

# Controlling the shape of a carbon nanotube by using the reaction chamber pressure

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**Abstract:** We report the effects of the reaction chamber pressure on the shape and the structure of vertically aligned carbon nanotubes (CNT) grown on a Ni catalyst by using dc plasma enhanced chemical vapor deposition system. By controlling the pressure of the reaction chamber we were able to alter the shape and the crystallinity of CNTs. With increasing the chamber pressure, the length was rapidly reduced from 4.5  $\mu\text{m}$  to 800 nm, but the crystallinity was strongly enhanced. As the reaction chamber pressure decreases, the tips of the CNTs were observed to change from a hemispherical tip with one conical Ni particle to a distorted tip with more than one tiny Ni particle which means that the formation of Ni conglomerates does not only occur during the pretreatment process but also continues during the CNT growth process. These results have further clarified the role of the reactive etching ions in the growth of CNTs.

**Author Keywords:** Carbon nanotubes; DC-PECVD; Length; Pressure; Reactive etching ions

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#### References:

- Iijima, S., (1991) *Nature*, 354, p. 56
- Gibson, C.T., Carnally, S., Roberts, C.J., (2007) *Ultramicroscopy*, 107, p. 1118
- Robertson, J., (2007) *Materials Today*, 10, p. 36
- Rakhi, R.B., Sethupathi, K., Ramaprabhu, S., (2008) *Int. J. Hydrogen Energy*, 33, p. 381
- Kim, H.S., Duy, D.Q., Kim, J.H., Lee, H.J., Yoon, D.M., Shin, S.S., Ha, J.W., Park, C.Y., (2008) *J. Korean Phys. Soc*, 52, p. 1057
- Yudasaka, M., Kikuchi, R., Matsui, T., Ohki, Y., Yoshimura, S., Ota, E., (1995) *Appl. Phys. Lett*, 67, p. 2477
- Cui, S., Scharff, P., Siegmund, C., Schneider, D., Risch, K., Klötzer, S., Spiess, L., Schawohl, J., (2004) *Carbon*, 42, p. 931
- Ebbesen, T.W., Ajayan, P.M., (1992) *Nature*, 358, p. 220
- Bower, C., Zhou, O., Zhu, W., Werder, D.J., Jin, S., (2000) *Appl. Phys. Lett*, 77, p. 2767
- Tu, Y., Huang, Z.P., Wang, D.Z., Wen, J.G., Ren, Z.F., (2002) *Appl. Phys. Lett*, 80, p. 4018
- Lim, S.H., Park, K.C., Moon, J.H., Yoon, H.S., Pribat, D., Bonnassieux, Y., Jang, J., (2006) *Thin Solid Films*, 515, p. 1380
- Yang, J.H., Lee, Y.J., Kim, Y.H., Moon, S.H., Ha, B.H., Shin, Y.S., Park, S.Y., Park, C.Y., (2003) *Jpn. J. Appl. Phys*, 42, p. 6713
- Moon, J.H., Lim, S.H., Park, K.C., Jang, J., Kang, S.G., Bae, W.K., Kim, J.J., Lee, C.H., (2004) *J. Korean Phys. Soc*, 45, p. 1165
- Merkulov, V.I., Lowndes, D.H., Wei, Y.Y., Eres, G., Voelkl, E., (2000) *Appl. Phys. Lett*, 76, p. 3555
- Chung, S.J., Lim, S.H., Lee, C.H., Jang, J., (2001) *Diamond Relat. Mater*, 10, p. 248
- Chhowalla, M., Teo, K.B.K., Ducati, C., Ru- pesinghe, N.L., Amaratunga, G.A., Ferrari, A.C., Roy, D., Milne, W.I., (2001) *J. Appl. Phys*, 90, p. 5308
- Teo, K.B.K., Chhowalla, M., Amaratunga, G.A.J., Milne, W.I., Hasko, D.G., Pirio, G., Legagneux, P., Pribat, D., (2001) *Appl. Phys. Lett*, 79, p. 1534
- Wang, S., Wang, P., Zhou, O., (2006) *Diamond Relat. Mater*, 15, p. 361
- Choi, J.H., Lee, T.Y., Choi, S.H., Han, J.H., Yoo, J.B., Park, C.Y., Jung, T., Kim, J.M., (2003) *Diamond Relat. Mater*, 12, p. 794
- Ferrari, A.C., Robertson, J., (2000) *Phys. Rev. B*, 61, p. 14095
- Merkulov, V.I., Guillorn, M.A., Lowndes, D.H., Simpson, M.L., Voelkl, E., (2001) *Appl. Phys. Lett*, 79, p. 1178
- Baker, R.T.K., (1989) *Carbon*, 27, p. 315