THE PRELIMINARY STUDY OF CHEMICALLY MODIFIED ACF

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Introduction

Activated carbons (AC) are widely used for purification and separation in many fields, and they have many forms such as pelletized, granular, powdered or molded form. Recently, a new kind of AC—Fibrous Activated Carbon (ACF) is increasing applications of AC in various areas due to its unique advantages[1].

The pore structure of ACFs attributed to their unique characteristics. Most of the ACFs' pores are micropores, a few belong to mesopore, and few is macropore. As a microporous carbon, ACF has strong adsorption to gases at low pressure due to orerlap of force fields from opposite pore walls[2], so ACF remove trace impurity from a contaminated gas very rapidly. Then, few macropore and relatively uniform micropores guarantee their fast adsoption and desorption rate. Finally, their fibrous shape lead to easy handling.

In spite of their advantages, the ACFs face many challenges, e.d. their high price. Based on these, people turn to the modification of ACF in order to develop a novel ACF with low quality/price ratio. By now, many ways were proposed. One of these methods is to prepare the metal - containing ACF, such as Cu - containing[3], Ag - contaicing[4], Co - containing ACF[5]. In this paper, Fe - containing ACF is prepared. The preparation method is very simple, but some interesting conclusions were reached.

Experimental

1、Sample preparation

The PAN fiber was preoxided with air, then was carbonized, activated by steam.

2、Sample Modification

The PAN ACF was modified with $FeSO_4$ salt solution. After immersed into $FeSO_4$ solution, the sample was heated in air at very low temperature. e.d. 150℃

3、Sample analysis

a. The pore structure parameter is determined by nitrogen adsorption at 77K using Micro meritics ASAP 2000 instrument.

b. The SEM analysis is conducted by AM-RAY 1910 SEM.

c. The XRD analysis is conducted by D/max - rA X - ray diffractometer.

d. The ESCA analysis is conducted by PHI5300X.

Results and Discussion

1、The pore structure of modified ACF.

During the modification, the pore structure of ACF change greatly as shown in Fig. 1.

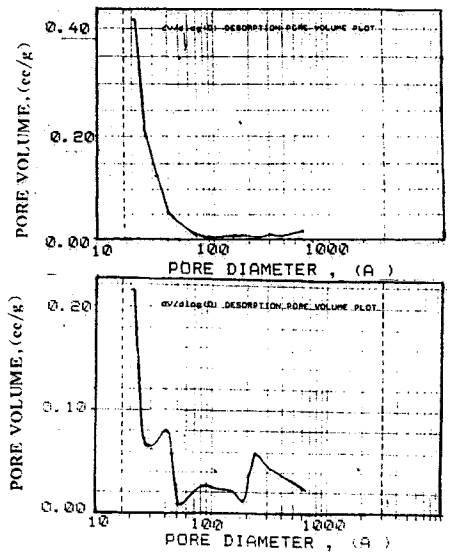

Fig 1. Comparision of the pore diameter distribution of ACF before(upper) and after modification

2、The XRD analysis of modified ACF.

PAN - ACF exhited a typital X - ray diffraction peak with a broad 002 reflection width (see Fig 2). After modification, in the X - ray diffraction profile, the (002) peak width was more broadened, while the peak height was lower. All

these showed that the crystilline structure was destroyed. The broadening of the peak probably arised from several reasons, such as mean particle size, strain or defect in the carbon lattice[6]. L_a and L_c decreasing (see table 1), showed the carbon lattic was destroyed and the crystal size was smaller.

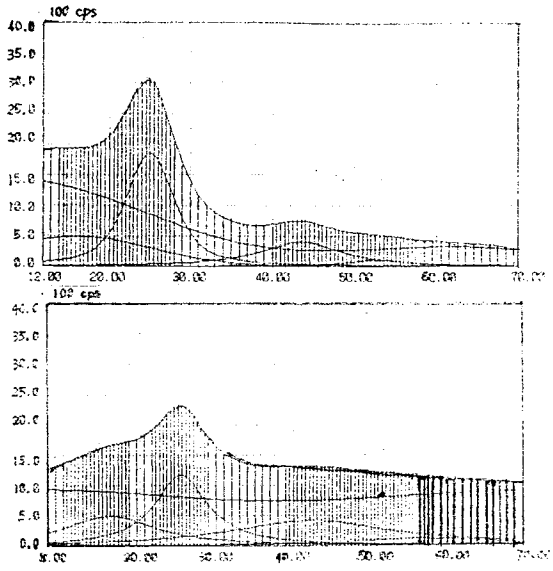

Fig 2. The XRD profile of ACF(upper) and modified ACF

Tabel 1. Structral parameters of PAN - ACF obtainted by X - ray diffraction

Sample	d_{002}	L_c	L_a
PAN - ACF	3.56	11.40	14.92
Fe - PAN - ACF	3.51	9.58	6.82

3、The XPS study of modified ACF.

The XPS test clarified that the carbon content decreased due to the modification (see table 2). That was to say, the weight of carbon lost dramatically during the process.

Table 2. The ACF' s element content according to ESCA

Sample	C_{1s}	O_{1s}	N_{1s}
PAN - ACF	81.71	16.91	1.38
Fe - PAN - ACF	70.88	25.60	1.55

4、SEM investigation of modified ACF.

In the SEM photograph (Fig. 3.), the changes of surface structure were obversed directly. In the course of the modification, the slit - shape or wedge - shape pores of ACF changed to ellipsoidal pores. In the meantime, the porosity of ACF was enlarged, which was the direct eviderce of figure. 1.

Fig 3. The SEM photograph of ACF(upper) and modified ACF condusion

The ACF' s structure changed greatly in the course of modification with $FeSO_4$ solution. All characterization arrived at following conclusions. At the relatively low temperature (150℃), the $FeSO_4$ catalysed the gasification of carbon, so the carbon lattice was destroyed, porosity was enlarged, and pores changed from slit - shape to ellipsodial shape.

Finally, the ACF changed so greatly by so simple modification. All these attributed to the facts that this novel modified ACF with special pore structures and adsorptive properties not only have potential to develop the applications (e. d. adsorping NH_3 gas), but also have great theoritical value.

References

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