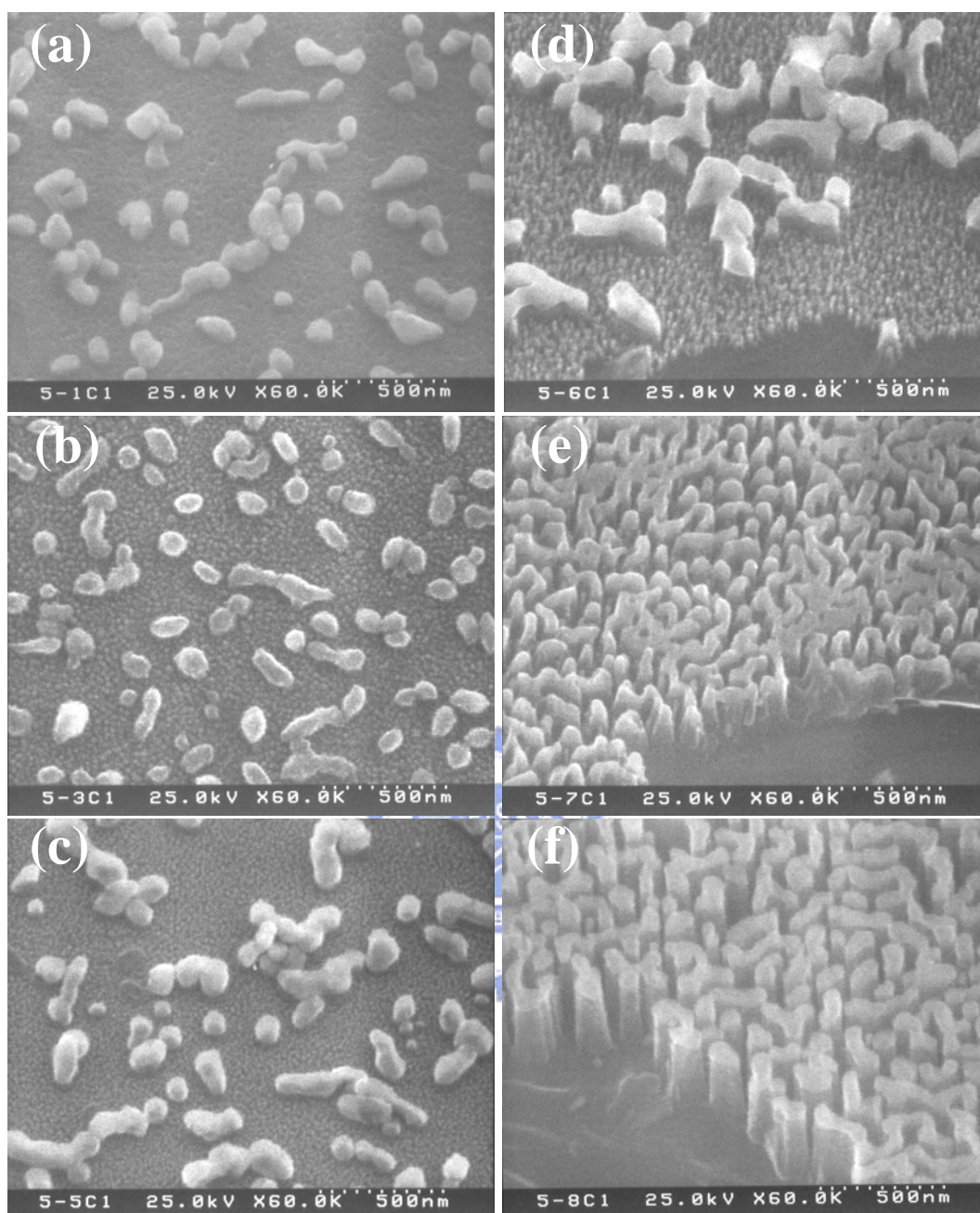
**Fig. 4-16** SEM morphologies of the as-deposited Co-assisted carbon nanostructures with  $H_2/CH_4=0/1$  (sccm/sccm) under different deposition times: (a) 1, (b) 2, (c) 3, (d) 4, (e) 5, (f) 10, and (g) 20min. for Specimens H1, H2, H3, H4, H5, H6, and H7, respectively.



**Fig. 4-17** SEM morphologies of the as-deposited Ni-assisted carbon nanostructures with  $H_2/CH_4=0/1$  (sccm/sccm) under different deposition times: (a) 1, (b) 2, (c) 3, (d) 4, (e) 5, (f) 10, and (g) 20min. for Specimens I1, I2, I3, I4, I5, I6, and I7, respectively.

