

THE CARBON NANOTUBES VALENCE BAND X-RAY SPECTRAL INVESTIGATION

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Introduction

The electronic states energy distribution in multiwall carbon nanotubes (MWNT) were studied by means of the ultrasoft X-ray spectroscopy. The investigated MWNT were obtained with different catalyst before and after purification. The carbon nanotubes with different walls number were also studied in the work framework.

Results and discussion

It was elucidated that spectra of refined and unrefined nanotubes produced over Ni catalyst are practically identical. At the same time $CK\alpha$ -bands of MWNT obtained over Fe catalyst some differences revealed. The spectra of nanotubes with Co are greatly differed one from another (fig. 1).

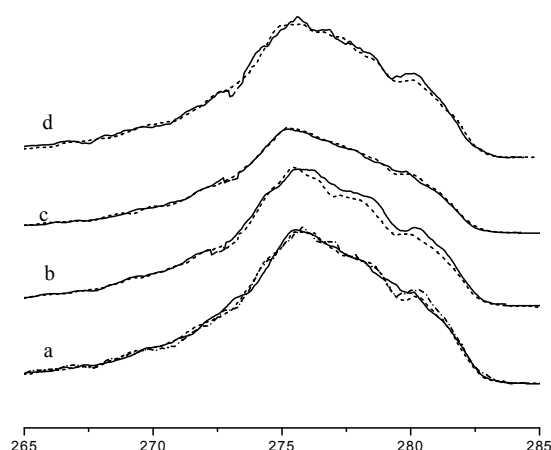


Fig. 1 – The MWNT spectra comparison:
a) with high content of metal
11% Co (- - -) , 30% Ni (- . -), 33% Fe
(- - -).
And also refined (- - -) and unrefined
(- - -) MHT
b) with Co; c) with Ni; d) with Fe;

It was established that the valence Cp -electrons energy distribution reflected in refined nanotubes bands high-energy part retained the strains with their obtained during MWNT synthesis over a different catalyst (Co, Ni, Fe).

The $CK\alpha$ -emission bands nanosize narrowing was elucidated under transition from multiwall carbon nanotubes with more than 200 walls ($n > 200$) to nanotubes with $n < 10$ (fig. 2).

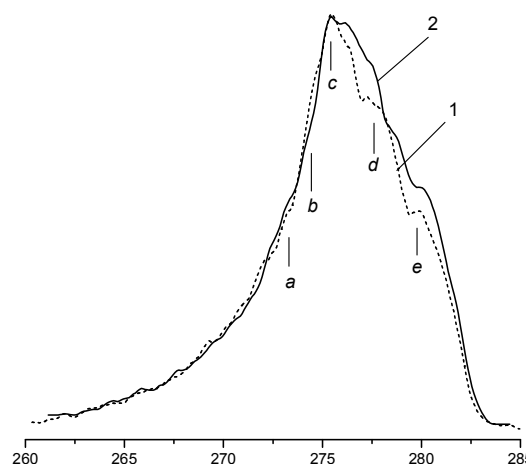


Fig. 2 – The MWNT spectra comparison
(1) – $n < 10$, (2) – $n > 200$

Conclusions

The metal-catalyst removal from nanotubes leads to contribution of valence electron of degenerated Cp -states which didn't take part in bonds owing to vacancies formation increase. The nanotubes walls number decrease leads to substantial redistribution of highenergy electronic states in consequence of p_z -states that didn't take part in π -bonds number increase.

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