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INFLUENCE OF PHYSICAL AND MECHANICAL PROPERTIES OF POLYMER COMPOSITS ON THE STRENGTH INDICATORS OF CAR PARTS

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Annotation. In this article, the influence of the physical and mechanical properties of polymer composite materials obtained by adding local fillers on the strength indicators of automotive parts was studied.

Keywords: Polymer, composite, physical-mechanical, part, strength, property, filler.

Introduction. From the beginning of the 20th century, polymeric materials replaced metallic and ceramic materials. Today, polymer parts are used in friction pairs as an alternative material to metals or other materials [1-4]. Their normal tribological properties and low friction are beneficial for their operation in various processes, including parts of vehicles, aircraft components, and other machines and mechanisms.

Research [2-6] shows that the reason for the loss of operability of machines and mechanisms is 80-90% wear due to friction. Around the world, 100 million tons of lubricants are used annually to reduce friction. In developed countries, the failure of machine-building equipment due to friction and wear accounts for 4-5% of the national income[5].

Most of the current research on polymer tribology [3-6] is focused on engineering polymers. However, most of them are simple and simple tribo-systems, in which relatively less load-bearing parts (bushing, shaft, pins, pulley) are involved. Until now, the tribological properties of polymers and their compositions in these tribosystems have not been thoroughly studied, but attention to these materials is increasing due to the emergence of problems.

Object and method of research

Research Method. The study of tribotechnical properties was carried out on the "Micron-tribo" tribometer, operating in mini and nano sizes. For the experiment, a SHX steel ball with a hardness of 38-40 was used. The diameter of the steel ball is 3-5 mm. The roughness of the polypropylene sample with a diameter of 40-50 mm and a thickness of 4 mm was measured using a profilometer.

The experiments were conducted at a contact pressure of 1-20 N, a rotational speed of 0.5 and 1 m/s. Changes in the surface and surface parameters formed on the surface and in the sample of a steel ball were observed and studied using a profilometer.

Results and their discussion.

The coefficient of friction and wear are significantly influenced not only by the type of filler, but also by its content in the composite. For this, their optimal amounts are determined experimentally. It is difficult to achieve the necessary properties by adding fillers to the polymer composition separately, therefore a mixture of several fillers is used.

Physical and mechanical properties of polypropylene

Table 1

No	Properties	Trial methods	Measure unit	JM 380 UZ COR GAS
1.	Elasticity modulus, 28 mm/min,	ASTM D 790	MPa	1682.53
2.	Density	ASTM D 1505	g/cm^3	0.85-0.95
3.	Relative elongation, min	ATSM D 638	%	30-50
4.	Impact toughness IZOD (+23), min	ASTM D 256	kg f cm/cm^2	6-9

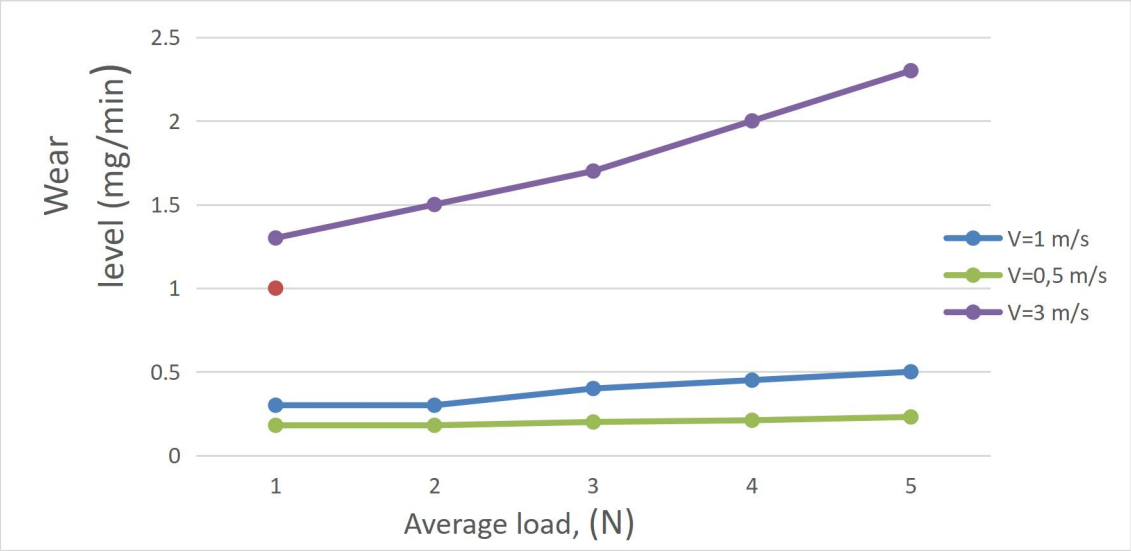

Figure 1. Dependence of wear on average load

Wear is directly proportional to the normal load, i.e., the greater the load, the greater the wear. The reason for this is that the increase in load brings the surfaces closer together, as a result of which their mechanical (penetration) and molecular attraction increases (Fig. 1). It has been shown that the degree of wear varies depending on the average load, the sliding speed is 0.5 l and 3.0 m/s. The maximum value of the degree of wear reaches 2-2.5 mg/min at a load of 5 N at a speed of 3 m/s, for 1 m/s this value is 0.4-0.5 mg/min, the minimum value is 1.4; 0.35 and 0.25 mg/min. Relatively small changes were observed at a speed of 0.5 m/s. The higher the material's velocity, the higher the temperature in the friction zone, resulting in softening of the material's surface and increased wear. To reduce wear, the optimal values of surface roughness for this pair are determined experimentally.

When a polypropylene sample is rubbed with a steel ball, it leaves a trace on the surface of the sample due to the normal load and sliding speed, the size and value of which depend on the friction modes and the type of material. These images are taken using a Micron-tribo"microscope mounted on a tribometer and are calculated based on trace measurements.

RESULT

The friction and wear of composites are significantly influenced by the normal load and the

sliding speed. The degree of wear varies depending on the average load. The maximum value of the degree of wear reaches 2-2.5 mg/min at a load of 5 N at a speed of 3 m/s, for 1 m/s this value is equal to 0.4-0.5 mg/min, the minimum value is 1.4; 0.35 and 0.25 mg/min at a load of 1 N. Relatively small changes were observed at a speed of 0.5 m/s.

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