

THE RADIAL DEPENDENCE OF THE Cr-Cu-Ag CATALYST CONTENT WITHIN THE ACTIVE CARBON CARRIER GRANULE

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Introduction

The increasing importance of carbon materials in catalytic processes is analyzed in terms of the most important characteristics of these materials when acting as catalysts or catalyst supports [1]. Active carbons impregnated with compounds of chromium, copper and silver are widely used for the removal of weakly adsorbing toxic substances from air, mainly in devices for the protection of respiratory systems in industrial and military applications. Despite a large number of studies carried out in this field, some problems e.g. the influence of the porous structure of a carbon carrier on the adsorptive-catalytic reactivity of impregnated active carbon, remain to be explained [2, 3]. The aim of this work has been to investigate the distribution of pores and the catalytic material throughout active carbon granules and their effect on cyanogen chloride breakthrough time.

Experimental

Granulated active carbons of different activation degree (AG-1, AG-2) obtained from the hard coal and active

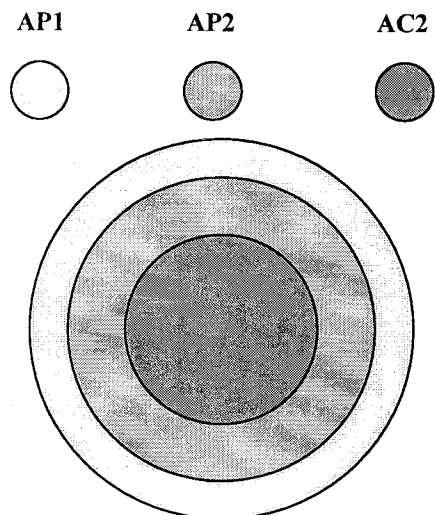
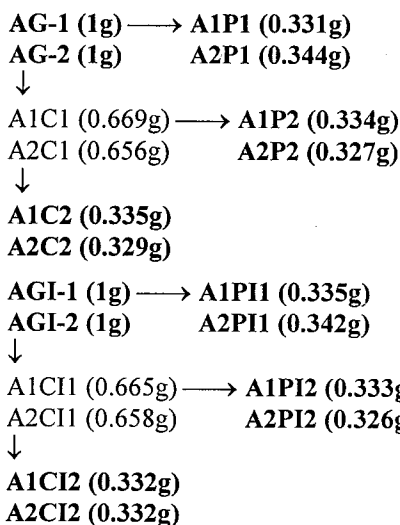


Fig. 1. Scheme of samples preparation.

carbons with deposited Cr-Cu-Ag catalyst (AGI-1, AGI-2) were exposed to attrition in a spouted bed [4].

Powder from the outer parts of granules (AP1/API1), cores (AC1/ACI1), powder from their outer parts (AP2/API2) and internal cores (AC2/ACI2) were obtained. This can be schematically expressed as:



The ash and catalyst contents of these products and for the starting materials (AG and AGI) were determined (Table 1). The porous structure (expressed by the mesopore surface area S_{me} and the limiting volume of micropores W_0) was characterized on the basis of benzene vapor adsorption-desorption isotherms measured at 293K (Table 1). The breakthrough times of cyanogen chloride for impregnated samples were measured for illustrating the dependence between adsorptive-catalytic reactivity and distance from the center of granule in the case of two different levels of activation.

Results and Discussion

Analysis of results presented in Table 1 shows almost linear dependence between S_{me} and the ash content in the case of analyzed carrier samples. Similar relation is observed for W_0 , but the values for higher activated

carbon (AG-1) lay below values of AG-2. Progressive burn-off leads to higher values of structural parameters.

It seems, that higher level of activation needs lower contents of catalysts to obtain similar the breakthrough times of cyanogen chloride for impregnated samples. But the catalysts contents very affect on this parameter. On the other hand the ash contents has a little influence on the value of t .

The mesopore surface area strongly influences on the breakthrough time. The volume of micropores not affects on the value of t up to about $0.18 \text{ cm}^3/\text{g}$, but over this limit exhibits very strongly influence.

All parameters exhibit radial heterogeneity. A specially pronounced decrease is observed in catalyst distribution in sequence A1P11 \rightarrow A1P12 \rightarrow A1C12. The ratio between catalyst content in A1P11 and A1C12 is near to 2:1.

On the other hand, the higher level of activation leads to the equalization of the values of structural parameters describing two outer parts of the whole granule. But the values of S_{me} for outer parts of granule (AP1, AP2) are greater. This can be explained by progressive burn-off and destroying of part microporous structure. During the activation process new micropores are created, so the total micropore volume is almost constant. This leads to

a conclusion that the increase in burn-off causes, apart from an increase in pore volume (mainly mesopores), a smaller differentiation of microporous structure as a function of granules radii.

References

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Table 1. Ash and catalytic material contents, porous structure characteristics of active carbon samples (before and after impregnation with Cr, Cu, Ag salts) as well as cyanogen chloride breakthrough time.

Sample (carrier)	Ash % wt.	$S_{me} \text{ m}^2/\text{g}$	$W_0 \text{ cm}^3/\text{g}$	Sample (impregnated)	Ash % wt.	Catalyst % wt.	$S_{me} \text{ m}^2/\text{g}$	$W_0 \text{ cm}^3/\text{g}$	$t \text{ min.}$
AG-1	14.5	34	0.281	AGI-1	12.9	10.8	29	0.183	156
A1P1	17.8	53	0.352	A1P11	15.0	15.5	34	0.194	189
A1P2	13.7	33	0.259	A1P12	12.5	8.9	27	0.182	147
A1C2	11.7	19	0.216	A1C12	10.8	8.0	20	0.152	134
AG-2	18.0	60	0.315	AGI-2	16.4	9.1	46	0.211	150
A2P1	20.9	77	0.338	A2P11	18.5	11.3	54	0.206	181
A2P2	17.1	60	0.294	A2P12	15.6	9.0	43	0.199	142
A2C2	14.3	41	0.245	A2C12	13.2	7.5	37	0.189	128

S_{me} - surface area of mesopores, W_0 - the Dubinin-Radushkevich equation parameter (limiting volume of micropores), t - cyanogen chloride breakthrough time