RESEARCH OF THE INFLUENCE FINELY DISPERSED FRICTION MODIFIERS ON THE ANTI-WEAR PROPERTIES OF GREASE LUBRICANTS

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Abstract: In this paper, a comparative study of the influence finely dispersed friction modifiers on the anti-wear properties of grease lubricants. Tests performed on the standard friction machine: four-ball machine-3.2. During the tests identify the optimal quantity and composition modifiers grease lubricants. The comparative analysis of the influence modifiers on grease lubricants of different manufacturers and recommendations for the practical use of research results was done.

Keywords: friction modifiers, anti-wear properties, grease lubricants.

1. INTRODUCTION

In practical use often noted the positive effect of techniques to increase anti-wear properties of commodity lubricants by introducing them finely dispersed solid functional additives. This procedure allows to reduce a friction and wear on the mating surfaces in the case of tougher operating conditions. One of the most common types of additives in lubricants are based on compositions serpentine minerals [1-3]. The main factor of the effective action of the modifier - selection of the optimum concentration and particle size of the solid filler.

The purpose of the study to determine the optimal concentration of fine friction modifier - serpentinite in grease lubricant, in which there is maximum to improve its anti-wear properties.

In this study, a comparative research of the influence fine friction modifier and its concentration in the anti-wear of grease lubricant Lithol-24 from different manufacturers. Lubricant Lithol-24 - antifriction multi-purpose water-resistant grease based on mineral oil, lithium soap containing antioxidant and viscosity additives (see Table 1). Selecting a base grease lubricant due to the widespread use of Lithol-24 in rolling and sliding bearings of all types, joints, gears, and other transmission; on the friction surfaces of wheeled and tracked vehicles; in industrial machinery, electrical machines, etc.

Table 1 Basic physical and chemical characteristics of the studied grease lubricants.

<table>
<thead>
<tr>
<th>Technical Specifications</th>
<th>Grease Lithol-24</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Manufacturer №1</td>
</tr>
<tr>
<td>Operating-temperature range, °C</td>
<td>-40...120</td>
</tr>
<tr>
<td>Penetration, mm</td>
<td>240</td>
</tr>
<tr>
<td>Melting point, °C</td>
<td>194</td>
</tr>
<tr>
<td>Colloid stability, %</td>
<td>11</td>
</tr>
<tr>
<td>Tensile strength, Pa</td>
<td>at 20 °C</td>
</tr>
<tr>
<td></td>
<td>at 80 °C</td>
</tr>
<tr>
<td>Efficient viscosity at 0 °C, Pa*s</td>
<td>221</td>
</tr>
<tr>
<td>Welding load (Lw), N</td>
<td>1410</td>
</tr>
<tr>
<td>Load wear index (Lwi)</td>
<td>28.2</td>
</tr>
<tr>
<td>Ultimate load (Lu), N</td>
<td>630</td>
</tr>
</tbody>
</table>

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As used in research as a modifier fine powder is a natural silicate - serpentine (Mg₆[Si₄O₁₀] [OH]₈) with a particle size of 1 micron, and 10, 30 microns. Friction modifier was introduced into Lithol-24 in an amount of 0.05 %, 1 %, 5 % and 10 % by weight of the grease lubricant.

2. EXPERIMENTAL

Tests performed on the standard friction machine: four-ball machine-3.2 in accordance with GOST 9490-75. To determine the optimum amount of lubricant modifier composition built the diagrams of the wear intensity of steel balls on the concentration of powder in the serpentine Lithol-24 of the manufacturer number 1 (Figure 1), and the manufacturer number 2 (Figure 2).

![Figure 1. Diagrams the wear rate Lithol-24 of the manufacturer №1.](image1)

![Figure 2. Diagrams the wear rate Lithol-24 of the manufacturer №2.](image2)

3. RESULTS AND DISCUSSION

Comparative analysis of the results showed that the greatest effect of the introduction of fine friction modifier in the grease lubricant both manufacturers found at a concentration of 10 % by weight, with a
particle size 30 microns. Especially brightly expressed positive effect of the additive on Litol -24 of the manufacturer №2 - wear rate decreased to 60.5 % of the base sample (Figure 2, 30 microns).

In tests with fine powder particle size of 10 microns it has been found that compositions Lithol-24 serpentine should contain an additive at a concentration of 5 - 10 % by weight. At such concentrations tribological characteristics of any lubricant manufacturer increased by almost half.

Significant differences influence of modifier for lubricating different manufacturers observed when added in the Litol-24 serpentine particular size of 1 micron. The effectiveness of geomodifiers grease lubrication of the manufacturer №2 above (Figure 2, 10 microns) than the lubricant manufacturer №1 (Figure 1, 10 microns). This is due to the composition of the base component compositions lubricants. The compatibility components greases associated with the chemical nature of viscosity additives and other additives.

Thus, this experiment confirms the hypothesis of a sequence of different processes in which it is believed that the fine particles of serpentine with optimal size of 5-10 microns in triboparah crushed to 2 microns, which corresponds to an optimal surface roughness and maximum wear resistance of conjugation. Over the same small particles form conglomerates larger sizes and harm mating surfaces of friction pair. [4].

4. CONCLUSIONS

The difference results from the use of fine friction modifiers for two lubricant manufacturers, most likely due to the different packages anti-wear additives. This is indirectly confirmed by the difference to the manufacturer specifications of greases one brand Litol-24. Violation of the industrial base balance additive can have a dual effect, both to improve wear properties so reduce their entering into a chemical reaction with the components of additives or provide mechanical action.

Use of fine powders in lubricants with complex industrial additives is only possible after laboratory testing and selection of the optimum composition and concentration of the particulate friction modifier for specific operating conditions.

REFERENCES