

DISTRIBUTION OF ACTIVE PHASE AND OTHER PROPERTIES INSIDE ACTIVE CARBON GRANULES

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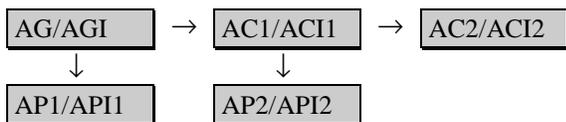
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Introduction

Active carbons impregnated with compounds of chromium, copper and silver are widely used for the removal 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 [1-5], some problems e.g. the influence of the porous structure of a carbon on the adsorptive-catalytic reactivity of impregnated active carbon, remain to be explained. The aim of this work has been to investigate the distribution of pores and the catalytic material throughout active carbon granules.

Experimental

Granulated active carbon (AG) produced from the hard coal and active carbon impregnated with Cr, Cu, Ag compounds (AGI) were exposed to attrition in a spouted bed [6]. Powder from the outer parts of granules (AP1/API1), cores (AC1/AC11), powder from their outer parts (AP2/API2) and internal cores (AC2/AC2I) were obtained [7-9]. This can be schematically expressed as:



The ash and catalyst contents of these products and for the starting materials (AG and AGI) were determined. The porous structure was characterized on the basis of benzene adsorption-desorption isotherms measured at 293K. The Cr-Cu-Ag sorbent samples (AGI, API1, AC11, API2, AC12) were tested with respect to their protective features - the time of their protective action against cyanogen chloride (t_{PA} , min) under standard conditions were determined.

Results and Discussion

The values of chosen parameters characterizing properties of studied samples (ash and catalyst contents, porosity parameters S_{me} - surface area of mesopores and W_0 - DR equation parameter (volume of micropores) as well as protective action time) are presented in Table 1 for carbon

carrier material and in Table 2 for impregnated material (Cr-Cu-Ag sorbent).

Table 1. Ash contents and parameters characterizing of porous structure of active carbon (AG) carrier samples

| Sample | Ash (% wt.) | S_{me} (m^2/g) | W_0 (cm^3/g) |
|--------|----------------|-------------------------|-----------------------|
| AG | 14.5 | 34 | 0.281 |
| API | 17.8 | 53 | 0.352 |
| AC1 | 13.0 | 23 | 0.257 |
| AP2 | 13.7 | 33 | 0.259 |
| AC2 | 11.7 | 19 | 0.216 |

Table 2. Ash and catalyst contents, parameters characterizing of porous structure and time of protective action against cyanogen chloride of impregnated active carbon (AGI) samples

| Sample | Ash (% wt.) | Catal. (% wt.) | S_{me} (m^2/g) | W_0 (cm^3/g) | t_{PA} min |
|--------|----------------|-------------------|-------------------------|-----------------------|-----------------|
| AGI | 12.9 | 10.8 | 29 | 0.183 | 159 |
| API1 | 15.0 | 15.5 | 34 | 0.194 | 181 |
| AC11 | 11.9 | 8.2 | 32 | 0.154 | 140 |
| API2 | 12.5 | 8.9 | 27 | 0.182 | 142 |
| AC12 | 10.8 | 8.0 | 20 | 0.152 | 128 |

The values of parameters W_0 and S_{me} show that the porous structure of active carbon (before and after impregnation) depends sensitively on the distance from the centre of granule. The volume of micropores and surface area of mesopores increase in successive layers in the direction from the centre to the outside. The differences are caused by the higher burn-off nearer to the external surface. The impregnation with salts of Cr, Cu and Ag leads to a decrease in pore volumes which is attributed to some pores being blocked or occupied by impregnating catalyst. The amounts of the deposited catalyst also exhibit radial heterogeneity. Its content increases from the inner core (AC12) toward outer layer of the granule (API1). The protective action time (against cyanogen chloride) is proportional to the weight of catalyst deposited in porous structure of layers (Table 2), showing that properties of impregnated active carbon depend on the position within granule.

Conclusions

Obtained results indicate the mechanism by which changes of porous structure and distribution of catalyst influence the adsorptive-catalytic properties of Cr-Cu-Ag impregnated active carbon.

References

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