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Structural Materials Based on Polyolefins

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Annotation: Antifriction and antifriction-wear-resistant composite polymer materials. The friction of raw cotton with a composite material has a complex nature. The mechanism of interaction of these bodies during friction is influenced by both molecular and mechanical processes.

Keywords: polyethylene, polypropylene, tribotechnics, raw cotton, graphite, carbon black, kaolin, talc, fiberglass, wollastonite and cotton lint.

The current level of development of composite polymer materials (KPM) allows you to create unique materials that can work in extreme conditions at low and elevated temperatures, pressures, aggressive and abrasive media.

However, existing polymeric materials and compositions based on them are not yet widely used in the electrical, engineering, and other industries due to the lack of a solution to the problem of creating reliable composite polymeric materials, the structure of which is purposefully organized under the influence of operational factors and possessing high properties. . composite polymer materials. Antifriction and antifriction-wear-resistant composite polymer materials. The friction of raw cotton with a composite material has a complex nature. The mechanism of interaction of these bodies during friction is influenced by both molecular and mechanical processes. The specificity of the contacting bodies is determined by the occurrence of electrostatic forces. Based on this, it was found that the friction of raw cotton with a composite material has a molecular-mechanical-electrical nature. These results make it possible to purposefully change and regulate the properties of materials, ensuring their compliance with the requirements for composite polymeric materials that work in interaction with raw cotton.

To create composite materials for antifriction purposes, it is necessary to strive to increase the strength of the material, reduce the temperature and reduce the amount of static electricity charge in the friction zone. And when developing a composite material for antifriction-wear-resistant (AI) purposes, it is necessary to take into account the requirements for the minimum values of the friction coefficient and wear rate. These problems can be solved by introducing various types of fillers, including a system of hybrid fillers. Graphite, carbon black, kaolin, talc, fiberglass, wollastonite, and cotton lint were used as fillers. However, each of them has its own disadvantages and advantages. Experimental studies have established that fiberglass, wollastonite and cotton lint increase the coefficient of friction and reduce wear intensity. Graphite, soot, kaolin and talc reduce the coefficient of friction, but increase the wear of composite materials, and also improve thermal and electrical conductivity and, thereby, reduce the temperature and magnitude of the charge of static electricity that occurs in the friction zone of the contacting pairs. Moreover, the effectiveness of these fillers, especially fibrous ones, is significantly manifested at a lower content, that is, with a lower content of glass fiber, the wear intensity is significantly reduced, and with a further increase in their content, the wear intensity of composite materials decreases relatively little, but the friction coefficient increases sharply. The most effective reduction in the friction coefficient of composite materials with raw cotton is observed with the introduction of soot and graphite. Based on the foregoing, we have developed anti-friction and anti-friction-wear-resistant composite materials based on polyolefins - high-density polyethylene (HDPE) and polypropylene (PP), in their optimal ratios, providing functionally important physical, mechanical, tribological and operational properties of composite polymer materials, working in conditions of interaction with raw cotton. Moreover, they have high anti-friction properties and wear resistance compared to

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steel. The table shows the strength and tribological properties of the developed anti-friction polyethylene (APEC) and polypropylene compositions (APPC), anti-friction wear-resistant polypropylene compositions (AIPPC). The main strength properties of the samples (breaking stress in bending u, flexural modulus Ei, impact strength a, Brinell hardness NB) are determined by generally accepted methods - state standards. The complex of tribotechnical properties (friction coefficient, wear intensity) of the composition when interacting with raw cotton of the C-6524 variety, moisture content 8.2% was determined on a disk tribometer.

Table

Physico-mechanical and tribological properties of polyethylene and polypropylene composites

Indicators	APEK-1	APEK-2	APPK-3	APPK-1	AIPPK
Breaking stress in bending and, MPa	33,4	35,4	90,1	85,7	93,3
Impact strength, a, kJ/m2	17,5	21,0	97,3	91,3	103,7
Brinell hardness Hb, MPa	45,1	48,4	80,3	76,2	73,8
Modulus of elasticity in bending, Eu, GPa	0,62	0,65	1,85	0,75	1,7
Friction coefficient f (*at P = 0.01 MPa, V = 1.5 m/s, W = 8.2%)	0,36	0,34	0,27	0,29	0,29
Wear rate I.1010 (at P = 0.01 MPa, V = 1.5 m/s, W = 8.2%)	5,7	5,5	3,12	3,2	2,8

* P-specific pressure, V- sliding speed, W- moisture content of raw cotton

As can be seen from the table, the properties of polyolefin composite polymer materials fully meet the functional requirements for the material of parts of rubbing pairs of working bodies of machines and mechanisms of the cotton complex, the main of which are the manufacturability and economy of the material used, the effective reduction of damage to cotton fiber and seeds, the elimination of the accumulation of static electricity, the formation of fiber windings on the surface of the pegs and sparks on impact with solids found in raw cotton.

From the developed composite polymer materials, parts of the friction pairs of the working bodies of the receiving-feeding mechanism, the mobile cotton reloader, the telescopic tunnel former, the tunneling machine, the cotton riot picker and the feeder picker used at procurement points and cotton ginning plants during the acceptance, transportation, disassembly and supply of cotton were made -raw material in subsequent technological installations. The use of the developed composite polymer materials as materials for parts of friction pairs of working bodies of cotton machines and mechanisms operating in frictional interaction with raw cotton leads to an increase in machine productivity by 12-16% and a decrease in power consumption by 7-18%, damage to cotton fibers and crushing of seeds, as well as the elimination of possible ignition of raw cotton and the formation of fiber windings on the surface of composite parts.

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