PRESSURE OF CAR PARTS FROM POLYMERIC MATERIALS AND LOADING OF PRODUCTION FACTORS ON IT

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ABSTRACT

In article the method of studying of modes of manufacturing of automobile details under pressure is consecrated. Based on the studies studied, the author made his own conclusions. The strategy of actions on five priority directions of development of the Republic of Uzbekistan, adopted in our country on the direct initiative and under the leadership of President Shavkat Mirziyoyev and consistently implemented, has launched a new stage of development. The practical results, signs and features of this process are clearly visible today in all spheres of our lives, and most importantly, in the consciousness, aspirations and actions of our people.

KEYWORDS: *a polymeric material, the material expense, the press form, the foundry car, a polymeric composition.*

INTRODUCTION

The strategy of actions on five priority directions of development of the Republic of Uzbekistan, adopted in our country on the direct initiative and under the leadership of President Shavkat Mirziyoyev and consistently implemented, has launched a new stage of development. The practical results, signs and features of this process are clearly visible today in all spheres of our lives, and most importantly, in the consciousness, aspirations and actions of our people.

In particular, the fourth point of the Action Strategy, "Priorities for the development of the social sphere" is to radically improve transport services to the population, increase passenger safety and reduce emissions, purchase new buses, build and reconstruct bus stations and bus stations. Continuation of the construction and reconstruction of road infrastructure, in particular, the development of regional highways, capital and current repairs of inter-farm rural roads, streets of settlements.[5,6]

METHODS

Statistical data on friction and wear of automotive polymer parts were collected and modern methodologies and methods of mathematical statistics were used in their analysis.

A microtribometer was used to study the friction of automotive polymer parts and modern methods were used to detect wear.

Polymeric materials can deform to plastic under the influence of heat and pressure to take a certain shape and keep this shape stable. The production of polymeric materials is increasing and expanding. Their use is also economically beneficial, as the cost of materials, labor costs of manufacturing parts are significantly reduced, parts are much easier, capital expenditures and operating costs are reduced, and so on. If the parts are made of metal by casting, thermal, mechanical and other processing, the polymer material is obtained mainly by casting or extrusion. Plasticity, that is, the ability to take the desired shape and retain it, is a characteristic feature of the polymer.

Waste in the manufacture of products from polymeric materials does not exceed 5-10%, and in the manufacture of metal - 60-70%. Products made of polymer material have less friction and are easier to rub than those made of metal. The cost is also two to three times cheaper than metal.

Polymeric materials have a complex composition. The main part of them consists of natural or artificial resins, binders consisting of polymers. Their molecules are composed of substances that are chemically bonded links that are repeated several times.[9]

Molecules of polymeric materials have a long chain shape and can be arranged differently. If the molecules are in the form of a straight thread, the substances obtained from them will have flexible properties. If the molecules are in the form of fibers, they can be elongated once or twice due to their correction.

Steel, on the other hand, stretches much less than that. That is, no more than 10-20%.

Some polymeric material compounds are attached to adjacent groups of atoms in the form of a virgin carcass. Such materials will not be flexible.

The properties of polymeric materials depend on the composition and amount of substances added to them. The amount of these substances varies, and different mists, even predetermined properties, can be obtained.

The most important positive properties of polymeric materials are their water resistance, the ability to resist aggressive substances to petroleum products.

Its chemical advances make it possible to obtain plastics that can operate at both low and high temperatures. Since polymeric materials are good electrical insulators, they can be used in the manufacture of electrical equipment for automobiles.

The lack of heat resistance, as well as the fact that it changes its properties over time, ie the tendency to wear, is a disadvantage of polymers. But more and more materials are being created that are free of these shortcomings.

The scheme of the equipment for injection molding of parts from polymeric materials is shown in Figure 1.

The pressurized injection machine consists of a stock 1, a piston 2, a cylinder 3, a nozzle 4 and a press mold 5.

600-650 g of polymer composition is poured into the loading hopper of the casting machine (1). The polymer composition is fed to the material cylinder (3) of the casting machine and heated to 240-2700 C for 30-40 minutes. The part (4) heated to a temperature of 2400 C is initially mounted on a shaping plate (5) heated to 80-1000C.

