

## CHEMISTRY AND CHEMICAL TECHNOLOGY

### Plastics, polymeric and synthetic materials, rubbers, rubber-technical products, tires and their production

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#### TRIBOLOGICAL PROPERTIES OF AROMATIC

#### POLYAMIDE PHENYLON C-1

Aromatic polyamide phenylon C-1 (TU 6-05-221-101-71) polycondensational product of m-phenylenediamine and dichloranhydrid of isophthalic acid, a thermoplastic polymer that is characterized by high glass transition temperature melting, has a good efficiency in the temperature range from 153 to 553 K, improved radiation and chemical resistance [1].

Thanks to high mechanical durability, ability to plastic deformation and good dielectric characteristics, this polymer is widely used in various industries, including mechanical engineering, as the material of structural composites.

Wear of machine parts and mechanisms is one of the main reasons for the loss of their operating capacity; therefore, the study of the effect of operating conditions on the tribological properties of aromatic polyamide phenylon C-1 has scientific and applied value.

The studies of the processes of friction and of the wear of phenylon C-1 was carried out on a friction machine in friction mode without lubrication under loads of 0.2-0.8 MPa and sliding speeds of 1, 1.5 and 2 m/s, the friction path was 1000 m. As opposite element was used disk made of steel 45 (GOST 1050-74), heated treatedly to the hardness of 45-48 HRC with the roughness of the surface  $R_a = 0.16-0.32$  mkm.

Friction coefficient  $f$  determines by the formula:

$$f = \frac{(F_1 + F_2)}{N}$$

where  $N$  – normal load on the sample;  $F_1$  – friction force of the tested sample;  $F_2$  – losses occurring when turning the lever in the horizontal plane.

Intensity on the linear wear rate  $I_h$  calculated according to ratio:

$$I_h = \frac{\lambda}{\rho_T} \cdot \frac{dG}{(A_a \cdot dL_T)}$$

where  $G$  – the amount of weight wear;  $L_T$  – the path of friction, m;  $A_a$  – nominal contact area;  $\rho_T$  – density of the investigated sample.

As a result of the research, it was found that the friction coefficient of phenylon C-1 decreased with increasing slip speed (fig. 1). This is due to the reduction of the friction bond time of the polymer sample – the steel opposite element, on the one hand, and, on the other hand, by the increase in the tangential component of the sliding speed, which contributed to the effective removal of wear particles from the friction zone [2]. In particular, it was found that under conditions of sliding speed of 1 m/s, the friction coefficient in the studied load range decreased by 30%, 1.5 m/s – by 53%, and at 2 m/s almost did not change being within 0.17-0.18.

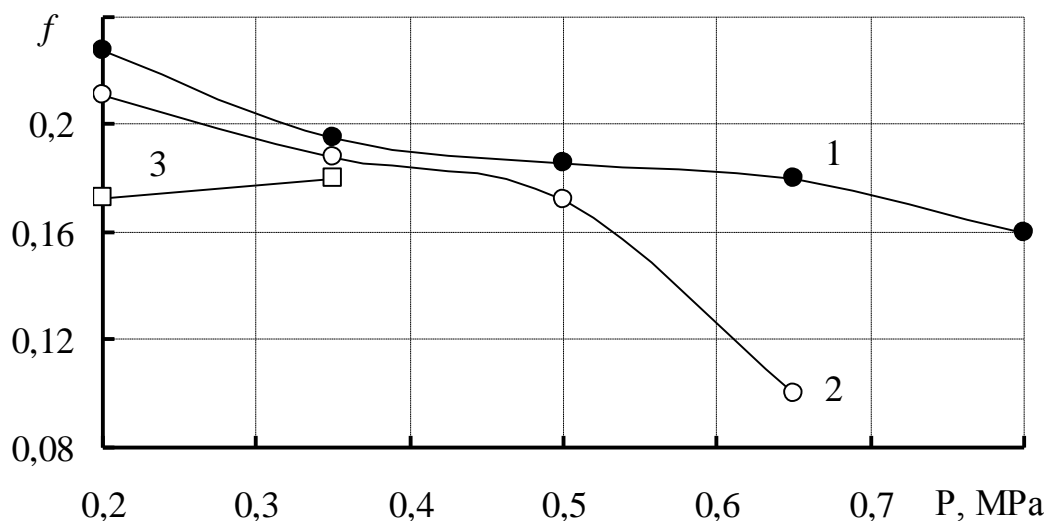


Fig. 1. The effect of specific pressure on the friction coefficient of phenylone C-1, studied at sliding speeds of 1 (1), 1.5 (2) and 2 m/s (3)

The most efficient was the polymer sample phenylon C-1, tested at a minimal sliding speed (1 m/s): under these conditions, the friction coefficient decreased from 0.23 to 0.16; at a sliding speed of 2 m/s it was steadily operated by only under loads of 0.2 and 0.35 MPa, then it began to wear out catastrophically, as a result of which the coefficient of friction could not be determined (Table 1).

