1 Introduction

Carbon nanotubes were first recognized in 1991 by Iijima, S (2). Since then, this structure became very popular with increasing interest among physicists, chemists and material scientists. The main reason for this are the promising applications of the special mechanical and electrical properties found on this material.

Single wall carbon nanotube is a tube with a diameter on the nanometric scale and a length of several microns to the centimeter scale. It can be a semi conductor or behave as a ballistic conductor with a localization length over 10μm (13, 14). The Young's modulus of the tube is higher than 1TPa on the axial direction (15, 6) and is very soft on the direction perpendicular to the wall of the tube, making this material excellent for applications which requires strong materials with good electrical properties (3). In order to control the electrical behaviour of this material, one can attempt to dope it, substituting a carbon atom by a foreigner one. Boron doped single wall carbon nanotube has a metallic behaviour, since it lowers the Fermi level (16, 17). They can behave as superconductors (18, 19), have improved field emission properties when compared to nitrogen doped and pure single wall carbon nanotubes (20) and are a better transparent conductors than pure tubes, since they reduce the sheet resistance at the same transparency (21, 22). Boron doping increases the binding energies of Carboxyl groups to graphene and carbon nanotubes and may substantially alter the way in which carbon nanostructures interact with organic and inorganic functional groups, molecules, and polymers (23).

The main goal of this work is to study the growth and characterization of boron doped single wall carbon nanotubes synthesized in a high vacuum chemical vapour deposition system, and for that reason, we had to built such deposition system. We also studied the characterization of those tubes using a field emission scanning electron microscopy (SEM), a transmission electron microscopy (TEM), a Raman spectroscopy and X-ray photoelectron spectroscopy (XPS).

We have obtained an evidence that the Fermi level of the tubes are lowered, thus indicating that our tubes are doped with boron. Based on our results, Professors Rodrigo B. Capaz and L.A. Terrazos made first principle calculations showing a theoretical evidence for the upshifted boron 1s XPS peak. This shift was already reported in the literature, with no theoretical support, to the boron atom on the carbon nanotube's structure. From this we could determine the doping concentration on the tubes. We have also developed a simple way to estimate the doping concentration through Raman measurements.

This thesis is organized in 6 chapters. The first one is the introduction. The second one is a basic description of the carbon nanotubes properties. The third and the fourth ones are a description of the principal method to grow nanotubes and a overview of boron doped carbon nanotubes regarding properties, production methods and applications. The fifth one shows the experimental conditions, results and conclusions of this work. The last one is a fast review of our results and conclusions, a little discussion about some works on the literature and some remaining questions as future perspectives.