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INFLUENCE OF LUBRICATING PROPERTIES OF MOTOR OILS ON THE RESOURCE OF THE ENGINE

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ABSTRACT

This article discusses the influence of lubricating properties of motor oils on the operation of engine parts. The quality of engine oils, especially lubricating indicators significantly affect the reliability of the engine, fuel consumption and other parameters. Therefore, high-quality selection and application of motor oils is very important.

KEYWORDS

Engine oils, lubricating properties, friction, engine, wear, friction modifiers.

INTRODUCTION

The lubricating properties of oil are understood as its ability to prevent the wear of friction surfaces, the formation of a strong film on the rubbing surfaces, excluding direct contact of parts. The lubricating properties of the oil depend on its viscosity, viscosity-temperature characteristics, lubricity and purity of the oil. With an increase in the oil temperature, its adsorption layer weakens, and at a temperature of 150-

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200°C, the strength of the oil film reaches the edge of dry friction and collapses.

The efficiency of the internal combustion engine ranges from 25 to 30%. An increase in efficiency by 1% leads to an increase in engine power by about 4%, since 25% efficiency corresponds to 100% engine power. Experts have calculated that friction and leaks account for 25-50% of all mechanical losses in the car engine, and losses in the piston ring-cylinder wall friction pair account for 9-15% of engine power. Another possibility to reduce friction is the use of improved lubricants.

A good lubricating property of engine oil is its ability to prevent wear, scuffing and welding by polishing the rubbing surface of the metal with the reaction products of the lubricant, which are formed during chemical interaction with the metal. Oils with high anti-wear properties to prevent wear are able to form a friction mode that excludes direct contact of the rubbing surfaces of metals.

Especially in this case, a combination of wedging and polishing action is effective, since the friction force between the rubbing surfaces depends on their roughness. The smoother the friction surface, the less mechanical and more molecular friction, and vice versa. On the other hand, oil is retained better on a finely rough surface.

The lubricity or oil is judged by its chemical composition, viscosity and the presence of additives. The oiliness of oils is influenced by resinous substances, high-molecular acids and sulfurous compounds, which can be contained in oils and have high surface-active properties. Poorly soluble surfactants of this type form multilayer protective films in the friction nodes with the introduction of alloying metals into the friction zone.

During normal lubrication, polar groups of oil molecules form adsorbed films on the friction surfaces. In boundary lubrication, the friction force and wear depend on the resistance of these films and the strength of the interaction of oil molecules with the metal surface, i.e. on the stickiness of the oil.

The thickness and strength of the oil boundary layer during friction of the working surfaces of engine parts depends on the chemical composition of the oil and its additives.

The operability of the boundary layer of oil depends on its viscosity and is determined by the interaction of the molecular film of oil with the rubbing surface of the metal. The resulting molecular oil films of physical origin are called adsorption, and films of chemical origin are called chemisorptions.

Lubricants containing surfactants have the ability to absorb on the interface surfaces of two media: liquid and solid. The ability of lubricants containing surfactants to form sufficiently strong layers of oriented molecules on lubricated surfaces is called oiliness or lubricating ability of oils. When the lubricating layer completely separates the working surfaces that move relative to each other, and this layer has a thickness at which normal volumetric properties of the oil appear, then such friction is called liquid. The coefficient of liquid friction is in the range of 0.003–0.03, which is 50–100 times less than with friction without lubrication. The friction force of this type of lubricant depends only on the inner layers in the lubricant. The wetting ability of surfactants can be manifested due to the formation of strong hydrogen bonds of surfactants with water and the displacement of water from the metal surface.

The formation of the boundary layer of the lubricant is associated with the physical process of adsorption of

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the adhesion of the polar-active elements of the lubricant with metal, resulting in the formation of new substances that differ in mechanical properties from the material.

The adsorption boundary layer produces a "wedging" effect, i.e. it contributes to the separation of the rubbing parts so much that they cease to directly touch each other. Schematically, the process of formation of boundary films can be represented as follows: a polar active oil molecule is attracted to the metal surface, forming a monomolecular film (Fig.1). A similar phenomenon occurs on another surface.

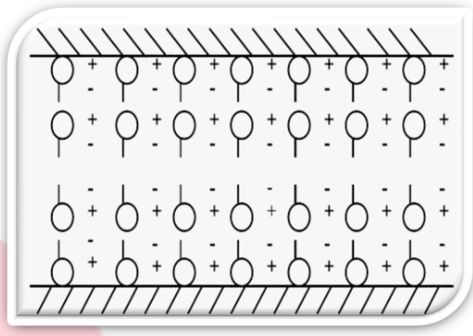

Fig. 1. Scheme of film formation under boundary friction

Friction modifiers regulate the coefficient of friction of the lubricated surfaces. To reduce the coefficient of friction, such compounds are used, in the molecules of which there is a strong polar group that provides good adhesion, and a long linear chain that provides good sliding

To increase friction, compounds are used in the molecules of which there is a strong polar group that provides good adhesion, and a short linear part that provides good adhesion.

Currently, substances containing sulfur, chlorine, phosphorus in one combination or another are used as lubricating additives - all of them are capable of giving compounds with metals with more favorable antifriction properties. These additives increase stickiness and improve lubricity.

Multi component polishing additives containing sulfur, chlorine, and phosphorus in pairs or together are the most effective, since in this case there is a functional differentiation and mutual complementation of the positive properties of individual elements.

Thus, the lubricating properties of the adsorbed layer are associated with its strength and the wedging action of molecules during relative sliding of surfaces. The wedging effect is associated with the polarity of the molecules, and the polarity, in turn, is determined by the structure of the molecule, as well as the number of hydroxyl, carboxyl or other functional groups containing oxygen, sulfur, chlorine, nitrogen, etc.

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