When the piston (7) of the casting machine moves from right to left, the squeezed tip of the liquefied polymer composition (6) is removed from the cylinder and it fills the gap between the forming surface and the surface of the eaten detail. Accordingly, the temperature of the liquid composition should be 200 C higher than its melting temperature, the specific pressure of the casting should be 30-35 MPa, and the time under pressure should be 20 hours. Then the pressure is reduced, the pressform is separated. The restored part is removed from it, the seams are cleaned, the excess pieces of material are removed, the part is heat treated in oil at a temperature of 1200-1300 C for 1.5-2 hours. The part is then cooled to 1110C together with the oil and cooled to room temperature in the open.When pouring the polymers under pressure, its dimensions should be checked after 24 hours.

In the method of casting parts under pressure, the work efficiency is high, it is possible to create the dimensions specified in the task, without additional processing of details.

RESULTS AND DISCUSSION

The disadvantage of this method is the need to prepare a separate press for each part and the weak adhesion of the polymer layer to the surface of the part.

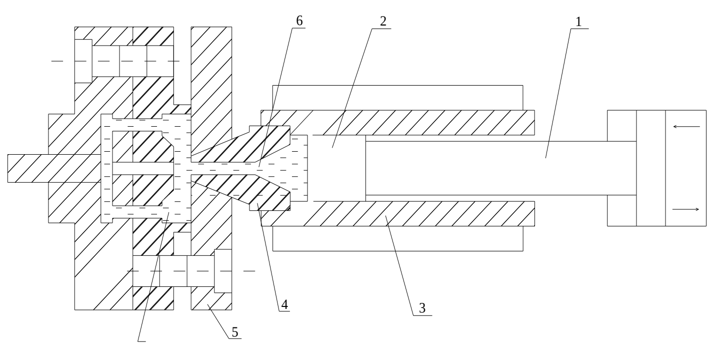

Figure 1. Scheme of the injection molding equipment

1-rod, 2-piston, 3-cylinder, 4-nozzle, 5-mold, 6-liquefied polymer, 7-detail

When making automotive parts under pressure from polymeric materials, the retention time of the compressive strength and the heating temperature of the mold are of great importance. The results of such an experiment conducted by us are shown in Figures 2-3. Different types of polymers with different properties were used in the experiments. Figure 2 shows the dependence of the load holding time on the injection molding of polymeric materials. Analysis of the graph shows that as the holding time increases, the compressive strength increases. But after its amount exceeds 15-20 seconds, the value of the download decreases.

The highest value of loading was observed in polyamide, while the lowest value was observed in polyethylene. It depends on the physical and mechanical properties of the materials and their structural structure. The conclusion is that since polyethylene is molded under pressure among polymeric materials better than other polymers, there is no need for great strength (Fig. 2).

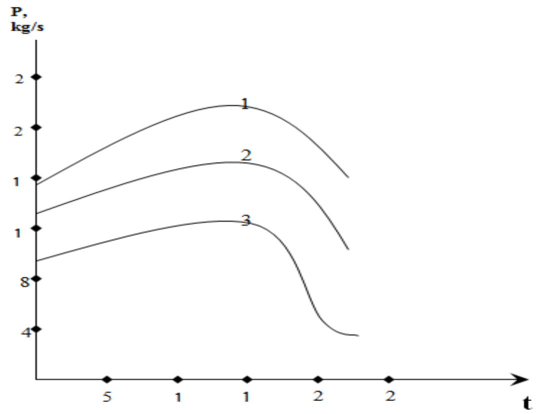

Figure 2. Dependence of the holding time of the load on the injection molding of polymeric materials

1- polyamide, 2- polypropylene, 3- polyethylene.

Figure 3 shows the dependence of the specific load on the heating temperature of the mold during the injection of polymeric materials. As can be seen from the figure, the specific load increases with increasing mold heating temperature. However, the value of the specific load decreases when the mold temperature decreases after 60-70 degrees. This is due to various changes in the physical and mechanical properties of polymeric materials with respect to temperature. That is, as the mold temperature increases, the polymer materials are poured well into the mold in liquid form, resulting in the mold cavity being well filled and the casting quality being good. As the mold temperature decreases, the polymer material thickens as it is poured into it, resulting in the mold cavity not being filled well and the casting quality not being good. Among the polymers seen in the experiment, the best result in this regard was recorded in polyethylene.

