Facile Catalyst Deposition Using Mist for Fluidized-Bed Production of Sub-Millimeter-Long Carbon Nanotubes

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Fluidized-bed chemical vapor deposition (FBCVD) has enabled mass-production of carbon nanotubes (CNTs) [1]. By using spherical ceramic beads as catalyst supports and depositing Fe/AlO_x catalyst on them, we have realized semi-continuous production of sub-millimeter-long CNTs [2,3]. To improve the controllability over catalysts, a new method of catalyst deposition on ZrO_2 beads in fluidized bed by feeding catalyst solution mist is reported. Mist of low-cost $Fe(NO_3)_3$ and $Al(NO_3)_3$ aqueous solutions is supplied and deposited on the beads by using fluidized-bed technology. CNTs of ca. 7 nm in diameter, triple-wall on average, 0.6 mm in length are synthesized with a yield of 16.6 mg_{CNTs}/g_{Beads} (Figures. 1 and 2). These results benefit from the uniform catalysts realized by mist-deposition and proper amount of Al, which is considered to play an important role in controlling the diffusion and aggregation of Fe atoms (Figure. 2). These results indicate that mist deposition will be a facile and effective method toward high-yield production of CNTs.

References

[1] Q. Zhang, et al., ChemSusChem **7**, 864 (2011).
[2] D. Y. Kim, Carbon **6,** 1972 (2011).
[3] Z. Chen, et al., Carbon, 339 (2014).

Figures

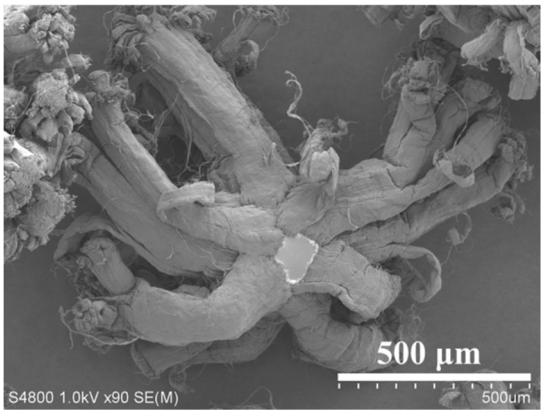

Figure 1: SEM image of CNTs on the beads.

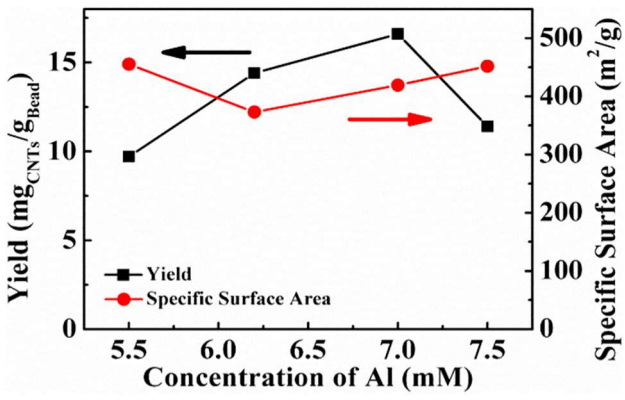

Figure 2: Effect of Al source concentration on the yield and specific surface area of CNTs.