CHAPTER I
INTRODUCTION

Single-wall carbon nanotubes (SWNT) have exhibited their outstanding mechanical and electrical properties, which can be used in a large number of potential applications (Yakobson and Smalley, 1997). SWNT has high Young's modulus (Treacy *et al.*, 1996) and tensile strength, which can be used as composite materials. Moreover, depending on their helicity and diameter, SWNT can show either metallic or semiconducting electrical behavior, leading to molecular electronic devices such as nanoscale wires, electron field emission sources and electrical components (Cassel, 1999).

Currently, there are three major techniques for SWNT production: (i.) carbon arc discharge technique, (ii.) laser evaporization technique and (iii.) catalytic reaction of hydrocarbon compound. Originally, the arc discharge and laser vaporization technique produced high quality nanotube materials (Journet *et al.*, 1997). However, these two techniques are high cost and the difficult to scale up (Hafner *et al.*, 1998). The catalytic decomposition of carbon–containing gases have been suggested to be the choice for the commercial scale production of SWNT.

In the catalytic decomposition technique, reactive carbon–containing gases, e.g. ethylene and acetylene, typically yield carbon nanofiber or multi-wall carbon nanotube (MWNT). However, when CO is used as a feed together with an appropriate catalyst, SWNT can be obtained with high selectivity. Some recent reports also show that methane can produce SWNT in high yields (Tang *et al.*, 2001).

In this research, to obtain the selective catalyst for producing SWNT, a number of Co-Mo, Fe-Mo and Ni-Mo catalysts supported on silica gel, alumina and magnesium oxide were systemically tested. Moreover, in comparison to CO disproportionation, CH_4 decomposition and mixture of CO and CH_4 were studied. Raman spectroscopy, Transmission electron microscope (TEM), and Temperature Programmed Oxidation (TPO) were used to characterize the carbon deposits on the catalysts.