Conclusion: In the preparation of parts by the injection method, the highest value of the load was observed in polyamide, and the lowest value was observed in polyethylene. Among the polymeric materials, the injection molding of polyethylene into the mold is better than others, so no great force is required for this. That is, as the mold temperature increases, the polymer materials are well poured into the mold in liquid form, and as the mold temperature decreases, the polymer materials condense during the pouring process, resulting in the mold cavity not filling well and the casting quality not being good. Among the polymers, polyethylene showed the best results in this regard.[7]

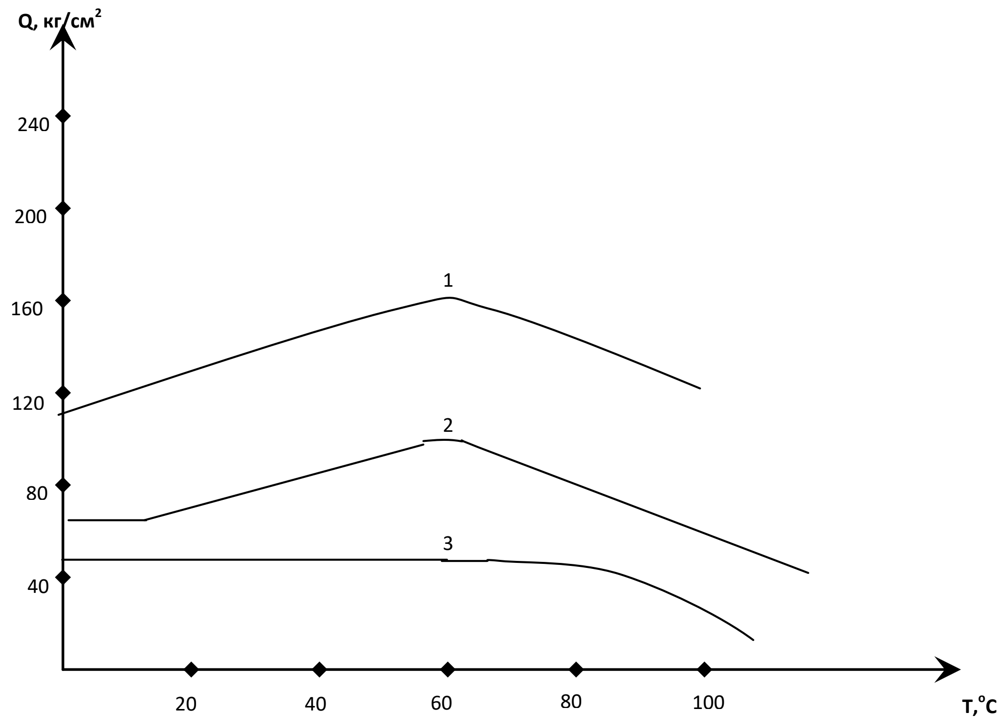

Figure 3. Dependence of the specific load on the heating temperature of the mold when pressing polymer materials polyamide, 2- polypropylene, 3- polyethylene.

Abrasion of polymer bushing materials

As mentioned above, different types of polymeric materials were obtained in the experiments. Thermoplastic polymers are used to make polyamide, which is widely used in the automotive industry, and polyethylene and polypropylene, which are produced in Uzbekistan.

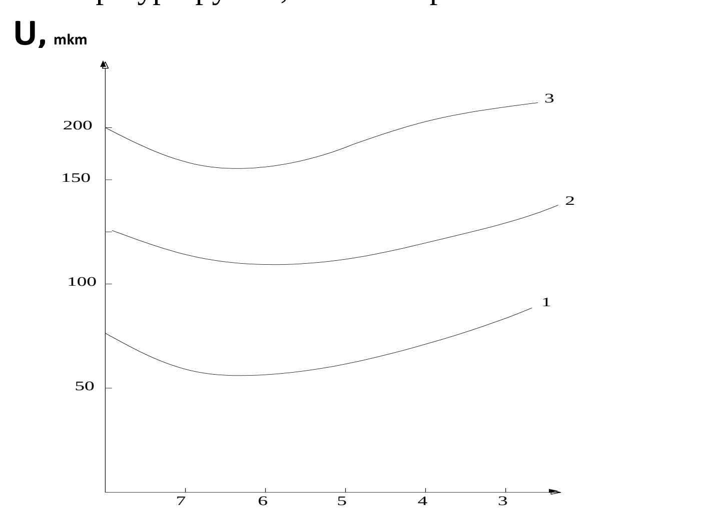

Figure 4. Influence of detail surface cleanliness on polymer wear. (1-ED-20, 2-polyamide, 3-polyethylene)

The results of the study are shown in Figure 4-5 and their results have been discussed at scientific conferences.

