1 & 2DM Conference and Exhibition
January 29-30, 2019

Mochen Li[1]
Risa Maeda[2], Toshio Osawa[2], HIsashi Sugime[3], Suguru Noda[1,2,*]
[1] Waseda Research Institute for Science and Engineering, Waseda University, Tokyo 169-8555, Japan
[2] Department of Applied Chemistry, Waseda University, Tokyo 169-8555, Japan
[3] Waseda Institute for Advanced Study, Waseda University, Tokyo 169-8050, Japan
noda@waseda.jp

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

Abstract
Fluidized-bed chemical vapor deposition (FBCVD) has enabled mass-production of carbon nanotubes (CNTs) [1]. By using spherical ceramic beads as catalyst support and depositing Fe/Al_2O_3 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 water or organic catalyst mist is reported. In the water system, low-cost $Fe(NO_3)_3$ and $Al(NO_3)_3$ aqueous solutions mist is supplied and deposited on the beads. CNTs of 5-10 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). Besides, quick deposition of catalysts are realized by feeding aluminium isopropoxide and ferrocene ethanol solution mist. CNTs with 0.5 mm in length are synthesized with a yield of 17.0 mg_{CNTs}/g_{Beads}. These results indicate that mist deposition to be a facile and effective method toward high-yield produciton of CNTs.

References

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

Figures

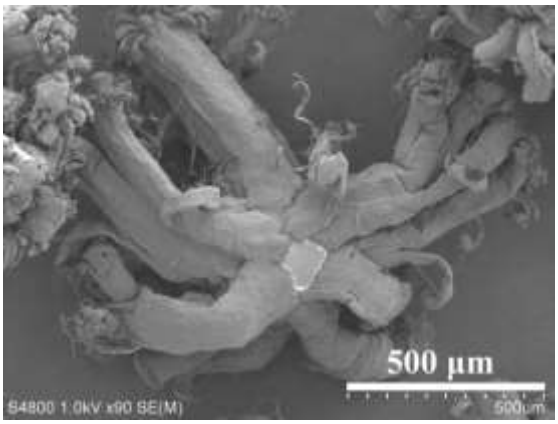

Figure 1: SEM image of CNTs on the beads.

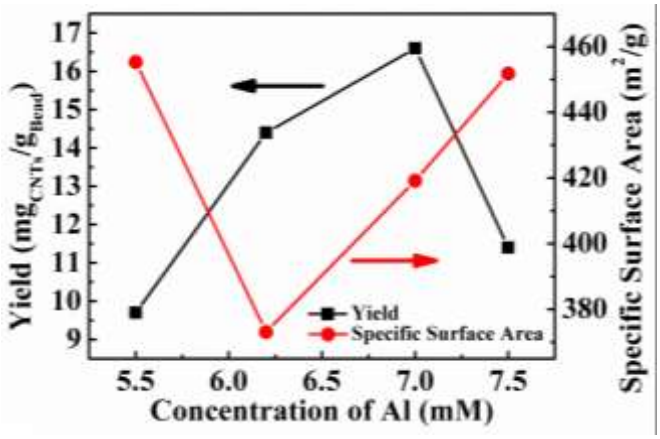

Figure 2: Effect of Al source concentration on the yield and specific surface area of CNTs.