Selective Removal of SWNTs of Certain Diameter Assisted with Light Irradiation

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We have shown that removing single-wall carbon nanotubes (SWNTs) of a certain diameter is possible by selecting a light wavelength corresponding to the gap energy of the SWNTs [1]. SWNTs with a diameter of about 1.2 and 1.33 nm could be selectively removed when they were treated with hydrogen peroxide and irradiated by light with a 488- or 514-nm wavelength, respectively. In this report, we use the latter wavelength light to assist in oxidizing SWNTs with hydrogen peroxide for selectively removing them. UV-VIS-NIR absorption, fluorescence, and Raman spectra were used to evaluate this result.

The primary results showed that certain SWNT structures were removed by using different wavelength lights. When a light of 450-550 nm was used, UV-VIS-NIR spectra on SWNTs showed that the intensities of several peaks in a range of 1372-1620 nm wavelength, which correspond to diameters of about 1.15 nm, largely decreased compared with that treated without light irradiation. For example, the intensities of peaks at about 1375 and 1496 nm, which probably correspond to the structures of SWNTs with (11, 6) and (12, 4), were decreased. The fluorescence spectra also showed similar results. Raman spectra showed that their breathing mode peak corresponding to about 1.2 nm diameter SWNTs almost disappeared completely.

These new experimental results give stronger support to our previous conclusion: light assisted oxidation is an effective way to remove a certain diameter of SWNTs electively.

[1] M. Yudasaka, M. Zhang, and S. Iijima, Chem. Phys. Lett., 374 (2003) 132.

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