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Gas-Phase Purification of Carbon Nanotubes Using H_2S and O_2 Mixture

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H_2S-O_2 혼합기체를 이용한 탄소나노튜브의 정제

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Since carbon nanotubes were first synthesized by Iijima in an arc discharge in a presence of a transition metal catalyst, they have have received much attention because of their fascinating electronic and mechanical properties. The proposed future applications of this unique material include a good conductor, quantum wires, nano-devices, field effect transistors, nanoprobes, energy storage or conversion, and many others. However, the carbon nanotubes produced by arc discharge, laser in a presence of a transition metal catalysis, pulsed laser vaporization, catalyst-assisted decomposition, and chemical vapor deposition methods generally contain large amount of impurities such as graphite, amorphous carbon and catalytic metal particles, resulting in a serious impediment for their detailed characterization. These impurities thus have to be removed for further physica and chemical processing.

In this work, we present a simple and efficient method for purification of single- and multi-wall carbon nanotubes produced by arc discharge. In order to eliminate catalytic metal particles, 3 M HCl solution was used. Hydrogen sulfide and oxygen mixture was to used to remove amorphous carbon and carbon nanoparticles. After purification, the purified nanotubes were examined by SEM (scanning electron microscopy), EDX (energy dispersive X-ray analysis system), and by Raman spectroscopy.

It was found that hydrogen sulfide plays a role of enhancing the removal of unwanted carbon particles as well as controling the oxidation rate of oxygen with carbon. We obtained high purity (> 95%) and high yield (30-60%) with the gas-phase purification using the H_2S-O_2 mixture. We believe that this method is simple and very effective to preferentially remove amorphous carbon and carbon particles.

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