CHAPTER I
INTRODUCTION

Hydrogen, the most abundance element on earth, has high potential to be energy carrier in the near future because it is expected to be used as an energy source for fuel cell. Hydrogen can be converted to electricity by combining with oxygen, and give water and carbon dioxide as products. For application of fuel cell in vehicle, hydrogen should be stored at the density high enough so that the car can run for at least 500 km before filling up again. The technology that is required to achieve this goal is the high capacity onboard hydrogen storage.

Several hydrogen storage techniques were too bulky, heavy, dangerous and/or expensive for practical transport applications. Recently, carbon nanotubes has been reported that can store hydrogen at high efficiency. However, the reported high capacity is still in controversial due to different testing technique and different sources of the materials.

There are several techniques to measure the amount of stored hydrogen, for examples, temperature programmed desorption (TPD), thermal gravitational analysis (TGA), and isothermal constant volume technique. TPD and TGA techniques have limitation resulting from the small sample size and/or sub-ambient temperatures during the adsorption. Moreover, some of reported high hydrogen storage are not be able to reproduced in other laboratories and some later found out that the high hydrogen storage is in fact resulting from the water adsorption.

In this study, three different carbon materials, which are single-wall carbon nanotubes (SWNT), multi-wall carbon nanotubes (MWNT), and activated carbon, are used as the materials for storing hydrogen. The relatively large amounts of carbon materials are tested by the constant volume technique at pressure ranging from 1 to 10 MPa and at constant temperature (25 °C). BET surface area and Raman spectroscopy are also employed to investigate the characteristic of carbon materials.