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IMPROVEMENT OF PHYSICAL AND MECHANICAL PROPERTIES
OF PLASTIC PARTS USED IN MACHINE BUILDING

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УЛУЧШЕНИЕ ФИЗИКО-МЕХАНИЧЕСКИХ СВОЙСТВ ПЛАСТИКОВЫХ ДЕТАЛЕЙ,
ИСПОЛЬЗУЕМЫХ В МАШИНОСТРОЕНИЕ

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ABSTRACT

The article analyzes the improvement of the physical, mechanical and strength properties of polypropylene produced at the Ustyurt gas chemical complex, as well as the composition obtained by adding some local to the production of plastic parts used in the automotive industry.

АННОТАЦИЯ

В статье анализируются пути улучшения физико-механических и прочностных свойств полиэтилена, производимого на Устюртском газохимическом комплексе, и композиционных полимерных материалов, получаемых путем добавления некоторых местных наполнителей в производство пластмассовых деталей, используемых в автомобильной промышленности.

Keywords: polymer, polypropylene, composition, material, plastic, properties, filler.

Ключевые слова: полимер, полиэтилен, композиция, материал, пластик, свойства, наполнитель.

It is known that today most of the car parts are made from plastic materials. Polymers, in terms of their structural properties, can replace many expensive and rare materials, and sometimes even surpass them, which has led to their widespread use. Their use is also economically beneficial, for example, material costs are reduced, labor costs for manufacturing parts, parts are much lighter, capital costs and operating costs (lubrication, repairs) are reduced, and so on. If parts are made of metal by casting, heat treatment and mechanical treatment, the polymer is obtained only as a result of a single operation, casting or extrusion. Losses of material in the manufacture of polymer products do not exceed 5-10%, and in the production of metals, losses are much higher (60-70%). Polymer products are two to three times cheaper than metal ones. The properties of plastics depend on the composition and the amount of fillers added to them. By varying the amount of these substances, it is possible to obtain compounds with different, even predetermined properties. Such additives mainly perform the functions of antifriction, antifriction, heat-conducting, heat-resistant, wear-resistant. For example, graphite, molybdenum disulfide, tacle, metal oxides, kaolin, phosphagips, dry, glass, asbestos and others are used as antifriction and anticorrosive 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 waste can be used as fillers [1, pp. 1575-1576].

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, to reduce the coefficient of friction and wear of the polypropylene composition, a certain amount of additives such as graphite and tacle, phosphogypsum, and additives such as lead, asbestos and tacle are used. The most important property of composite materials is their resistance to deformation. The elements used as fillers are usually in the form of fine powder or short fibers.

Such additions mainly reduce the cost of the material. But they can also increase the strength of the composite material by 1.5-2.0 times. A certain amount of reinforcement increases the strength of materials by 2-10 times.

Since the effect of an additional element (filler) on the properties of composite materials is very large, the name of many composite materials is also called by the name of its filler. For example, graphitoplasts, fiberglass compositions, organoplastics and so on.

If the properties of composite materials are the same in all directions, the properties of such materials will be isotropic. These include composite materials in which powdered additives are in error. When the properties of materials in different directions differ, such compositions are said to have anisotropic properties. In polymer-based composite materials, polymer binders are used as a matrix that combines all the components to form a single whole. Examples of polymer-based composite materials are polymers.

In the creation of polymer compositions, the polymer base is brought to a state of high fluidity or high elasticity, and then additives are introduced by a certain technological method. After cooling, the solid base of the composition is in a glassy or crystalline state. Nowadays, polymer-based composite materials with excellent properties have been developed, such as their relative strength, abrasion and abrasion resistance, corrosion resistance, controlled magnetic and electrical properties, which are not inferior to ordinary steel, cast iron and other structural materials. Polymer-based composite materials have been developed that retain performance capabilities even in the 200-400 °C. Such materials are widely used in the automotive industry, as well as in all sectors of the economy.

It is not possible to achieve the desired properties by adding fillers to the polymer separately, so the best method is to use a system of several fillers.

For each of the material properties, not only the type of filler, but also its amount in the composition has a significant impact. To do this, the optimal amount of them is determined experimentally [3, p.39-41].

Deformation of bodies can vary at different mechanical stresses. Therefore, the deformation property of the material is an important aspect in the evaluation and selection of the material. In most cases, bodies become brittle and brittle at low temperatures. The brittle material deforms under conditions that cannot compensate for the stresses that occur. Breakage or cracking may occur when the mechanical load value exceeds the limit value. The elongation strength of the specimen is determined by the device in picture 1.[2, p.50-60; 5-6].
Picture 1. Compression and elongation testing machine for plastic materials. (QUASAR 2500)

Picture 2. Device for determining the impact resistance of plastics. (Tinius Olsen IT504)

The following results were obtained on the properties of polypropylene using the above and other types of laboratory equipment (Tables 1 and 2).