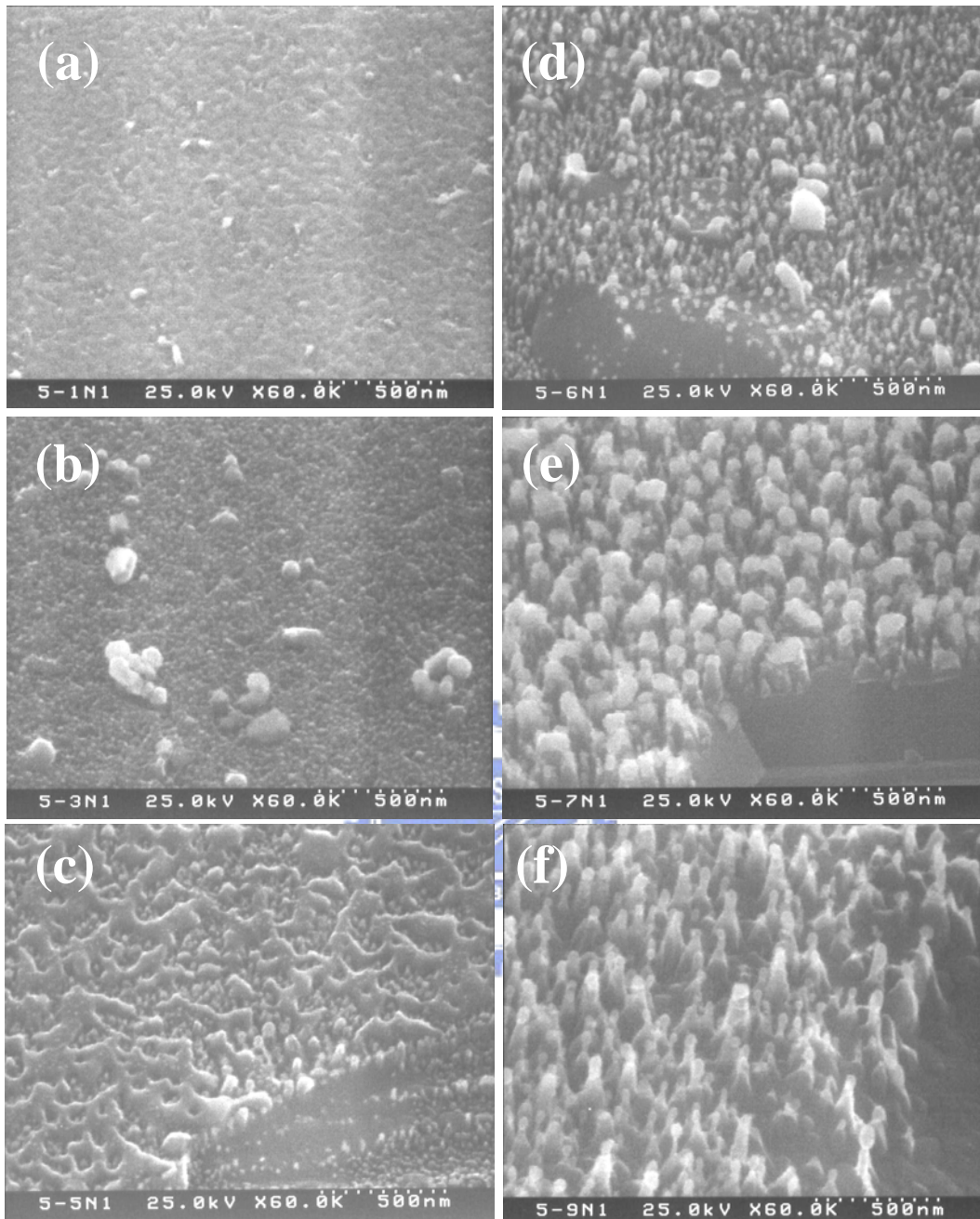


**Fig. 4-18** SEM morphologies of the as-deposited Fe-assisted carbon nanostructures with  $H_2/CH_4=0/1$  (sccm/sccm) under different deposition times: (a) 1, (b) 2, (c) 3, (d) 4, (e) 5, (f) 10, and (g) 20min. for Specimens J1, J2, J3, J4, J5, J6, and J7, respectively.



