PROGRAM SCHEDULE

CARBON 2019
LEXINGTON, KY

JULY 14 - 19

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FABRICATION OF COMPOSITE MATERIAL BASED ON MULTIWALL CARBON NANOTUBES OBTAINED ON DIATOMITE SUBSTRATE

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Introduction

Diatomite is a silicon dioxide mineral containing fossilized skeletal remnants of one-cell water plants called diatom algae. Due to a number of significant advantages as high specific surface area, easy regeneration, the price, availability, it can be used in various industries.

At the presented work, diatomite mineral was used as a matrix for growth of multiwalled carbon nanotubes. For synthesis of carbon nanotubes, there is used the method of chemical catalytic vapor deposition (CCVD) from the gas phase. The propane-butane gas mixture was used as a gaseous carbon source. Argon gas was used as an inert carrier gas. Nickel nitrate was selected as an accelerator in order to obtain carbon nanotubes. To optimize the catalyst particles, diatomite was heated with nickel nitrate at 400-500°C.

The multiwall carbon nanotubes obtained in various temperature from 650°C up to 800°C.

Experimental

Carbon nanotubes were synthesized by chemical catalytic vapour deposition (CCVD) method. Propane-butane mixture was used as a carbon-containing gas, and diatomite was used as a matrix. The diatomite was preliminary saturated with an alcoholic solution of nickel nitrate followed by drying in oven. The CCVD process consists of furnace with a quartz tube of 35 mm in diameter and 450 cm in length. The middle part of the reactor can be heated to 1000°C.

The temperature was measured by thermocouple (chromel–alumel). The process of growth was carried out by catalytic decomposition of a propane-butane mixture on the surface of diatomite.

Results and discussion

The Raman spectra of obtained CNT showed four characteristic peaks: D band at about 1360 cm^{-1}, G band at 1580 cm^{-1}, 2D (G') band at 2710 cm^{-1} and D+G band (also assigned as D+D') at about 2930 cm^{-1}. D band point out the existence of defects in the MWCNT sample, like carbon impurities with sp^3 bonding or dangling sp^2 bonds at the edges. The existence of G band was due to sp^2 graphitic nature of obtained sample and full width at half maximum (FWHM) point out crystallinity of the MWCNT. 2D band is bound with the long-range order in a sample mainly along the crystallographic c-axis and also ensure information on the number of walls. The 2D peak emerge from the two-phonon second order scattering process that results in building of an inelastic phonon [1]. No defects are necessary for its activation. While D+G band is combination of phonons with varied momenta and thus it requires a defect for its activation [2-3].

Obtained MWCNTs were characterized by Raman scattering method using 473 nm laser at the National Nanotechnology Laboratory of Open Type, al-Farabi Kazakh National University.

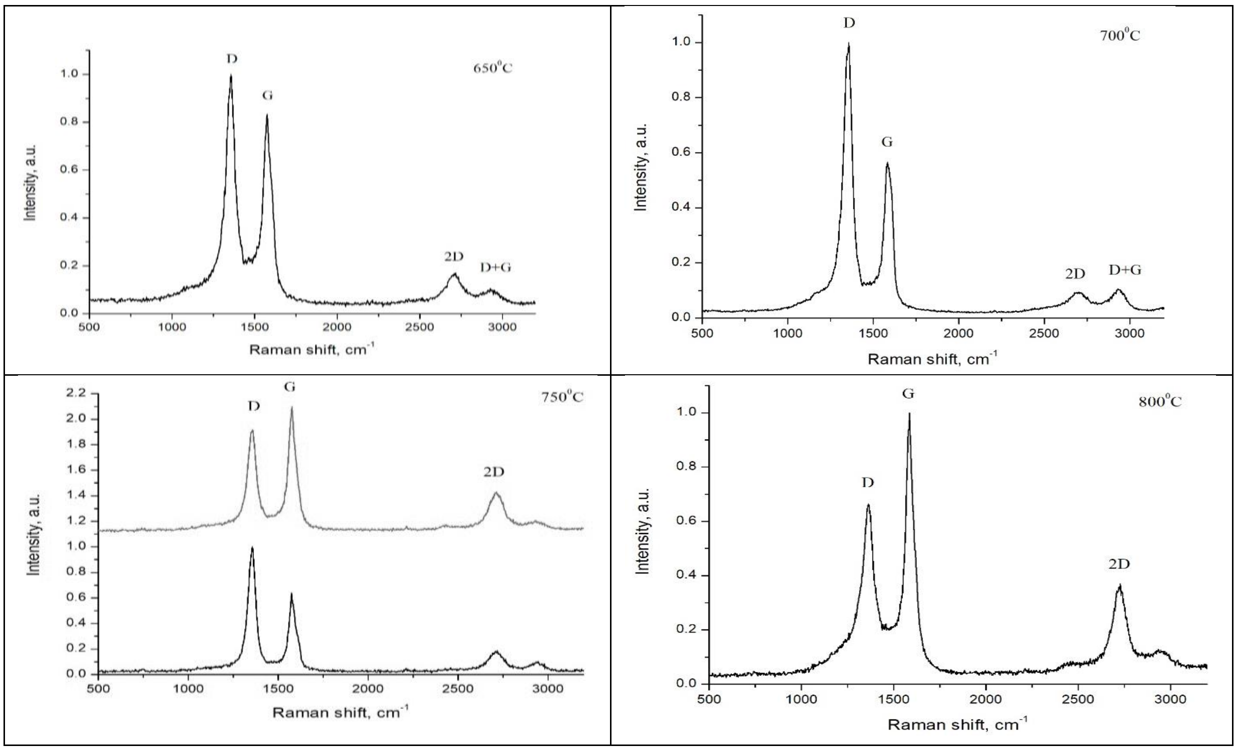

Fig.1. Raman spectra of MWCNTs synthesized on diatomite at different temperatures

Conclusions

Natural diatomite was used to synthesize multiwall carbon nanotubes. The obtained samples were analyzed by Raman spectroscopy. It was shown that the quality of MWCNT strongly depends on the synthesis conditions and the crystallinity and diameter of nanotubes increase with increasing temperature.

Acknowledgements

The work was supports by a grant from the Ministry of Education of the Republic of Kazakhstan: AP AP05133836 "Obtaining nanostructured materials based on diatomite for water purification".

References

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