Table 1. The influence of the operation modes on the intensity

of the linear wear of aromatic polyamide phenylon C-1,  $I_h \times 10^{-8}$

Specific pressure, MPa	Sliding speed, m/s		
	1,0	1,5	2,0
0,20	1,3	1,5	1,8
0,35	1,9	2,7	3,0
0,50	4,2	5,6	–
0,65	5,9	23	–
0,80	13	–	–

The linear wear rate ( $I_h$ ) samples of phenylon C-1 significantly depended on the specific load ( $P$ ). With loads of 0.2-0.5 MPa, this indicator increased on average 1.3-1.6 times, while  $P = 0.65$  MPa, the linear wear rate increased at almost 4 times. An analysis of the surface of the opposite element testified to the presence of a dense film on it that is formed from the products of polymer tribodestruction. The formation of a surface film was caused by the result of the temperature increase in the contact zone of the polymer sample – the opposite element, the adhesion forces between the polymer and the steel disk had increased. Samples of the polyamide binder were worn by the pseudoelastic mechanism: during the wear process fine wear products were created, which were accumulated on the surface of the steel disk, as a result of friction of the polymer material in the process of research was carried out not by the surface of opposite element, it was made by the wear products.

#### References:

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2. Bartenev G.M., Lavrentiev V.V. Friction and wear of polymers L.: Chemistry, 1972, 240 p.
3. Kragelsky I.V. Friction and heat: M.: Mechanical Engineering, 1968. – 480 p.

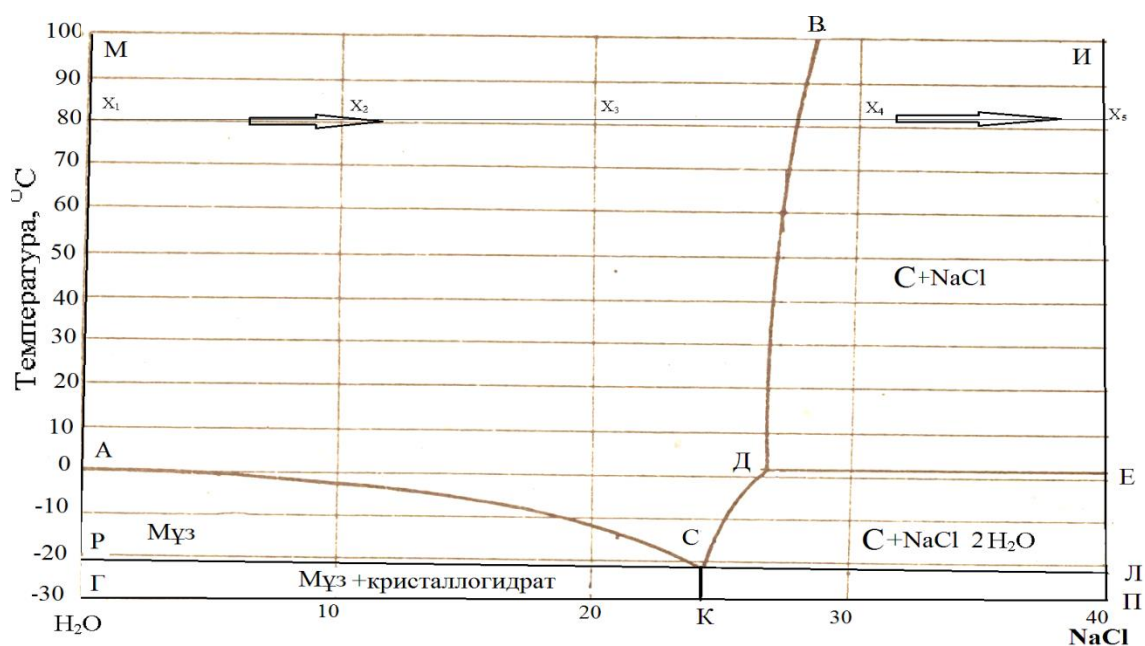
## Inorganic chemistry

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### СУЛЫ-ТҰЗДЫ ЖҮЙЕЛЕРДЕГІ ФИЗИКА-ХИМИЯЛЫҚ ӨЗГЕРІСТЕР СИПАТАМАЛАРЫ

Бейорганикалық заттар өндірістерінің басым бөлігін сулы-тұзды жүйелер құрайды. Оларды алудағы физика-химиялық үрдістер негізінен сулы ортада өтеді де міндетті түрде сулы-тұзды қоспаларды құрайды. Осы кезде олардың физика-химиялық қасиеттері үрдістердің технологиялық тәртіптерін орнықтыруға үлкен әсер етеді. Сондықтан оларды тек біліп қана қоймай меңгеру арқылы үрдістер нәтижесі мен тиімділігін артыруға қол жеткізуге болады [1]. Жүйенің физика-химиялық қасиеттерінің өзгерістерін олардың күй айналары арқылы түсіндіруге болады.



1-Сурет-NaCl-H<sub>2</sub>O жүйесінің күй диаграммасы

Күй диаграмасын қанығу сызықтары бірнеше аймақтарға бөледі. Олар АСДВМ қанықпанған ерітінділер аймағы, АС-СД-ДВ қанығу сызықтары, ГМ температура өзгерістері, ГП тұз шоғырының өзгерістері, АСР мұздың