UE05

Nickel decoration on multi-walled carbon nanotubes using multi-step impregnation method

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Introduction

Hydrogen is one of the cleanest and idealized energy sources. Hydrogen storage is widely recognized as a critical enabling technology for the successful commercialization and market acceptance of hydrogen powered vehicles. Kim and co-workers reported 6 wt% nickel nanoparticle-dispersed multi-walled carbon nanotubes (MWNTs) released 2.8 wt% hydrogen amount [1].

Experimental

In order to decorate nickelparticles on MWNTs, 0.5 g of MWNTs treated with acids [2] was immersed in 110 mM nickel nitrate solution of 20 ml. These solutions were sonicated for 1 h at room temperature for good dispersion. Each sonicated solution was evaporated in oil evaporator until solution was perfectly vaporized. After vaporization, vaporized powder was dried at 383 K overnight.On the other hand, 0.5 g of MWNTs immersed into 22 mM nickel nitrate solution. Other procedures were same described as above. 5 times for same loading amount of nickel were repeated in series. After drying, the samples were reduced in flowing 5 % He/Ar as the reducing gas, during which reduction conditions were first heated by 5 K/min up to 773 K and kept for 3 h, respectively.

Results and Discussion

As shown in Fig. 1(b), in case of Ni-MWNTs (10-5), small nickel particles were observed in the inner wall of MWNTs. This is very interesting results. On the study of hydrogen storage on carbon nanotubes, many researchers tried to use the inner space of MWNTs to store hydrogen. Also, Kim and co-workers suggested that nano-sized nickel particle were more efficient to store hydrogen on MWNTs [2]. This result suggests that impregnation method using low nickel concentration through several times can penetrate nickel oxides into the inner wall.

(a) (b)

Fig. 1. TEM images decorated with nickel.

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UE06

Self-assembly multi-layer fabrication and photochromism using diazonium resin and spiroxazine compound

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Recently, the fabrication of self-assembled ultrathin film has received considerable interests due to their importance for nanostructured materials with tailored structures and properties [1]. The layer-by-layer self-assembly method, initially developed with the use of a pair of oppositely charged polyelectrolytes, is a facile and a versatile technique that has recently emerged as a viable approach to prepare ultrathin films in large application areas. In this study, we described the preparation of diazonium resin and photochromic spiroxazine derivative in fabrication of multi-layers [2].

Firstly, the diazonium resin layer having positive charge was presented on the negatively charged substrate, which occurred by electrostatic forces. Secondly, the substrate having positively charged diazonium resin was dipped into the solution containing negatively charged PSS (poly(sodium-4-styrene)sulfonate). Finally, a negatively charged substrate was then dipped into positive spiroxazine derivative aqueous solution. This preparation process was repeated until the desired number of the multi-layers was achieved. The fabrication of diazonium resin, PSS and spiroxazine dye compound is schematically illustrated in Fig. 1.

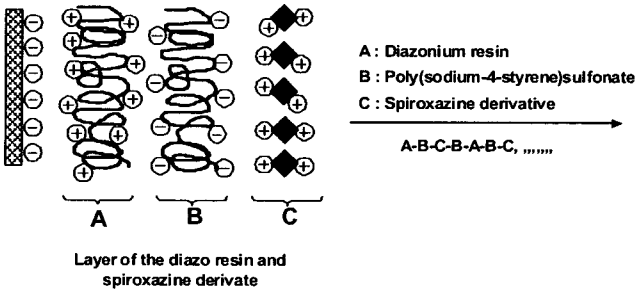

Fig. 1. Scheme of the self-assembled fabrication multi-layers.

As shown in Fig. 1, the self-assembled multi-layers caused by electrostatic forceswere formed on the surface. The gradual growth of the layers formed by successive adsorption of diazonium resin and spiroxazine dye derivative was examined by UV-vis spectrophotometer.

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