Parameter optimization of CNT production using Sri Lankan graphite by arc discharge method

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(09/8110)

Degree of Master of Philosophy

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DECLARATION

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R. M. S. J. Gunasekara Date:

The above candidate has carried out research for the M. Phil thesis under our supervision.

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Prof. J. P. Karunadasa Date:

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R. M. Sunanda Jayalath Gunasekara

ABSTRACT

Since their discovery in 1991 by Iijima, carbon nanotubes have been of great interest. The key advantages of these structures are their electronic, mechanical, optical and chemical characteristics, which open a way to a variety of applications. These properties can even be measured on single nanotubes. For commercial application, large quantities of purified nanotubes are needed.

Different types of carbon nanotubes can be produced in various ways. The most common techniques used nowadays are: arc discharge, laser ablation, chemical vapor deposition and flame synthesis.

Fundamental and practical nanotube researches have shown possible applications in the fields of energy storage, molecular electronics, nano-mechanical devices, and composite materials. Real applications are still under development.

This project is basically focused on arc discharge method of CNT production using Sri Lankan vein graphite. Sri Lankan graphite is unique due to its perfect crystalline structure and the higher as mined purity compared with that of commonly available flake graphite. This type of natural resource is found mainly in Sri Lanka. Detailed study on flake and vein graphite was carried out in this study as one of its objectives. Also SEM and TGA analysis of the multiwall carbon nanotubes are discussed. Special technique for comparing diameters of multiwall wall carbon nanotube was developed by using TGA. Further, the cross section analysis was carried out for the arc scoot to analyze the formation of the nanotubes on the cathode. Another objective here was to identify the optimum parameters for the production of CNT using the arc discharge method. Arcing time, current, chamber inert gas, chamber pressure and the type of the electrode were the variables. Arcing current around 100 A, pressure around 700~900Torr and arcing duration around 60s with helium as the inert gas were the optimize conditions.

Key words: Vein Graphite, CNT, MWCNT, Arc discharge, Nanotube

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LIST OF ABBREVIATIONS

Abbreviation	Description
Å	Angstrom
AFM	Atomic Force Microscope
Ar	Argon
CNT	Carbon nanotube
EDX	Energy Dispersive X-ray analysis
FTIR	Fourier Transform Infrared Spectroscopy
g	gram
kg	kilogram
kV	Kilo Volts
MWCNT	Multi wall carbon nanotube
SEM	Scanning Electron Microscope
SWCNT	Single wall carbon nanotube
TGA	Thermo Gravimetric Analysis
CVD	Chemical Vapor deposition
DC	Direct current
USA	United States of America
DWCNT	Double wall carbon nanotube
VPGCF	Vapor phase grown carbon fibers