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Physical-Mechanical Properties Of Polymer Bushing Used In Automobile Industry

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Abstract: *The article describes the method of physical and mechanical properties of automobile bushings made of local polymeric materials.*

Keywords: *graphite and talc, fasfogips, graphite and sawdust, asbestos, talk.*

It is difficult to achieve the required properties by adding fillers to the polymer separately, so a mixture of several fillers is used. For example, mixtures of additives such as graphite and talc, phosphogypsum, graphite and lead, asbestos and talc are used to reduce the coefficient of friction and abrasion of the epoxy polymer.

Nowadays, the service of cars is increasing and it is impossible to imagine our lives without them. In the process of operating a car, many of its mechanisms are eroded by friction, resulting in a decrease in its performance. To know the causes of such wear, it is necessary to study the laws of friction of materials.

Polymers are many expensive and rare materials that can replace them, and sometimes surpass them, which has led to their widespread use. Their use is also economically beneficial, for example, the cost of materials, labor costs for the manufacture of parts are reduced, the details are much lighter, capital expenditures and operating costs (lubrication, repairs) are reduced, and so on. If the parts are made of metal by casting, thermal and mechanical processing, the polymer is obtained only by a single operation, casting or extrusion. Material loss in the manufacture of polymer products does not exceed 5-10%, and in the manufacture of metals the loss is much higher (60-70%). Polymer products are two to three times cheaper than metal ones.

It is known [1-2] that polymers are characterized by low modulus of elasticity, heat resistance and thermal conductivity, high coefficient of linear expansion, ductility, tendency to relaxation and other properties relative to metals.

In the friction pair of polymer and metal, the coefficient of friction is mainly determined by the resistance to shear of the thin films formed on the surface. The cleaner the metal surface, the less corrosive the polymer will be.

Various fillers are added to polymers to increase their abrasion and abrasion resistance at high load and movement speeds. Such additives mainly serve the function of anti-friction, antifriction, heat-conducting, heat-resistant, abrasion-resistant. For example, graphite, molybdenum disulfide, talc, metal oxides, kaolin, phosphagips, dry, glass, asbestos and others are used as antifriction and corrosion-resistant fillers. Copper, aluminum, bronze, iron, lead, graphite powder and others are used to increase the thermal and electrical conductivity of polymers. All organic and inorganic substances as well as industrial and agricultural wastes can be used as fillers.

Not only the type of filler, but also the amount of it in the composition has a great influence on the coefficient of friction and wear. To do this, the optimal amount of them is determined experimentally.

It is difficult to achieve the required properties by adding fillers to the polymer separately, so a mixture of several fillers is used. For example, mixtures of additives such as graphite and talc, phosphogypsum, graphite and lead, asbestos and talc are used to reduce the coefficient of friction and abrasion of the epoxy polymer.

Polyamides are relatively widely used in thermoplastic polymers as antifriction materials. Polyamide has kapron P-66, P-68, caprolon V and other types. They operate at temperatures from -40 0S to +80 0S (Table 1).

Table 1

Physico-mechanical and friction properties of some polymers and other non steel materials

Materials	Strength limit, kg / cm^2		Operating Temperature, ^{0}C	Friction coefficient
	Stretching	In Compression		
Thermosetting plastics	800-1000	-	250-300	0,10-0,40
Thermoplast plastics	-	700-800	100-120	0,15-0,40
Metal-ceramic materials	2500-2800	-	300-500	0,25-0,40
Carbon materials	200-400	140-250	300-450	0,20-0,35

The coefficient of friction of polyamide with steel is f = 0.1-0.2 (oil-free), f = 0.05-0.1 in oil friction and f = 0.08-0.15 in water friction. If fillers are added to its composition, its properties are improved by 2-3 times.

Fluoroplastic and its composition are widely used as antifriction materials in automotive and mechanical engineering. They are resistant to chemicals and resistant to high temperatures (+300 0S and above). There are fluoroplast-2, 2M, 3, 3M, 4 (PTFE), 4M, 4D and other types of fluoroplastics. The coefficient of friction of Ftoroplast-4 with steel is as small as that of oil friction.

Currently, polyolifins (polyethylene, polypropylene, polystyrene) are also used as antifriction polymers. They are resistant to acids. They are also mainly

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used as various filler compositions. Their coefficient of friction with metals is in the range f = 0.2-0.4 (Table 2)

Table 2

Coefficient of friction and corrosion of plastics (metal + polymer)

Material	Friction Coefficient		Relative corrosion
	static	dynamic	
Polyamides	0,20-0,25	0,25-0,30	200
Polypharmaldehyde	0,15	0,20	65
Politerofluoroethylene	0,10	0,15	8
Polycarbonate	0,30	0,40	2500
Polyurethane	0,30	0,40	340

Pentaplast is used in the manufacture of some high-precision machine parts (gears, cuffs, pulleys, etc.). It is resistant to chemicals and is less susceptible to water. Operating temperature 120-130 0S. The coefficient of friction of pentaplast with steel is f = 0.12-0.20. Polyfarmaldehyde and epoxy resins are used in the manufacture of many gears, bushings, couplings, etc. They are resistant to organic solvents. Friction coefficient: polyformardehyde and steel f = 0.3-0.35, epoxy and steel f = 0.24-0.3. Polymers are mainly used as thin coatings (Table 3).

Table 3

Friction properties of thin coatings

Plastics	Friction coefficient	Plastics	Friction coefficient
Polyamides	0,04-0,05	Ftoroplast	0,032
Polycarbonate	0,032	Epoxy (ED)	0,032
Polyacrylate	0,040		

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