As can be seen from Figure 3, when polymer samples are rubbed with metal, the erosion of all polymers is observed to decrease to a certain extent on the surface purity of the metal, followed by an increase, i.e. the erosion is of an extreme nature. When the purity of the metal surface is up to class 6, the wear of all polymeric materials decreases, and when its amount decreases below class 5, an

increase in wear is observed. In this case, the absorption of polyamide and eposide polymers is relatively low.

The most commonly eaten is polyethylene. For example, the corrosion of polyethylene is around 200 μm when the metal surface is in grade 6, and 100-110 mkm when epoxy is used, which is 2 times less. This indicates the corrosion resistance of polyamide and epoxy. It was observed that the corrosion of polymers increases further with the decrease in the purity of the metal surface.

Figure 5 shows a graph of the dependence of the corrosion of the selected polymeric materials on the roughness of the metal. In this case, low corrosion was observed in ED-20, while corrosion is relatively high, especially in polyethylene. This is due to the low mechanical properties of polyethylene. For polyethylene, a rapid increase in abrasion was observed at 20-30 mkm of roughness, while for other polymers, abrasion increased very rapidly when the roughness was greater than 60 mkm.

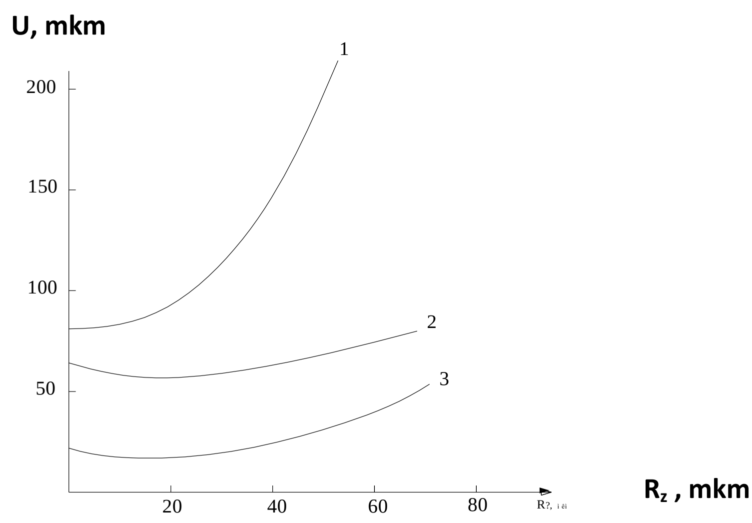

Figure 5 Influence of detail surface roughness on polymer wear (1- polyethylene, 2-polyamide, 3- ED-20)

The analysis of the above results shows that the corrosion of polymeric materials also depends on the amount of their friction coefficient. The greater the amount of friction coefficient, the greater the wear of polymeric materials.

Therefore, we have studied below the effect of metal surface roughness on the coefficient of friction of polymeric materials.

When the polymer is rubbed with steel, the most brittle is polyethylene, and the least brittle is the epoxy polymer.

Figure 6 shows the change in the coefficient of friction with the metal of the polymer materials under study relative to the ro ess.

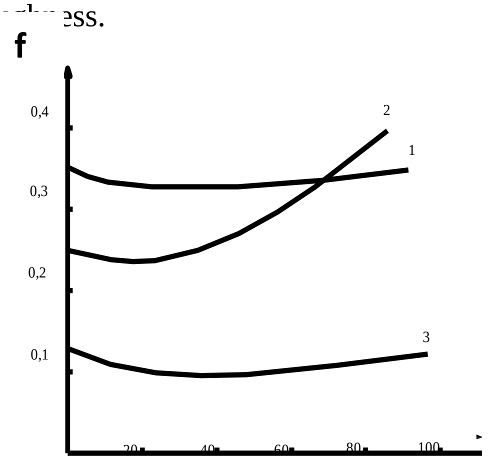

Figure 6. Influence of detail surface roughness on the coefficient of ıe polymer.

As can be seen from Figure 7, the coefficient of friction decreases with increasing amount of roughness Rg, but after a certain value it is observed to increase again. That is, the change in the coefficient of friction with respect to roughness is kept to a minimum, as noted in scientific works and literature. The smallest coefficient of friction is observed at a value of 40-50 µm of Rg. The results show that the coefficient of friction of a polymeric material after a certain friction path is the same whether the initial roughness is too large or too small. In this case, when the initial Rz = 40 and Rz = 10 µm for the polamide, the coefficient of friction was recorded in the range of 0.2 and Rz = 20 µm (Fig. 15).

