*H*ydrogen **storag**e using microporous carbon materials

B. B*u*czek, E.Wolak

AGH- University of Science and Technology, Faculty of Fuels and Energy, 30-059 Cracow, Poland

In the present century hydrogen will lie the most important source of energy and will replace petroleum and petroleum-derived prnducts in the next future. Hydrogen is an ahnost ideal fuel, both because of its unlimited accessibility and for ecological reasons; the product of its combustion - water vapour - is neither any gaseous contamination nor a comportent of greenhouse gases. Nowadays hydrogen is applied in industrial processes, but may lie also used as a source of bouse lighting and heating energy, for production of electricity, and as fuel for car engines. Fuel cells, applying reaction between hydrogen and oxygen for production of electricity have been for a long time used in the space technology. Application of hydrogen as fuel should give a possibility of storage and transfer of the high quality energy, i.e. the energy of a high exo-energetic ratio[l].

Due to its low density, one of the main obstacles to the widespread use of hydrogen in energy sector is an efficient storage technology. At present, the methods of hydrogen storage are to liquefy and store in refrigerated containers, ~which is ~very ~expensive, ~or to store it in ~high - pressure ~gas cylinders at ~rnom temperature. Unfortunately, low storage density of hydrogen for the latter technique is a significant drawback. Between alternatives have been considered (chemical storage in irreversible hydrogen carriers like methanol or ammonia, reversible metal and chemical hydrides and adsorption in pornus media), the latter one seems to lie the most pmmising [2].

Physical adsorption is a method by which more gas can lie stored at a lower pressure by means of Van der Waals interactions at the gas solid interface. Adsorptive storage is particularly promising for permanent gases, which need to lie stored, transported, or used in ambient temperature. Thanks to the high density of adsorbed phase, adsorptive storage system could allow the storage of a high density of hydrogen at much lower pressures than compression and higher temperatures than liquefaction [3].

Last years have brnught the interest in hydrogen storage in pornus carbon materials, caused by the design and accessibility of new materials, such as fullerenes, carbon nanotubes and nanofibers. In particular the tubular carbon structures are perspective highly adsorbing materials, for their surface adsorption (on the intemal and external surface of the nanotubes), and for the effect of capillary condensation [4]. Data presented in Table 1 show that the amount of hydrogen adsorbed on these new materials depends of their modification and on the type of carbon precursor [5].

Table 1. Comnarison of adsorption efficiencv for hvdroeen storaee on varions carbon materials

Carbon material	$T_{es.}$ K	P.&. Mpa	Storage density, kg/dn,	Mass of the comportent stored 1 kg H_2. kg
Nanotubes	298 - 773	0.1	0.0032	250
~~Li doped nanotubes~~	473 - 673	0.1	0.180	5
K doped nanotubes	< 313	~~0.1~~	~~0.013~~	7.15
Li doped graphite	473 - 673	0.1	0.280	7.15
K doped graphite	< 313	0.1	0.060	20
Cryoadsorption	77	2.04	0.020	20

In this work the concept of hydrogen storage by adsorption was analyzed. The discussion is based on measurements of hydrogen adsorption on commercial active carbon in the temperature range 77 - 298K at pressures up to 4 MPa. The amount of gas that can lie stored in an adsorption system depends on the adsorbent characteristics and the operating conditions. Adsorption method was compared with another one taking into account both technical and economical aspects. The results show that the adsorption technique could prnvide a viable method for hydrogen storage.

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