

세라믹 비드를 이용한 단일벽 탄소나노튜브의 기상산화 정제
Purification of Single-walled Carbon Nanotubes Using Ceramic Beads
in Gas Phase Oxidation

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Impurities such as a metallic catalyst, amorphous carbon, and graphitic nanoparticles usually come together with single-walled carbon nanotubes (SWCNTs) upon their synthesis. Such impurities have been purified in most cases by gas and liquid phase oxidations, during which SWCNTs might be also damaged. This study developed a novel process of gas phase oxidation that ceramic beads were mixed together with SWCNT soots to increase their surface area exposed to reactant gases during the oxidation process. Here, SWCNTs produced by arc discharge were packed into a vertical quartz tube together with zirconia (ZrO₂) beads having different diameters of 1~10 mm. SWCNTs were characterized by using scanning electron microscopy, thermogravimetric analysis, and Raman spectroscopy. The preliminary results showed that the gas phase oxidation using smaller diameters of ZrO₂ beads gave larger weight loss, better morphologies, and higher crystallinity of SWCNTs, compared with the ones oxidized without beads. Subsequent to removing part of amorphous carbon via gas phase oxidation, SWCNTs were treated with a nitric acid to eliminate the metallic catalyst. SWCNTs were thereafter subject to the second gas phase oxidation at high temperature for a short time to further remove the remaining amorphous carbon as well as the residues produced by the acidic treatment, finally producing a highly pure SWCNTs.