1 Introduction

This thesis work focus on the production and characterization of Boron doped Single Walled Carbon Nanotubes. But, from where does the interest in this so specific kind of material come from?

As will be seen in next chapter "Overview of the Research Field", Carbon Nanotubes are Carbon allotropes. This means that Carbon Nanotubes are one of the many structures in which Carbon atoms may be organized. The discovery of Carbon Nanotubes is not of an isolated kind, but it comes from decades of research of the Carbon community in trying to understand the allotropes derived from Carbon.

Carbon Nanotube is a promising material, and first was given prominence by Sumio Iijima in his seminal paper [1] in 1991. Later, as the scientific community unraveled this newly discovered material's physical properties, interest increased in studying it. The reason was that Carbon Nanotubes presented unprecedented new properties, such as the highest Young Modulus, and yet being a light material, and high surface to weight ratio. Other properties are enhanced electrical conductance, enhanced optical absorption properties, and thermal conductance.

These properties make Carbon Nanotubes a promising material, with potential applications in material science, to make high mechanical endurance, and light composites, chemistry and medicine, to work as catalysts, nanoreactors, or drug deliverers; electronics, as diodes, logic components, field emitters, sensors, etc.

Notwithstanding the unusual properties, Carbon Nanotubes come in a variety of types, and effort is being done to control its production in such a way that only certain type of Nanotubes would be produced for a corresponding application. Following this type of reasoning, doping of Carbon Nanotubes is seen as a possible way of tailoring Nanotubes with modified, and yet controlled, physical properties.

This thesis is devoted into studying the following variation of Carbon Nanotubes: Boron doped Single Walled Carbon Nanotubes.

Since few papers have claimed to have produced this material by chemical vapor deposition methods, this thesis aims at understanding this production mechanism, and characterizing the physical properties of the produced Carbon Nanotubes. One interest is to study the viability of controlling doping levels of produced Boron doped single Walled Carbon Nanotubes. The other is to understand the physical properties of this kind of Carbon Nanotubes.

This thesis work is divided in five parts, to say: Introduction, Overview of the Research Field, Methodology, Results, and Conclusion.

The "Overview of the Research Field" chapter serves as an introduction to the state-of-art in the science of Carbon Nanotubes. The main concepts will be described so that the reader gets acquainted with the scientific community findings on the field of research. The production processes, the physical laws

underlying Carbon Nanotubes, and the scientific terms necessary for the readers to understand the subsequent chapters.

The “Methodology” chapter is devoted to describing with deep detail the experimental setup used for both producing and characterizing Boron doped single Walled Carbon Nanotubes. Also, the experiments conducted in the thesis will be listed, with a motivation as to the expected results. The synthesis apparatus, and steps used to produce the material in this thesis work will be detailed. And, finally, the analytical equipment as well as the method used to characterize the produced samples, in order to probe for the desired effects of doping Single Walled Carbon Nanotubes will be given.

In the “Results” chapter, the experimental results and analysis will be presented and discussed in an integrated way, so as to understand the physics behind the synthesis mechanism and the doping effects. The results will be discussed under the light of the published literature described in chapter “Overview of the Research Field”.

Finally, in the “Conclusion” chapter, a summary of the main topics seen in this thesis will be made, and focus will be given to the main experimental results. Some future research suggestions will be listed.