

THE ROLE OF CARBON IN RADIATION-STIMULATED PROCESSES IN HETEROGENEOUS SYSTEMS

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Introduction

Carbon materials and composites on their base are one of perspective directions in scientific and technological aspects [1]. But the rapid progress in sphere of technique demands the constant improvement of operational parameters of carbon-containing materials [2]. At present the radiation-chemical modification is the most perspective method among the stated materials with preliminary set properties.

Experimental

The radiation-chemical processing was realised by irradiation of carbon materials by gamma-flow ^{60}Co at UKP-200 device and by accelerated electrons with energy of 0,325 and 2,0 Mev at LT-1,5 device.

Matrix and fillers: granulated active carbon -KAU, SKN-[3,4], carbon cloths on base of viscose, polyethylene of low and high density. Solid components of composition: disperse gold-containing, quartz and sulfide rocks. The components of gas media: cresol, quaiacol and trinitrotoluene.

Results and Discussion

We present below the results of investigation of carbon material, modified under different conditions, namely:

I. Radiation-chemical processing of carbon materials after their contact with liquid reagents of different nature:

a) the formation of active carbon granules of abnormal structure in surface layer and volume, namely: separate disconnected (isle) structure-dendrite-like and plate ones with nonordinary isle films by space geometric ordering (size vary from 0,1 – 5 mkm);

b) the high ionisation potential meanings (during the effect of radiation on heterogeneous systems: carbon sorbent-gold-containing [cyanide] solution);

c) the process of transfer of noble metal's atoms into soluble state with their further reduction at carbon sorbents (Tabl.1).

II. Radiation-chemical impregnation of carbon materials by metals:

a) the changing of power parameters of systems (the volume of double electrical layer) on base irradiated active carbon with impregnated metals (Li, Na);

b) the rise of unusual space-ordered geometric structure during the presens of inserted heteroatoms and

surface oxygen-containing group: phenol-, carbonyl- and carboxyl type.

These modification materials were successfully used for providing of effective purification of gas media (Tabl.2) and normal human activity in closed objects.

III. Radiation-chemical influence on heterogeneous system "carbon material - polymer":

a) the appearance of abnormal properties, such as operating coefficient as example (Tabl.3),

b) the rise of abnormal physical-chemical characteristics (Tabl. 4).

Thus, present work contains a new information, connected with peculiarities of radiation-chemical modification of carbon, carbon-containing and multicomponent compositions with the aim of improvement of previous and creation of new materials with raised operating characteristics. The mechanism of radiation-chemical transformations is defined by two specific circumstances: 1) the peculiarities of water and solution's behaviour at phase interface under the influence of radiation (factor of power effect) and the formation of water cluster structure; 2) the peculiarities of chemistry's change of surface and parameters of double electric layer at phase interface "active carbon-electrolyte solution". Formation of isle structures with unusual possibilities of electric charge localization, presence of heteroatoms and surface oxygen-containing groups - the factors which define the abnormal character of heterogeneous systems transformation's in irradiated field.

Conclusions

The obtained results can be used for elaboration of radiation-chemical processes for creation of new materials for high technologies.

References

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3. Strelko VV, Korovin JuF, Kartel NM and Cherbitsky AB. 1984, J. App. Chem., 6, 1223.
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Table 1. Influence of radiation-chemical processing of heterogeneous system “gold-containing disperse medium-aqueous solution-carbon” at the level of gold extraction

IRRADIATED SYSTEM	Type of reagent	Level of extraction, %	
		without radiation	with radiation
Quartz-containing rock	Inorganic salt solution	10-15	97-99
Sulphide quartz-containing rock	Solution of inorganic salt	10-15	95-96
Wastes of hydrometallurgical production	Solution of inorganic salt	10-12	75-80

Table 2. Efficiency of gas media refining by modified carbon materials

GAS MEDIA	Level of refining, %
Products of burning of rubber and polymers	98-99
Cresol	99 – 100
Guaiacol	99 – 100
Trinitrotoluene	98 - 99

Table 3. Operating factors of heterogeneous systems “polymer-carbon” after radiation-chemical processing.

FACTOR	VALUE
Friction factor	0,002
Pressure/ ambient /, providing the product tightness	1000 atm.
Pressure /internal/, providing the operational reliability of product	Pressure of powder burning
Elasticity under multiple effect of low temperatures /up to - 77 K/	more than 20 times

Table 4. Physical-chemical parameters of radiation-modified carbon-containing composite materials.

PARAMETERS OF MATERIAL	FACTOR'S VALUE	
	Irradiated	Non-irradiated
The level of crystals refining from Impurities, %	97-98	99,998
The time of material failure to microcrystalline state	doesn't fail	immediately
Coefficient of neutrons flow decrease	1,3-1,4	2,5-4,0