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The World Conference on Carbon

Madrid, SPAIN, July 1st-6th

Book of Abstracts

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Carbon 2018

The World Conference on Carbon

July 1st (Sun) - 6th (Fri), 2018

Madrid Marriott Auditorium Hotel & Conference Center
Madrid, Spain

DIATOMITE: AN EMERGING BIOMATERIAL WITH HIRARCHIRAL POROUS STRUCTURE IN NANOTECHNOLOGY AND ITS APPLICATION IN SYNTHESIS OF MULTIWALLED CARBON NANOTUBES BY CHEMICAL VAPOR DEPOSITION METHOD

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Introduction

Nature is a unique developer of biomolecular mechanisms and processes of assembling biocompatibility that can generate a variety of biomaterials with a set of functional properties superior to artificial production technologies.[1] This natural molecular self-assembly process is able to create the unique biological structures with high accuracy and reproducibility.

One of them amorphous silicon dioxide, which called diatomite is one of the most impressive examples of biologically self-assembling received nanostructured materials. Fossilized diatom silica (diatomite) is a raw material made by biomineralization process from diatom algae that have the ability to generate a highly ornamented, fanciful and elegant porous silica cell wall, known as the frustule.[2]

Thanks to following properties, such as low density, high porosity, high surface area, inertness, absorptive capacity, diatomite has a wide variety of uses. Furthermore, these properties have been led to applications as adsorbents, as filters, but nowadays through the year, applications of diatomite have gone for beyond just filters and adsorbents. For example, it suggested that diatomite with centric metalized structures have been used as a nanostructured substrates and catalytic support.[3]

So, in this current work, diatomite was applied as an alternative catalyst carrier for the synthesis of MWCNTs, because of high surface area of pores that could retention capacity of the deposited catalyst. MWCNTs were synthesized on catalyst system prepared by impregnation of Co particles on to diatomite substrate. A new approach for obtaining MWCNTs by using silica diatomite has been developed and employed.

Materials and Methods

Diatomite rock has obtained from Aktobinsk region of western Kazakhstan.

1 M catalyst solutions of $NiNO_3 \cdot 6H_2O$ and $Co(NO_3)_2 \bullet 6H_2O$ were made by dissolving each analytically graded salt in a certain amount and then diluted to a proper volume with methanol.

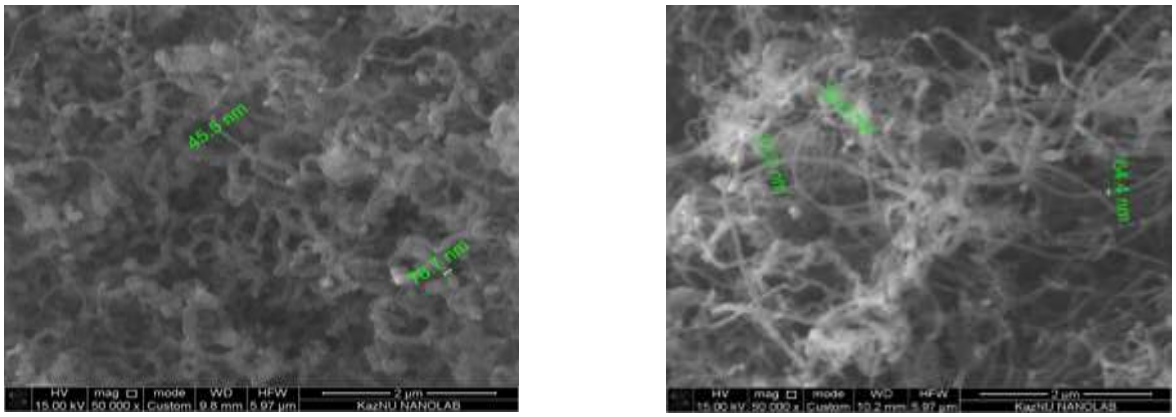
In a typical route, appropriate amount of diatomite was placed in a Petri dish; small amount of catalyst solution was poured into it. Final mixture of diatomite and metal particles was dried at room temperature.

