

SYNTHESIS OF CARBON NANOFIBER BY SOLVOTHERMAL METHOD

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Carbon nanotubes(CNT) and carbon/graphitic nanofibers(CNF) have the different structural features. The main difference between them consists in the lack of a hollow cavity for the nanofibers.

These nanostructured carbon materials have found their applications for field emitter, fuel cell electrode, electronic device, sensor, electromagnetic absorber, etc. Especially, The CNF can be expected to play an important role in catalyst supports for fuel cell electrode and chemical reaction [1]. Developing various nanostructured carbon materials at low cost can further expand these applications. Thus far, extensive researches have been made on the CNT synthesis techniques, such as arc-discharge, laser ablation, thermal chemical vapor deposition, pyrolysis using ferrocene, and plasma enhanced chemical vapor deposition (CVD).

In this research, we will introduce the unique synthesis method of CNF from liquid phase carbon source by a solvothermal treatment. The Co metal (ex. Co, Ni, Fe) nanoparticles as the seeds of CNF were prepared from cobalt (\square) acetate tetrahydrate and Na metal. Some reaction aids were also added for formation and dispersion of the Co nanoparticles. On the other hand, diphenyl ether as a source of CNF growth was applied for the solvothermal reaction.

The reaction conditions, such as temperature, time, and concentration of reactants were investigated. Actually, the CNF was prepared at as low temperature as $450\square$ for 1h. The CNF with diameter of about 10 nm was confirmed by HRTEM as shown Fig. 1. It was found that the platelet - structured CNF was synthesized.

As a result of Raman spectrum in Fig. 2, it showed two characteristic Raman band at $\sim 1350\text{cm}^{-1}$ (D band) and $\sim 1595^{-1}$ (G band). The G band indicates original graphite feature, but the D band has been explained as disorder features of carbon structure. The synthesized CNF showed the good thermal stability at $400\square$ for 3h in air.

References:

[1] Philippe Serp, Massimiliano Corrias and Philippe Kalck, "Review; Carbon nanotubes and nanofibers in catalysis," Applied Catalysis A: General, 253 (2) 337-358 (2003)

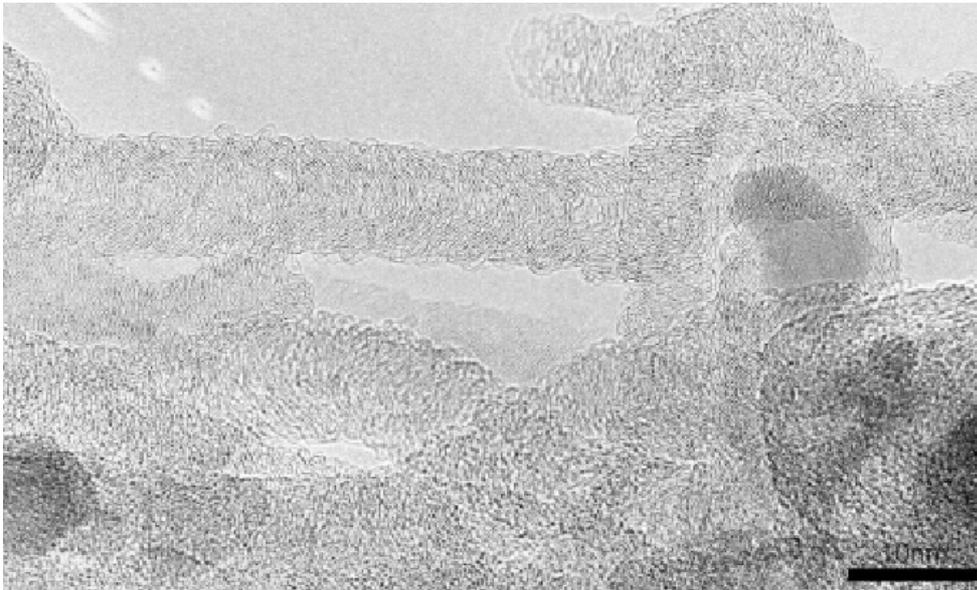


Fig.1 HRTEM photograph of carbon nanofibers (CNF) synthesized by solvothermal method at 450°C for 1h.

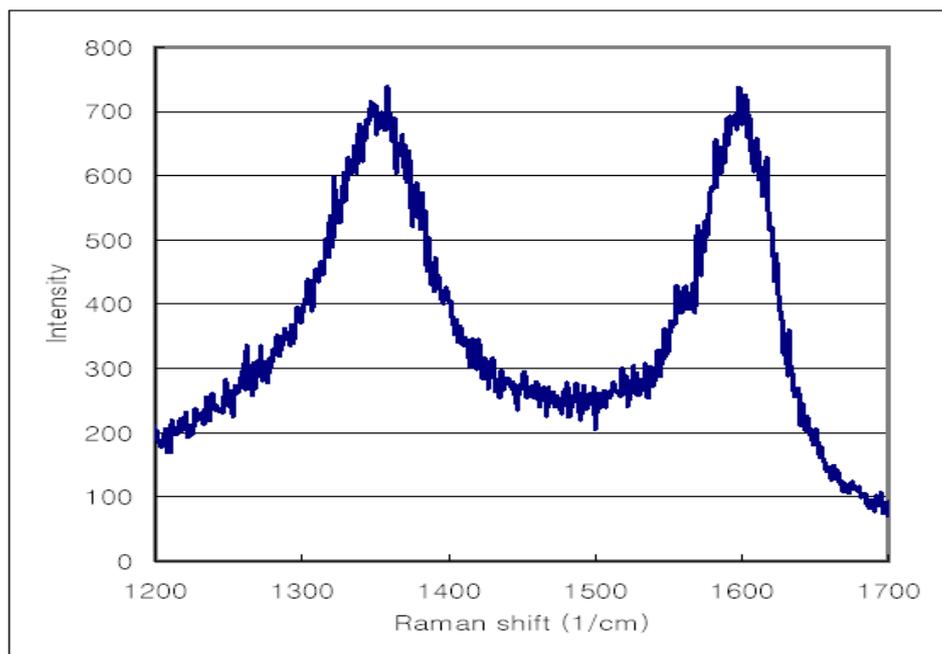


Fig. 2 Raman spectrum at room temperature of the synthesized CNF.