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Title: ***Synthesis and Characterization of Single Wall Carbon Nanotubes and Their Sensor Applications***

Abstract

Nanotechnology may be defined as the investigation, understanding and control of material in the range of 1-100 nm in at least one dimension. At this dimension scale the material shows the novel applications and new physics and chemistry can be generated. Prof. Iijima accidently did a wonderful discovery of carbon nanotubes in 1991. These well–ordered CNTs may be defined as the seamless, hollow cylinders of carbon which are generally made up of graphene sheet. The area of potential application of CNTs widely includes highly sensitive gas sensors, field emission devices, solar cells, Super capacitors and transistors etc. In the present thesis, the work has been done on the Growth Characterization of SWCNTs for gas sensor and field emission device applications. The Growth of SWCNTs was successfully done by PECVD technique at an operating temperature 650^0C. The work has been composed in 7 chapters.

Chapter [1]

This chapter includes a brief and systematical introduction aim and objectives of the present work carried out. The chapter also highlights the advantages of PECVD technique and some unique properties of SWCNTs. The main and some optimized factors promoting the enhancement of the gas sensing and field emission behavior of SWCNTs have also been highlighted.

Chapter [2]

This chapter includes the detailed literature review of most emerging and fascinating nanotechnology specially carbon nanotubes (CNTs). It highlights the historical background of CNTs with their extraordinary and unique properties. Different Growth techniques have been explained in detail with the market applications of SWCNTs in different fields.

Chapter [3]

This chapter highlights the deposition of Fe catalyst on Si substrate through RF-Sputtering technique and then the growth mechanism of SWCNTs through plasma enhanced chemical vapour deposition (PECVD) technique. The different characterization techniques like field emission scanning electron microscope (FESEM), High resolution transmission electron microscope (HRTEM) and Raman Spectroscopy with their working mechanism and appropriate diagrams have been properly discussed.

Chapter [4]

This chapter includes the Fabrication of Sensitive SWCNT Sensor for trace level detection of different gases specially NO_2 and NH_3 for High quality environmental monitoring and security reasons. The various parameters of the SWCNT sensor like sensitivity, repeatability, stability, resistance variation and selectivity has been discussed in detail.

Chapter [5]

This chapter was focused towards the enhancement of sensor response of SWCNT sensor with decoration of Au (gold) nanoparticles on SWCNT surface through cast effective spray technique. A surprising enhancement in sensor response was observed by this approach. In addition of this, the effect of the temperature and concentration on sensor response was also conducted. Heating treatment has been given to the sample during recovery time to obtained complete recovery.

Chapter [6]

This chapter highlights the structural effects of SWCNTs on gas sensing and field emission properties. Both the structures vertically aligned/randomly oriented SWCNTs were observed for gas sensing and field emission investigation. Vertically align SWCNTs were observed best field emitters while disordered SWCNTs were found best sensitive gas sensors. Structural qualities of SWCNTs were observed through FESEM, HRTEM and Raman Spectroscopy.

Chapter [7]

This chapter includes the summary of the whole work with a directive conclusion. It also highlights the attractive and innovative new ideas which enhance the properties of SWCNTs and future scope of the SWCNTs in gas sensing and field emission applications.