Synthesis is carried out by Chemical vapour deposition method in the reactor which was composed a horizontal quartz tube with a ceramic boat in it. While synthesis process, for making inert environment, argon gas and as a carbon source, the propane stream was used at 800 °C.

Results and Discussion

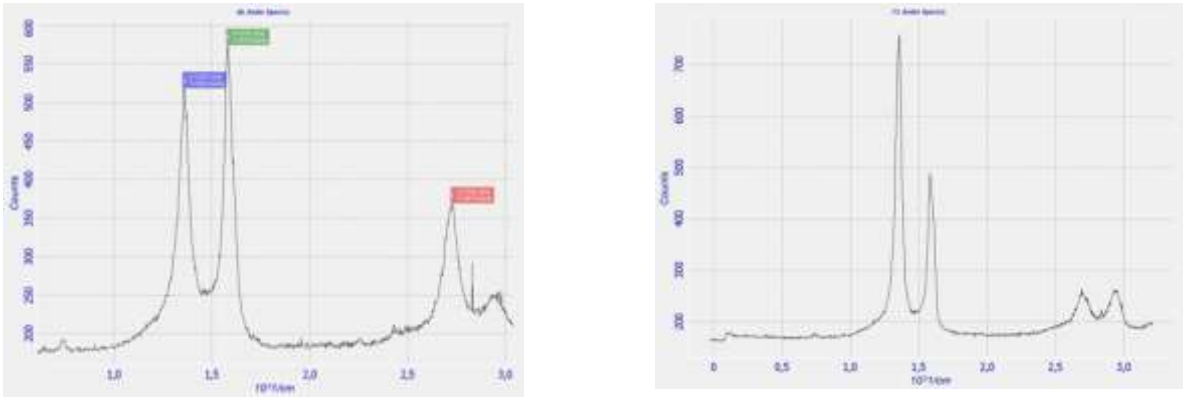
According to scanning electron microscope images, the diameter of MWCNTs on Co catalyst/

diatomite substrate at 800 °C was ranged of 45-80 nm (Figure 1a) and MWCNTs on Ni catalyst/diatomite was ranged of 30-75 nm.



a b

Figure 1. The SEM images of (a) MWSNTs on (a) Co and (b) Ni /diatomite based substrate at 800 °C



a b

Figure 2. Raman spectrums of the CNTs prepared on diatomite by using (a) Co based diatomite substrate and (b) Ni based diatomite substrate.

Raman spectroscopy is considered to be a very good method for proves of CNTs presence. In both case the position G of the peak in the range 1570-1580 cm^{-1} is characteristic for carbon nanostructures of the graphite group, and the shift to the low-frequency region is most characteristic of carbon nanotubes (Figure 2a,b). The increase in the intensity of the 2D peak in the region 2710-2715 cm^{-1} indicates an increase in the orderliness of the structure of the material.

Conclusions

In this work, a novel approach was developed for synthesis MWCNTs on diatomite supported catalytic system by CVD method. According to Raman shifts, samples obtained on nickel practically do not contain an amorphous phase, which is expressed in the small width of the main Raman peaks. In addition, the ratio of the intensities of the peaks I (2D) / I (G) is much higher, compared with the spectra of the samples on cobalt, which indicates a fairly high degree of ordering of the sp^2 carbon structure under investigation.

References

1. Kroger N., Bunner E. (2014). Complex-shaped microbial biomineral for nanotechnology. WIREs Nanomed Nanobiotecnol 6, 615-627

2. Xiao W.S., Yu X. Zh., Dusan L. (2017). Diatom silica, an emerging biomaterial for energy conversion and storage. *Journal of Materials Chemistry A* 5, 8847-8859

3. El-Shazly M. Duraia, M. Burkitbaev, H. Mohammedbakr, Z. Mansurov (2009).Growth of carbon nanotubes on diatomite. *Vacuum* 84,464-468