(a) Sp. K1, 1min	(d) Sp. K4, 7min
(b) Sp. K2, 3min	(e) Sp. K5, 10min
(c) Sp. K3, 5min	(f) Sp. K6, 20min

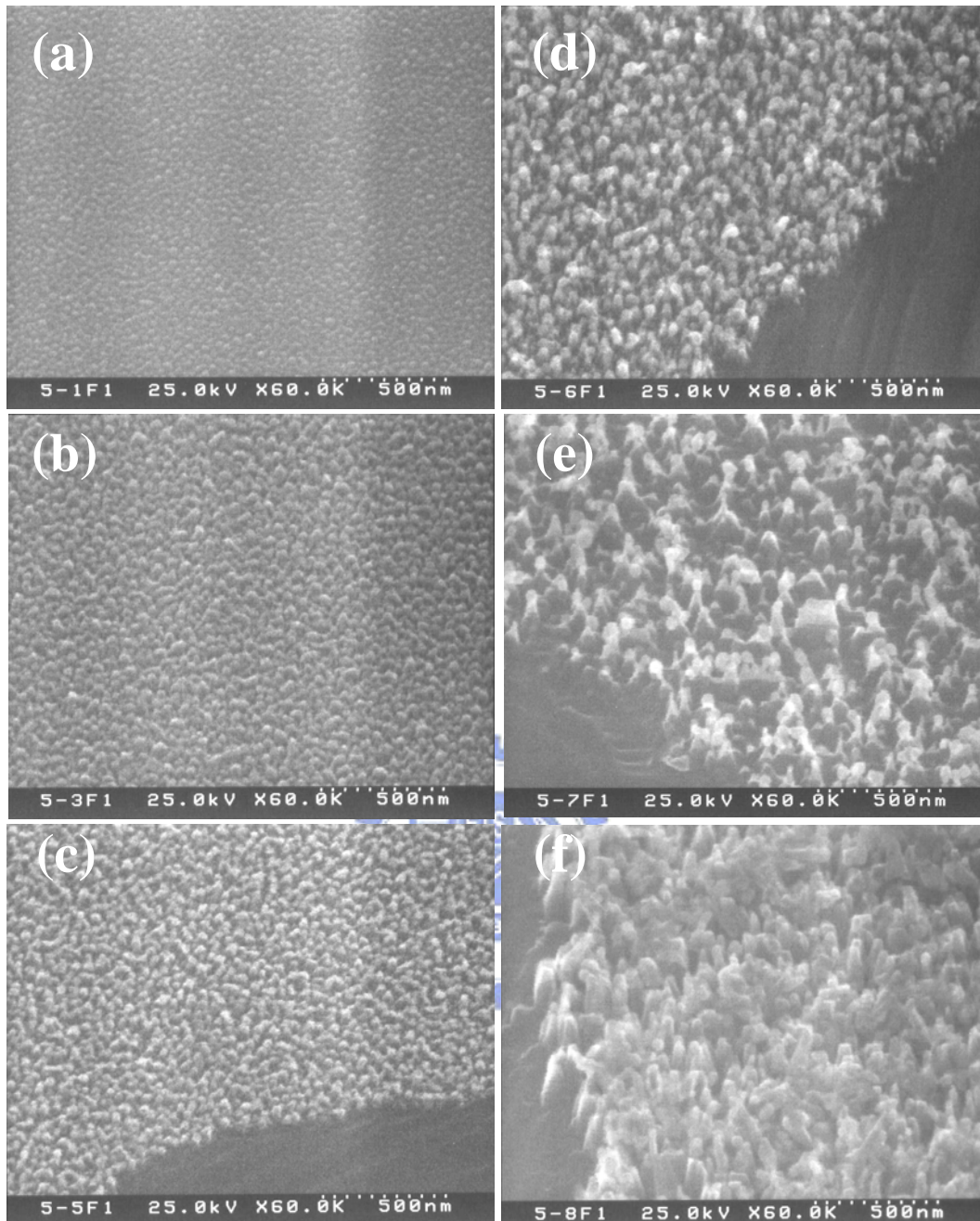
**Fig. 4-19** SEM morphologies of the as-deposited Co-assisted nanostructures with  $H_2/CH_4=100/0$  (sccm/sccm) under different process times: (a) 1, (b) 3, (c) 5, (d) 7, (e) 10, and (f) 20min. for Specimens K1, K2, K3, K4, K5, and K6, respectively.



