

Holly Verse

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

قال تعالى

وَمَا أَرْسَلْنَا مِنْ قَبْلِكَ إِلَّا رِجَالًا نُوحِي إِلَيْهِمْ فَاسْأَلُوا أَهْلَ الذِّكْرِ إِنْ كُنْتُمْ لَا تَعْلَمُونَ

صدق الله العظيم

سورة النحل الآية 43

Dedication

This research work is dedicated to:

The Soul of my father, my mother, Brothers and Sisters

My teachers, my friends

Acknowledgement

First and foremost I would like to send my great gratitude and thanks to my supervisors Dr. Rawia Abdelgani, and Prof. Dr. Mubarak Dirar Abdalla in the Physics Department, College of Science, University of Science and Technology who were generous with time and provided much needed advices, encouragements, and direction. I would like to acknowledge the contribution of Dr. Abdalsaki Suiman For all time that he was spend in support me, And Dr. Ali Suliman. Also I would like to acknowledge all the friends at College of Science, Sudan University of science and Technology.

Abstract

In this research two types of carbon nanotubes (CNTs) doping by cobalt oxide and carbon nanotubes doping by titanium dioxide were synthesized by chemical vapour deposition (CVD), the main objective of this research was to synthesize and determine structure, morphology and optical properties of carbon nanotubes doping by cobalt oxide (CoO) and titanium dioxide (TiO₂) at different concentrations. Tenth samples of CNTs were prepared, five samples were doped by cobalt oxide at different concentrations (0.5, 0.75, 1.00, 1.25 and 1.50) and other five were doped by titanium dioxide at different concentrations (0.5, 0.75, 1.00, 1.25 and 1.50) in addition to the reference sample. X-ray diffraction (XRD) was used to obtain crystal structure and lattice parameters of samples, Scanning electron microscope (SEM) analysis was used to study surface morphology of the samples. UV-visible used to evaluate the optical parameters. The increasing on concentration on cobalt oxide and titanium dioxide leads to change structure parameter of carbon nanotubes samples (grain size, d-space, density and miller indices), the crystal types for all samples also changed due to concentration and molecular weight for doping element. For the optical properties the maximum value of absorbance is 1.83 (a.u) for CNTs + CoO_(1.5) and the minimum value is 1.002 (a.u) at the same wavelength for reference sample while the maximum value of absorbance is 1.82 (a.u) at wavelength (258) nm for CNTs + TiO_{2(1.5)} and the minimum value is 0.99 (a.u) at the same wavelength for reference sample. CNTs+CoO and CNTs+TiO₂ when to compare with the reference have same value of reflection 0.2 at different wavelengths in red shift because they have the same value of the polarization in different wavelengths. The optical energy band gap decrease with concentration increase according to atomic level convergence and this confirm with XRD results, the value of E_g for reference samples is 4.298 eV, CNTs+Co_(1.50) is 3.613 eV and for CNTs+ TiO_{2(1.50)} is 3.333 eV. Finally, the average diameter of CNTs+CoO decreased from 29.736 nm for CNTs+CoO (0.5

molar) to 13.486 for CNTs+CoO (1.5 molar) and for CNTs+TiO₂ decreased from 45.032nm for CNTs+TiO₂ (0.5molar) to 21.951 nm for CNTs+TiO₂ (1.5molar) while the diameter of reference sample is 51.21 nm, cobalt oxide reduced the average diameter of carbon nanotubes more than titanium dioxide.

المستخلص

في هذا البحث تم تحضير نوعين من انابيب الكربون النانوية المطعمة باوكسيد الكوبالت و المطعمة بثاني اكسيد و ذلك عن طريق الترسيب بالبخار الكيميائي (CVD). الهدف الرئيسي لهذا البحث هو تحضير وتحديد التركيب والتشكيل والخصائص البصرية وحساب اقطار انابيب الكربون النانوية المطعمة باوكسيد الكوبالت وثاني اكسيد التيتانيوم بتراكيز مختلفة. تم تحضير عشرة عينات من انابيب الكربون النانوية ,خمس عينات مطعمة باكسيد الكوبالت بتراكيز مختلفة (0.5,0.75,1.00,1.25,1.5) وخمس عينات اخرى مطعمة بثاني اكسيد التيتانيوم (0.5,0.75,1.00,1.25,1.5) بالاضافة العينة المرجعية. وقد تم استخدام حيود الاشعة السينية للحصول على البنية البلورية ومعاملات الشبكة البلورية للعينات كذلك استخدم المجهر الالكتروني لدراسة التشكيل السطحي واقطار الانابيب النانوية للعينات كما استخدم مطياف الاشعة فوق البنفسجية- المرئية لدراسة الخصائص البصرية للعينات. وجد ان زيادة تركيز اوكسيد الكوبالت وثاني اكسيد التيتانيوم تؤدي الى تغير البنية التركيبية لعينات انابيب الكربون النانوية(حجم الحبيبات ,المسافة بين المستويات الذرية , الكثافة ومعامل ميلر)كما ادى ذلك الى تغير نوع خلية الوحدة الاساسية لجميع العينات وذلك بسبب ان زيادة التركيز والوزن الجزئي لعنصر التطعيم تؤدي الى تقارب المستويات الذرية.

بالنسبة للخصائص البصرية وجد ان اعلى قيمة للامتصاص هي 1.83 وحدة ذرية عند الطول الموجي 220 نانوميتر لـ $CNTs+CoO_{(1.5)}$ بينما اقل قيمة هي 1.002 وحدة ذرية للعينة المرجعية عند نفس الطول الموجي بينما اعلى قيمة للامتصاص هي , 1.82 وحدة ذرية عند الطول الموجي 258 نانومتر لـ $CNTs+TiO_{2(1.5)}$ بينما اقل قيمة هي 0.99 وحدة ذرية للعينة المرجعية عند نفس الطول الموجي.

تملك عينات الكربون النانوية المشوبة باوكسيد الكوبالت وثاني اوكسيد التيتانيوم عند مقارنتها بالعينة المرجعية نفس القيمة للانعكاسية 0.2 وحدة ذرية عند اطول موجبة مختلفة وبانزياح نحو اللاشعة تحت الحمراء.

وجد ان فجوة نطاق الطاقة الضوئية تتناقص بزيادة التركيز وذلك لان التركيز يعمل على تقارب المستويات الذرية وهذا يتفق مع نتائج حيود الاشعة السينية .قيمة فجوة الطاقة للعينة المرجعية هي 4.298 أ.ف و لـ نانوميتر لـ $CNTs+CoO_{(1.5)}$ وبينما لـ $CNTs+TiO_{2(1.5)}$ هي 3.333 أ.ف.

اخيراً ,وجد ان متوسط قطر انابيب الكربون النانوية يتناقص بزيادة التركيز حيث تناقص من 29.673 نانومتر لـ $CNTs+CoO_{(0.5)}$ الى 13.684 نانومتر لـ $CNTs+CoO_{(1.5)}$ و تناقص من 45.032 نانومتر لـ $CNTs+TiO_{2(0.5)}$ الى 21.951 نانومتر لـ $CNTs+TiO_{2(1.5)}$ بينما كان قطر العينة المرجعية 51.021 نانومتر وبالتالي لوحظ ان قطر الانابيب النانوية تتناقص باضافة اوكسيد الكوبالت اكثر من ثاني اوكسيد التيتانيوم.

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