METHANE STORAGE BY A SERIES OF ACTIVATED CARBONS

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1. Introduction

Recently, the effective energy storage and new sources of electricity like lithium ion second batteries and fuel cells are most expected to solve the to future energy problem. Among them, Fuel Cell systems, which have relatively higher efficiency and discharge only water without any toxic polluent, are considered best for future energy system. The promising candidates for hydrogen source of such fuel cells are hydrogen itself, methane, methanol and gasoline of new type.

However, hydrogen and methane have filling problems as a source gas for fuel cell. Some effective gas storage carbonaceous materials are expected to have function to relieve the pressure and increase the energy density and safety when they are filled with high pressure in the storing tank.

The aim of this work is to attempt to create novel carbonaceous material of new concept. The face of carbon fiber prepared by the melt spinning of mesophase pitch is usually known to be covered with horizontal hexagonal graphene sheets of 110 phase. Recently, several reports confirmed us that hexagonal graphene sheets of 002 phase can be effectively exposed with solvent extraction of as-spun fibers. We tried the method of the solvent extraction to create hexagonal carbon edges to surface for the effective hydrogen charge in the step of storage.

Methane adsorption experimental on the prepared novel activated carbon fibers was carried out to examine gas adsorption capacity. The alkaline activation of prepared carbon fibers also tried to enhance the gas adsorption sites.

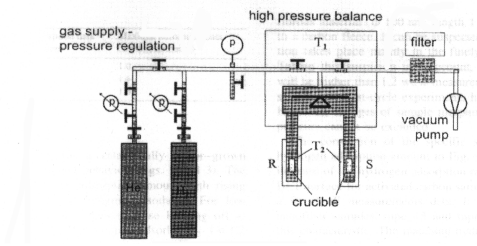

Figure1 CAHN balance of the gravimetric methane

2. Experimental

The gas adsorption property of various novel activated carbon fibers and commercial activated carbons was examined using high pressure isothermal gravimetric analysis. A schematic drawing of the apparatus is shown in Figure 1.

The balance chamber can be pressurized up to 3.5MPa. and mass resolution is within the range of 100 . The buoyancy of sample was calibrated with numerical method. Before

starting the high-pressure adsorption experiment, the sample chamber was rinsed with the gases of CH4 and N2. The chamber was evacuated for 20 min. After evacuation, the chamber was heated at 200 in 1 hour under nitrogen atmosphere. The samples were measured in one adsorption - desorption cycle at the maximum pressure of 3.5 MPa.

3. Results and discussion

Figure 2 shows the increase of the methane adsoption amounts with increase the methane pressure. OG-5A, OG-10A, OG-20A, and petoca-ACF are commercial activated carbon fibers and Py-petoca-CF is the novel prepared activated carbon fiber in this study. The higher methane pressure rise up, the more methane adsoption confirmed. Some physical properties of samples used in this study were summarized in Table 1.

The adsorption amounts do not showed a good correlation with the surface area and pore size (Table 1).

The activated carbon fibers with larger surface area tended to absorb more methane, but OG-10A of the surface area of 780 /g absorbed more methane than OG-20A of the surface area of 1930 /g. Such a fact shows the dimension and shape of pores and other uncertain factors also have strong effects on the amounts of methane adsoption. The novel activated carbon fiber prepared through the solvent extraction and the alkaline activation showed maximum adsoption amounts of 16.5% methane under 3.5Mpa.

4. Reference

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Table1 The properties of series of CF and ACF

CF and ACF	Elemental Analysis(wt%)					
	C	H	N	O	Surface area (/	Pore size
OG-5A	89.48	1.18	0.67	8.72	572	7.9
OG-10A	95.65	0.27	0.27	3.36	780	7.4
OG-20A	90.32	0.94	0.51	8.27	1930	9.8
Petoca-CF	94.18	4.83	0.01	0.98	10	
Py-petoca-CF	99.11	0.32	0.02	0.55	61	6
Petoca-ACF	93.36	0.37	0.17	6.10	2630	10