POSTER

Influences of Preparation Conditions of ACF on Catalytic Activity for SO_2 Removal

Je-Young Kim, Ikpyo Hong and Jong Gyu Lee

Research Institute of Industrial Science and Technology
P.O Box 135, Pohang 790-600, Korea

Introduction

Active coke and active carbon have been used for removal of sulfur compound for long times and it was known that active carbon with higher content of nitrogen was more effective.[1,2] . But the active coke process uses the low surface area carbon in moving bed as the catalysis with high strength. Because the specific surface area is low in this process, the equipment should become large, eventhough compact equipment is desirable. PAN-based ACF has been reported to exhibit a high activity for removal of sulfur compound.[3,4] The process with ACF would be more compact if the ACF has high adsorption capacity in fixed bed.

In present study, influences of preparation conditions of ACF on catalytic activity for SO_2 removal were studied.

Experimental

- Preparation of PAN-based ACF

Activated carbon fiber were prepared from polyacronitrile(PAN) fiber by steam activation and chemical activation. The steam activation were proceeded at 850℃ for 30 min. The carbonization temperature of stabilized PAN fibers was ranged from 850℃ to 1000℃ before activation. Chemical activation was carried out by heat treatment of stabilized PAN fiber which was immersed in KOH solution for 24 hours.

Heat treatment temperature were 600,700 and 800℃ . The remaining KOH on the ACF was removed by washing with water after activation.

The prepared ACFs were characterized by BET surface area and pore volume. Pore size distribution of ACFs were determined by Horwath-Kawazoe method[5]. The elemental analysis was also performed.

- Desulfurization of model flue gas

The removal of SO_2 in the model flue gas was carried out in fixed bed reactor. The composition of the model flue gas was $SO_2$1000ppm, O_2 5%, H_2O 10% and N_2 balance and space velocity was 200ml/g.min.The reaction temperatures were 30℃ to100℃. The effect of moisture content on catalytic activity for SO_2 removal was also studied.

Results and Discussion

Table 1. shows the properties of PAN-based ACFs. The sample A,B and C are activated by steam have the values of specific surface area between about 800m^2/g and 1000m^2/g and the yield were between11% and 23%. The nitrogen contents of A,B and C activated by steam were all less than 1% regardless of carbonization and activation conditions.

However, the chemically activated ACFs D and E have higher nitrogen contents and yield than steam activated samples. It might be the results of the lower activation temperature of D and E.

It was found that it was very difficult to prepare the ACFs by steam activatin with higher surface area than A due to the burn-off and low yield.

Fig.1 shows the breakthrough curves of SO_2 in model flue gas through steam activated ACFs at 30 C. Sample C removed SO_2 completely until 150min. but it lost its activity rapidly after breakthrough. Behavior of steam activated ACF shows the tendency that the sampe carbonized at lower temperature retains activity longer.

But specific surface area of A is the lowest among the steam activated samples. It might be the results of carbonization at lower temperature and the functional groups of oxygen and nitrogen . Contentsof nitrogen in A,B and C are less than 1%, however the contents of elements of ACFs are relative values and absolute values of nitrogen content in A might be higher than B and C due to the lower carbonization temperature.

Fig. 2 shows breakthrough curves of SO_2 in model flue gas through the chemically activated carbon fiber D and E. D and E have higher nitrogen content and specific surface area than the samples activated by steam. D and E removed SO_2 completely until 15 hours and 38 hours, respectively. The catalytic activities of D and E were increased by 6 and 15 times

compared to C. This results might be the effect of the higher nitrogen content and the specific surface area. While E has higher nitrogen content than D, their specific surface areas are similar. From the Fig.2 , it can be induced that the nitrogen content is important factor for desulfurication if the carbon catalysis has same specific surface area.

References

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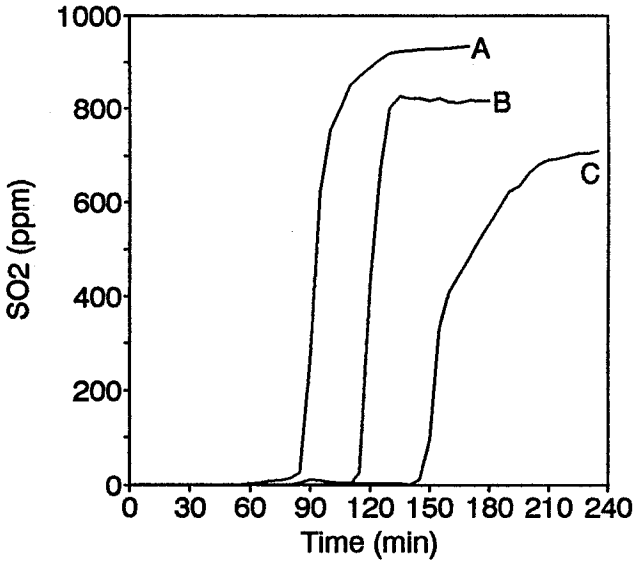

Fig.1 Breakthrough curves of SO2 over steam activated CFs

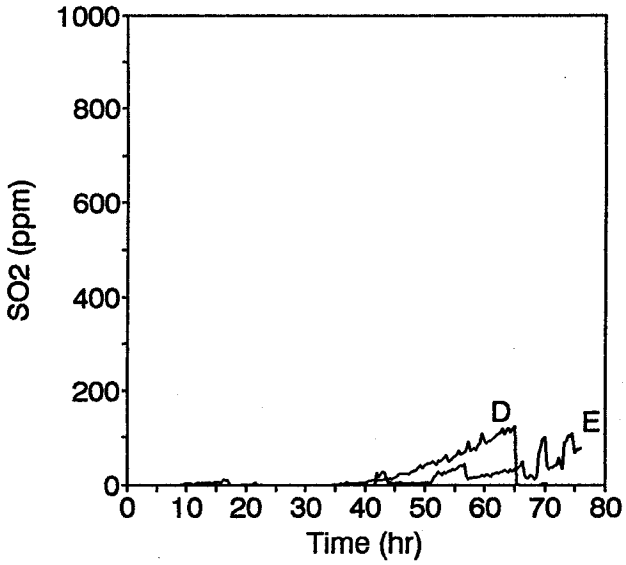

Fig.2 Breakthrough curves of SO_2 over chemically activated CFs

Table 1. Properties of PAN-based ACF

Sample	Carbonization Temp(℃)	Activation Temp(℃)-Time(min)	Elemental Analysis			Yield (%)	S_{BET} (m^2/g)
			C	H	N		
A	1000	850-30	84.8	1.60	0.65	23	917
B	900	850-30	83.0	1.58	0.46	13	899
C	850	850-30	80.8	1.24	0.41	11	778
D	-	700-15	72.7	1.70	4.76	49	1692
E	-	700-15	71.2	2.74	5.60	54	1628