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Research Article

IMPROVING THE POLISHING PROPERTIES OF TRANSMISSION OILS BY ADDING ADDITIVES

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ABSTRACT

This article examines ways to improve the polishing properties of transmission oils. The operating conditions of gears are characterized by high loads in the contact zone of the teeth, relatively high speeds of mutual movement of the rubbing surfaces. The polishing properties of the oils should protect the transmission parts from wear and the undesirable phenomenon of jamming, abrasion of gears. In complex additives (chlorine, phosphorus, sulfur), sulfide films prevent bullying, while chloride films, due to their elasticity, reduce wear and energy costs to overcome the friction force.

KEYWORDS

Transmission oil, gears, transmission, viscosity, polishing properties, additives.

INTRODUCTION

Transmission oil is the "vital basis" of the transmission. It plays an extremely important role in its durability and operability.

The operating conditions of gears are characterized by high loads in the contact zone of the teeth, relatively high speeds of mutual movement of the rubbing

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surfaces and significant temperatures in the contact zone.

Energy losses in the transmission account for up to 20% of the total power consumption of the car. If 25% of the so-called useful engine power goes to the transmission without taking into account losses, then in the general system of transmission units due to their own losses in the units, this power transmitted to the driving wheels is reduced to 12%.

Transmission oils should, on the one hand, maintain high viscosity at operating temperatures so that the film does not collapse and the gaps are normally sealed, and on the other hand, do not become too viscous so that at the beginning of the mechanism, cold oil in the unit would not interfere with the free rotation of the gears.

RESEARCH ANALYSIS

The time of oil ingress into the oil channels of the gearbox bearings and drive axles significantly depends on both the viscosity of the oil and its temperature.

The polishing properties of the oil are the ability of individual elements of the lubricant to interact with metals and at the same time form new substances that differ in mechanical properties from the base metal. To form a polishing film on metal, chemically active substances phosphorus, sulfur, chlorine, etc. are needed. However, there are no such components in transmission oils. They are introduced with additives that have polishing properties. As a result of the chemical interaction of these substances with the metal surface, new products are formed, characterized by a lower melting point and an increase in plasticity. For example, sulfur forms metal sulfides. The melting point of iron sulfide is 350 °C lower than the melting point of iron, and iron phosphide is 515 °C. The flow of the alloy at the points of contact produces chemical polishing of the surface, as a result of which the specific pressure and temperature decrease.

The combination of wedging and polishing action is especially effective when the effect of chemical polishing agents and polar substances with long chains is simultaneously manifested. This circumstance is a consequence of the formation of an adsorbed film of polar substances on a chemically polished surface.

Currently, substances containing sulfur, chlorine, phosphorus in one combination or another are used as polishing additives - all of them are capable of giving compounds with metals with more favorable antifriction properties.

Under conditions of increased loads and temperatures, sulfur-containing compounds: sulfides, polysulfides of the compound interact with metal. When the temperature rises, the iron sulfide film, which has a lower melting point than the base, melts and is an additional lubricant that prevents wear and tear.

The adsorption layer, getting into the microcracks of a solid, quickly spreads deep into the crack and has a significant wedging effect on the walls, contributing to the destruction of the surface layers.

We conducted a study of samples of industrial oils, and samples with the addition of XFS-9 additives, which perform a polishing and extreme pressure function.

It is believed that the process of chemisorption of the additive on the metal plays an independent positive role, also in severe friction modes.

Transmission oils 85W-140 and additive XFS-9 (1-8%) were selected as the object of the study. To conduct experiments, the oils with the additive were analyzed according to physico-chemical parameters in accordance with the requirements and norms. The test results of transmission oils with an additive are shown in Table 1.

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Test results of transmission oils 85W-140 with XFS-9 additive

(chlorine 2.8%, phosphorus 2.5%, sulfur 3.7%)

Quality indicators	Additive Content - XFS-9, %							
	1	2	3	4	5	6	7	8
Viscosity, mm2/s at t=100°C	14	14,2	14,4	14,6	14,8	15,6	16,8	17,2
Polishing properties,%	10	12	14	16	18	20	22	25

CONCLUSIONS

From the results of the analysis, we selected the additive content of 5% X FS9, which shows the optimal viscosity value. With a further increase in the concentration, the viscosity increases greatly, which can lead to increased friction losses.

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