(a) Sp. L1, 1min	(d) Sp. L4, 7min
(b) Sp. L2, 3min	(e) Sp. L5, 10min
(c) Sp. L3, 5min	(f) Sp. L6, 20min

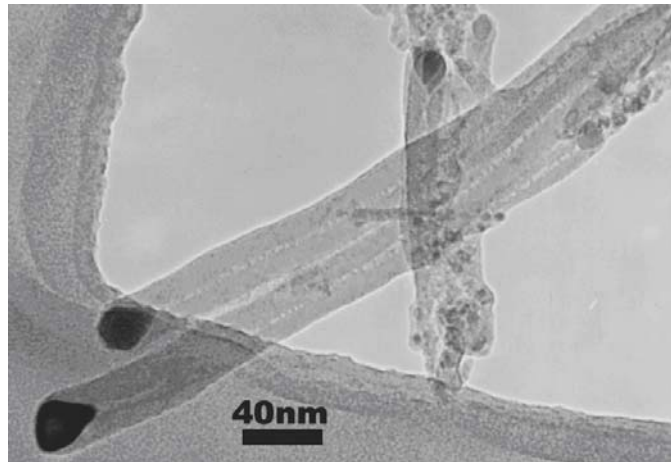
**Fig. 4-20** SEM morphologies of the as-deposited Ni-assisted nanostructures with  $H_2/CH_4=100/0$  (sccm/sccm) under different process times: (a) 1, (b) 3, (c) 5, (d) 7, (e) 10, and (f) 20min. for Specimens L1, L2, L3, L4, L5, and L6, respectively.



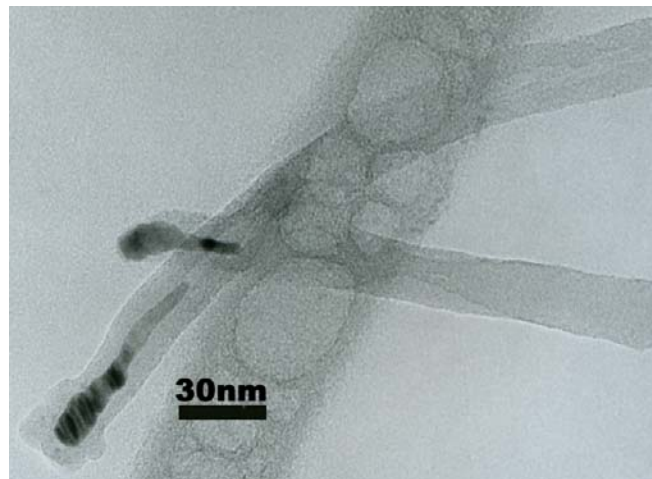


(a) Sp. M1, 1min	(d) Sp. M4, 7min
(b) Sp. M2, 3min	(e) Sp. M5, 10min
(c) Sp. M3, 5min	(f) Sp. M6, 20min

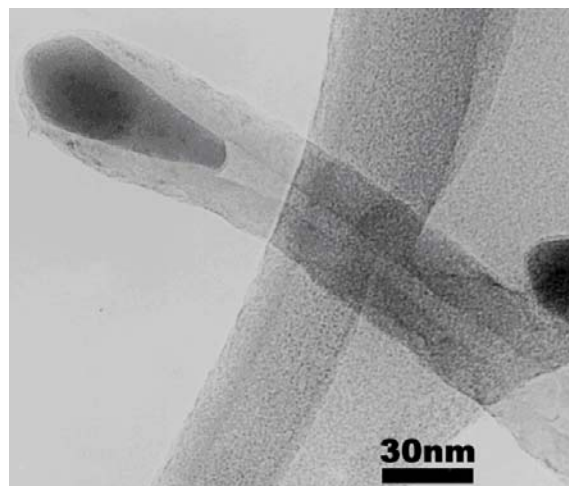
**Fig. 4-21** SEM morphologies of the as-deposited Fe-assisted nanostructures with  $H_2/CH_4=100/0$  (sccm/sccm) under different process times: (a) 1, (b) 3, (c) 5, (d) 7, (e) 10, and (f) 20min. for Specimens M1, M2, M3, M4, M5, and M6, respectively.



**Fig. 4-22** TEM image of the as-deposited Co-assisted carbon nanostructures for Specimen H5.



**Fig. 4-23** TEM image of the as-deposited Ni-assisted carbon nanostructures for Specimen I5.



**Fig. 4-24** TEM image of the as-deposited Fe-assisted carbon nanostructures for Specimen J5.