**Table 1.**

| №  | Properties                              | Test methods | Unit of measurement | EP 640T KO-REA | JM 380 UZ COR GAS |
|----|----------------------------------------|--------------|---------------------|----------------|------------------|
| 1. | Readability                            | ASTM D 1238  | g/10min             | 51             | 55-65            |
| 2. | Elasticity module, 28 mm / min         | ASTM D 790   | MPa                 | 1733,52        | 1682,53          |
| 3. | Density                                | ASTM D 1505  | g/sm³               | 0,85-0,95      | 0,85-0,95        |
| 4. | Strength to elongation, 50 mm/min      | ASTM D 638   | kg f /sm²           | 240            | 240              |
| 5. | Relative elongation, min               | ASTM D 638   | %                   | 25             | 30               |
| 6. | Impact viscosity IZOD (+23), min       | ASTM D 256   | kg f sm/sm²         | 7              | 6,00             |
| 7. | Impact viscosity IZOD (-30), min       | ASTM D 256   | kg f sm/sm²         | 3              | 3                |
| 8. | Heat resistance, 0.455 Mpa or 4.6 kg f / sm², min | ASTM D 648   | °C                  | 95             | 90               |

**Table 2.**

| №  | Properties                              | Test methods | Unit of measurement | EP640T 66% TALK 15% EPDM 19% | JM380 66% TALK 15% EPDM 19% |
|----|----------------------------------------|--------------|---------------------|-----------------------------|-----------------------------|
| 1. | Readability                            | ASTM D 1238  | g/10min             | 42                          | 45                          |
| 2. | Elasticity module, 28 mm/min,          | ASTM D 790   | MPa                 | 1779,4                      | 1778,4                      |
| 3. | Density                                | ASTM D 1505  | g/sm³               | 1,01                        | 1,01                        |
| 4. | Strength to elongation, 50 mm/min      | ASTM D 638   | kg f /sm²           | 248                         | 249                         |
| 5. | Relative elongation, min               | ATSM D 638   | %                   | 20                          | 22                          |
| 6. | Impact viscosity IZOD (+23), min       | ASTM D 256   | kg f sm/sm²         | 15,6                        | 15,00                       |
| 7. | Impact viscosity IZOD (-30), min       | ASTM D 256   | kg f sm/sm²         | 3,8                         | 3,85                        |
| 8. | Heat resistance, 0.455 Mpa or 4.6 kg f / sm², min | ASTM D 648   | °C                  | 99,5                        | 100                         |
The conducted research and the analysis of their results show that in the manufacture of plastic parts of automobiles it is effective to use composites of polypropylene with the following known filler system (Table 3).

**Table 3. Compositions of polypropylene**

| №  | Material       | CPP1 | CPP2 | CPP3 | CPP4 |
|----|----------------|------|------|------|------|
| 1  | Polypropylene  | 65   | 70   | 75   | 75   |
| 2  | EPDM           | 15   | 10   | -    | -    |
| 3  | Talk           | 20   | -    | 10   | 5    |
| 4  | Kaolin         | -    | 20   | -    | -    |
| 5  | Phosphogypsum  | -    | -    | 10   | 10   |
| 6  | Glass fiber    | -    | -    | 5    | 5    |

**CONCLUSION**

The use of polypropylene and its composition, mainly produced in Uzbekistan, in the creation of plastic parts and coatings of the car has many advantages, as a result, firstly, cheap local raw materials of not inferior quality, secondly, saves on foreign exchange, and thirdly, as a filler from environmental waste access will be created.

It is known that the Ustyurtgaz complex currently produces 83,000 tons of polypropylene. In order to make full use of these local plastic materials, bumpers, instrument panels and door trims manufactured by UzKORAM KO JSC, interior lining details at the joint venture Uz-Dong Yang Ko LLC, Andijonkabel, Uz Chasis JSC and Uz-Kodji "can be used in the manufacture of electrical insulation. Polypropylene in its pure form does not give the necessary effect due to the decrease in its physical and mechanical properties with increasing temperature. To prevent this, it is advisable to use additives based on polypropylene production waste - fillers with the addition of talc, phosphogypsum, soot, kaolin, fiberglass, waste cotton and alkali fibers.

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