Name of the Candidate : **Javid Ali**

Department **: Physics, F/O Natural Science, JMI**

Name of the supervisor : **Prof. Mushahid Husain**

Name of Co-supervisor : **Prof. Harsh**

Title of the thesis : **Synthesis of Multi-walled Carbon Nanotubes (MWNTs) and their characterization**

Abstract of Thesis

In the present thesis, the research work on experiments on the growth of multi-walled carbon nanotubes (MWNTs) using low pressure chemical vapor deposition (LPCVD) Method and its characterization using various techniques have been reported. The field emission properties of as-grown MWNTs have also been studied and findings have been reported. The research work has been summarised as below:

- **Growth of uniformly distributed multi-walled carbon nanotubes by low pressure chemical vapor deposition (LPCVD) and their characterizations:**

The uniformly distributed carbon nanotubes have been grown successfully by LPCVD technique at a lower temperature of 600 ^{0}C. After the successful growth uniformly distributed carbon nanotubes characterized by SEM, Raman spectra and field emission properties has also been studied. Growth of CNTs on different substrates has also been studied which show that the properties of carbon nanotubes also depend upon the interaction with substrates in which they are deposited. The properties of carbon nanotubes also depend upon the interaction with substrates in which they are deposited.

In fact, recent studies have shown that a strong interaction between carbon nanotubes and the substrate can lead to important changes in the nanotube properties. As we are trying to grow the CNTs suitable for electronics devices (field emission displays), therefore carbon

nanotubes have been grown mainly on silicon substrate but I have also carried out CNTs growth on quartz substrate.

- **Growth of CNTs using different catalyst like Fe, Co, Ni, $CrSi_2$:**

  We deposited carbon nanotubes using different catalyst (Fe, Ni, Co and Ti) and found Fe as the best catalyst for the growth of CNT at lower temperature.

- **Growth of CNTs using different catalyst deposition methods:**

  The film of Iron catalyst has been deposited by Dip coating, Adhesive dip coating, Electrolysis and RF sputtering methods. The effect of catalyst-deposition methods on the alignment of carbon nanotubes has been studied. The intensity ratio I_G/I_D for dip coating, adhesive dip coating, electrolysis and RF sputtering samples are 1.152, 1.100, 1.222 and 1.028 respectively, which indicates that electrolysis sample has lesser defects as compared to other samples. The SEM investigations show that the alignment of carbon nanotubes in an electrolysis and RF sputtering samples is better than others samples.

- **Enhancement of field emission properties of carbon nanotubes by electron cyclotron resonance (ECR) plasma treatment:**

  We report a significant improvement of electron field emission property in carbon nanotubes films by using an ECR- plasma treatment. Our research results reveal that plasma treatment can modify the surface morphology and enhance the field-emission characteristics of CNTs. These results indicate that the ECR plasma treatment is an effective method to improve the field emission property of CNTs and CNTs can be used in display devices.

AS grown carbon nanotubes are uniformly distributed and have good field emission property, therefore this research is useful in the field emission display devices.

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