Modified Carbon Nanotubes: A New Technology to Attachment of TiO_2 Nanoparticles

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A new technology to modify Multi-Wall carbon nanotubes (MWNTs), TiO_2 nanoparticles were attached to the nanotube and locations of functional groups were further confirmed. Using synchrotron radiation source develops of sol-gel solutions for the formation of TiO_2/MWNTs hybrid material. The surface properties of MWNTs could be change by intensity or exposure time of X-ray. By X-ray interaction, the MWNTs could be successfully coated with about 15nm TiO_2 nanoparticles. Thus while this approach is envisaged to be quite challenging, its success will provide new fundamental knowledge and tremendous opportunities for the synthesis of hybrid material. The X-ray absorbation data were collected using synchrotron radiations at NSRRC 17C1 W20 beam lines. Material synthesized to achieve in the 01A1 SWLS. The X-ray irradiation step as shown in Figure 1.

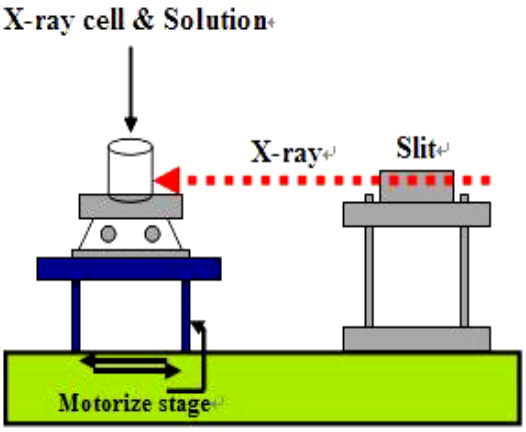

Figure 1. The schematic diagram of the synchrotron X-ray irradiation setup.

For a more detailed microstructural characterization HRTEM investigations were carried out. Figure 3 presents MWNTs coated with nanoparticles of TiO_2 after X-ray exposure during 1h. It is obvious that the nanosized TiO_2 particles were coated onto the surface of the MWNTs. The amount of TiO_2 is increase with long exposure time. The thickness of TiO_2 layer on the MWNTs was found to be around about 5-15 nm on average. So the TiO_2 coated onto MWNTs might lap over together and from layer which is thicker than the particle size of the TiO_2.

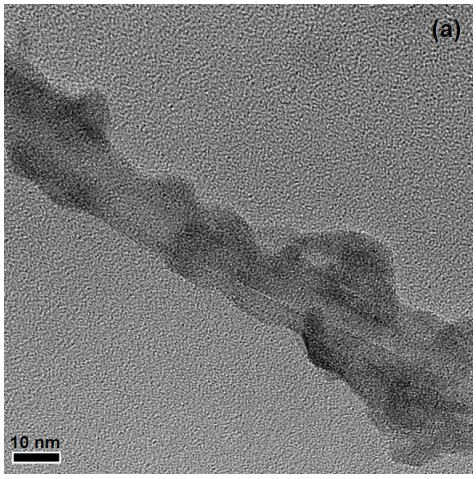

Figure 3. HRTEM micrographs of MWNTs coated with TiO_2 after 1 hour X-ray exposure.

Anatase and rutile phases show three weak preedge peaks in XAS, indicating an octahedral symmetry of Ti cation surrounded by six O anions. In the postedge region, the resonance patterns of the absorption coefficient for anatase and rutile TiO_2 are somewhat different. Figure 4 shows the resonance at ca. 4.94 to 5.04 KeV in the rutile phase is not present in anatase structure. A weak but clear shoulder peak appeared next to the main preedge peak, which could be interpreted as the third peeedge peak of anatase.

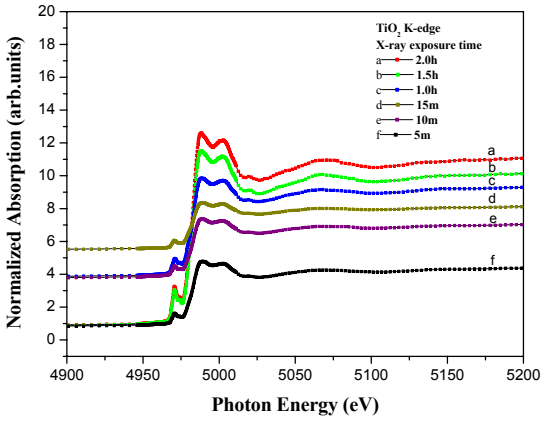

Figure 4. The XANES spectra of the crystalline anataseTiO_2.