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

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DECLARATION

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

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