The effect of the changing temperature and catalyst on the growth of Carbon Nanotubes

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We have conducted two types of experiments in order to study the growth of carbon nanotubes synthesized through the method of chemical vapor deposition (CVD) of methane (CH₄). In the first experiment, the synthesis process will use MgO supported type catalyst of FeCl₂/(NH₄)₂MoO₄ with mass ratio Fe:Mo of 9:1 at the temperatures of 700 °C, 800 °C, 850 °C, 900 °C, and 1000 °C. In the second experiment, MgO supported type of FeCl₂ alone was used as catalyst with all the other parameters remaining the same. The objective is to observe and study the temperature dependence of nanotube growth, and specifically, whether or not the temperature would affect the diameter and the quality (smoothness) of the tubes. In addition, samples from the two experiments will be compared in order to find the effect of adding Molybdenum to the catalyst, making it bimetallic, on the growth of the tube.
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Introduction
Much research has gone into Carbon nanotubes (CNTs) in recent years. This is due to its excellent mechanical properties as well as extreme electrical and thermal conductivity resulted from its unique long, thin, cylindrical structure. These potentials allow it to be used in diversified fields such as aerospace, automobile, and construction materials applications. However, since the properties of CNTs depends greatly on its chirality and diameter, different structure tubes are required for different applications. Furthermore, since chirality has a closed relation to the diameter, by controlling the diameter we are able to control the chirality of CNTs as well. Therefore methods of controlling the diameter are essentially required. In this study, we explored the effect of temperature and bimetallic catalyst on the growth of CNTs, in particular, the diameter and the quality (smoothness) of CNTs.

Synthesis Method
Carbon Vapor Deposition (CVD)

Characterization Method
Raman Spectroscopy
TG-Thermogravimetry
SEM-Scanning electron Microscope
TEM-Transmission electron Microscope

Conclusions
•Temperature during the synthesis process has an effect on the growth of CNTs as with higher temperature resulting CNTs to grow with more defects.
•Lower temperature favors the growth of smaller diameter CNTs as well as single and double walls CNTs.
•The effect of adding Mo to the catalyst on the growth of CNTs is undetectable.

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