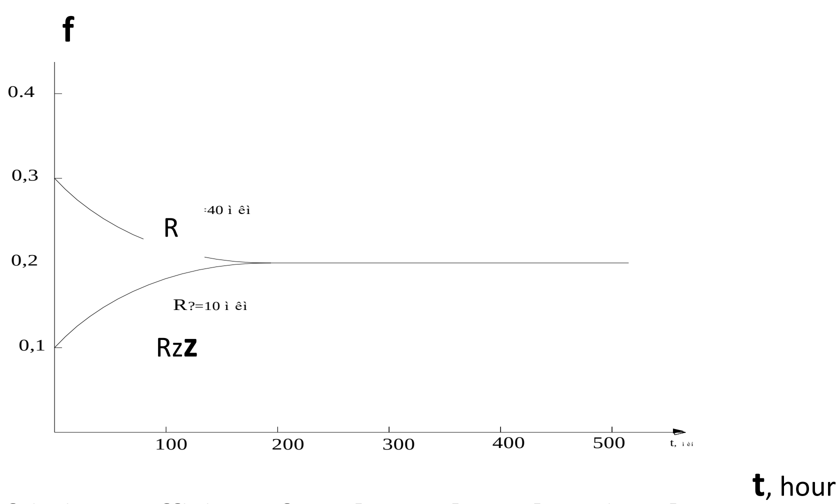

Figure 7. The friction coefficient of a polymer depends on its adaptation period

This means that the coefficient of friction of the same amount of friction will be small, regardless of the initial roughness.

At present, the production of polyethylene and epoxy resin (ED-20) is launched in the country. However, the erosion rate of pure polyethylene was found to be relatively high. To increase its corrosion resistance, it would be expedient to use additives available in the country.

However, as we noted above, the wear of polyethylene in its pure form increases with increasing temperature due to a decrease in its physical and mechanical properties. To prevent this, we recommend the use of polyethylene talc, phosphogypsum, kaolin and metal powder compositions.

Thus, we offer epoxy resin (ED-20) and polyethylene for automotive friction parts based on the detection of friction and abrasion between the prepared sample and the metal.

Based on the results of the study, we have developed and recommend the following procedure for the selection of polymer materials for friction car parts.

Procedure for selection of polymeric materials for friction pairs;

The selection of a polymer material for friction pairs consists of the following main steps:

I. Analysis of the conditions of friction pairs

1. At this stage the following work is performed:

a) The characteristics of the external environment and the conditions of loading are determined;

b) The place, amount and mode of loading is determined;

c) The temperature is determined.

2. Geometric and design requirements:

a) The overall dimensions of the node;

b) Surface and sitter specifications.

3. Requirements for use:

a) Reliability indicators and service life;

b) Coefficient of friction and energy capacity;

c) Noise and its damage;

g). storage conditions.

4. Technological and economic requirements:

a). development volume;

b). cost of the product;

v). performance of equipment;

g). energy consumption;

d) Appearance;

e) Other information.

Based on the analysis, a technical task is set for the design of the friction pair.

II. Initial selection of polymer material.

A group of materials is selected, some of which are taken separately for experimentation.

III. Evaluation of the performance of the friction unit by constructive calculation:

The optimal shape and size of the pairs, the resistance of the joints to cracks and cast loads, the coefficient of friction were determined, and the bending intensity of the node was calculated. As a result of the calculations, the necessary constructive changes will be made.

IV. Final (final-main) selection:

Based on the calculations, the polymer materials selected for the pairs are tested under their working conditions. The tests are performed first in a laboratory setting and then directly on a stand. In the end, an experiment was conducted on a direct friction unit, and the most suitable polymeric materials were selected, ie low cost, high physical and mechanical properties and low wear.

CONCLUSION

Loss of performance of parts (80-90%) during the operation of vehicles occurs as a result of their wear.

Therefore, once the wear of the part has reached a certain level, it is recommended to replace it or restore the worn surface. Replacing a detail is costly for us, that is, for the national economy. Therefore, the use of polymer coating and pressure-treated parts in surface restoration is both inexpensive and reduces vehicle mass.

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