Investigation of Hydrogen Storage of Carbon Materials by Physiosorption

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As part of the Solar Hydrogen Project at IIT, research is being conducted on various types of carbon to determine their hydrogen storage capacity. To market a hydrogen-fuel cell vehicle as competitively as the present internal combustion engine vehicles, there is a need for materials that can store a minimum of 6.5wt% of hydrogen[1]. Carbon nanotubes (CNTs) are being heavily investigated because of their promise to offer an economical solution to the challenge of safe storage of large hydrogen quantities[2]. An investigation is underway at IIT to determine the hydrogen gas uptake ability of carbon materials.

As shown in Figure 1, one method of storing hydrogen in carbon sorbents such as activated carbon and carbon nanotubes is by introducing the gas under high hydrostatic pressure. The amount of hydrogen that would be adsorbed at any given temperature increases (to a certain degree) with the pressure of the gas. The operating pressure is varied between 0-3500psi and temperature is varied from $30^{o}C$ – $150^{o}C$.

Adsorption and desorption experiments on a number of commercial samples of carbon nanotubes will be carried out to investigate optimum storage pressure, temperature and recyclablity. Experiments will also be carried out on activated carbon for comparison. All samples will be tested and characterized as received and later after purification. The experimental setup shown in Figure1, includes a micro-compressor that uses properties of reversible metal hydride alloys to passively produce high purity hydrogen at an elevated pressure. In order to ensure accurate readings, the apparatus underwent thorough leak-check where tests have demonstrated a reproducible leak-rate of $1.47E^{-2}$ torr/hr at the vacuum side.

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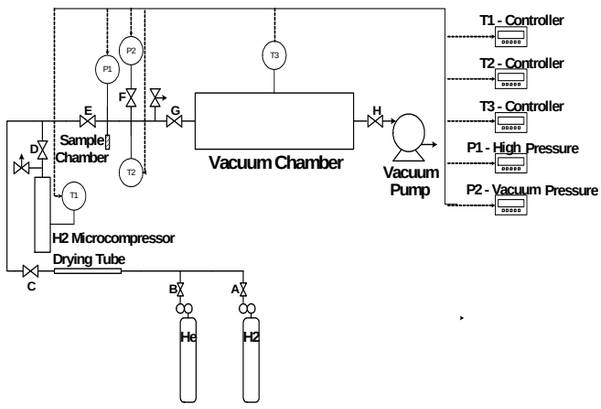

Fig.1: Schematic representation of experimental setup

References

[1] Hynek S, Fuller W, Bentley J, *Int J Hydrogen Energy*.

[2] Nutzenadel C, Zuttel A, Chartouni D, Schlapbach L., *Electrochem Solid-State Lett.*

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