THE SERS SPECTROSCOPY OF SINGLEWALLED CARBON NANOTUBES AND POLY VINYL ALCOHOL COMPOSITES

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Abstract: Thin films of Singlewalled carbon nanotubes-poly vinyl alcohol composites (SWCNTs-PVOH) were produced. In order to obtain information on the possible interactions between these two materials, we characterize the composites by the surface enhanced Raman scattering (SERS). We discussed the interaction mechanism between SWCNTs and PVOH.

The discovery of carbon nanotubes [1] has encouraged many studies about their properties and potential applications. Their mechanical and electrical properties make them attractive for new materials. Recently, composites such that nanotubes were dispersed in a polymer matrix attract more interesting.

In this paper, the films of singlewalled carbon nanotubes-poly vinyl alcohol (SWCNTs-PVOH) composites were produced. We got the SERS spectrum using the rough surfaces of noble metals silver sheets as the substrates. Then we mainly discuss the interaction mechanism between SWCNTs and PVOH by the SERS spectrum.

A chemical treatment described elsewhere [2] was used to produced an electrostatically stabilized dispersion of SWCNTs in water. Rough surfaces of noble metals silver substrate were obtained through nitric acid eroding methods. The composites SWCNTs-PVOH were made according to the paper [3]. Considering the stiffness and conductivity of the composites film [3], we made the samples with 40wt% SWCNTs loading.

The SERS spectrum of the PVOH, SWCNTs and SWCNTs-PVOH composites at 1064nm excitation wavelength are presented in Fig.1. The Raman peaks of the SWCNTs are clearly observed in the SWCNTs-PVOH spectrum, but they shift toward the higher frequencies compared to the peaks of the pure SWCNTs (Table 1.). The PVOH peaks do not appear clearly in the composites.

The phenomenon indicates that the SWCNTs are influenced by the PVOH environment. PVOH can insert SWCNTs cluster, the diameter of the tube become larger. Pressure impressed on the wall make the vibration frequency of SWCNTs increase, so the SERS peaks shift toward the higher frequencies. The PVOH peaks do not appear clearly in the composite because of its low intensity.

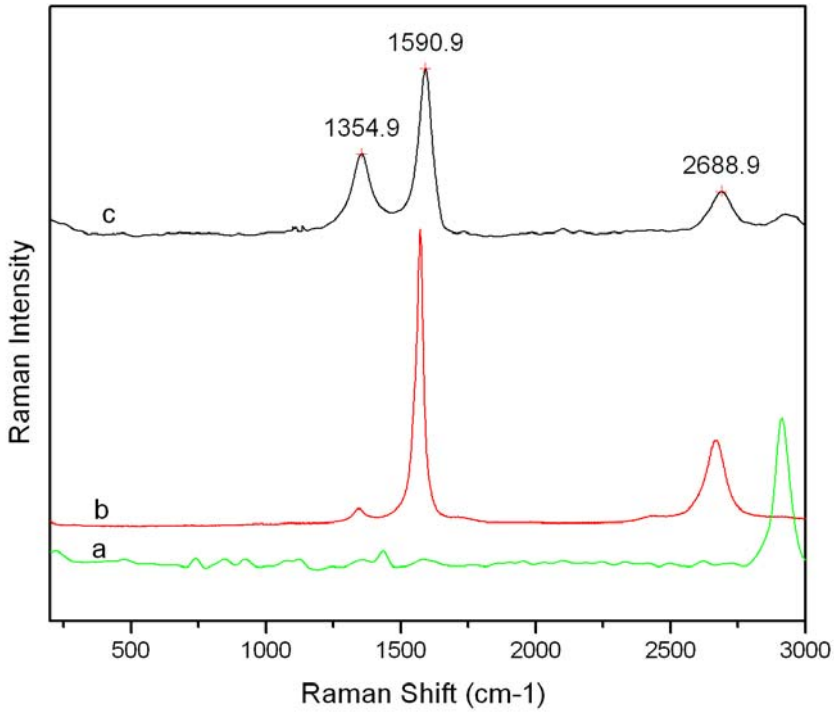

Fig.1. SERS spectrum of (a) the PVOH; (b)SWCNTs and (c)SWCNTs-PVOH composites.

Table 1. The SERS characteristic peaks of SWCNTs and SWCNTs-PVOH composites

SWCNTs(cm^{-1})	SWCNTs-PVOH(cm^{-1})	Shift(cm^{-1})
1345	1354.9	about 9.9
1580	1590.9	about 10.9
2671	2688.9	about 17.9

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