УДК 621.89:621.43

CHARACTERISTICS OF THE AGING PROCESS OF MOTOR OIL

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During the operation of internal combustion engines, under the influence of many factors, the physical and chemical properties of the motor lubricant change - it ages. The main directions of aging of the lubricant in the engine are distinguished: oxidation of the hydrocarbon base, activation of additives, contamination. In addition, the processes of chemical-colloidal aging and thermo-oxidative destruction (thermal decomposition) are also considered as independent directions of the lubricant aging process. Separate directions are closely related, and it is difficult to consider the process of contamination of the lubricant in isolation from the process of its oxidation and activation of additives.

Oxidation of the hydrocarbon base of motor oil is caused by its high heating in the presence of air oxygen. Features of the design and mode of operation of the diesel engine suggest four main zones of possible oxidation of the lubricant.The first zone is the crankcase space of the engine. The temperature of the lubricant in the zone varies from -50^{o}C (before starting) to 100^{o}C and more, the intensity of oxidation in this zone is small.In the second zone - between the piston skirt and the sleeve - the lubricant, in addition to contact with highly heated parts, is exposed to gases escaping from the combustion chamber. Even more intense thermal load and contact with hot gases is experienced by the lubricant in the third zone - the ring belt of the pistons.In particularly harsh conditions of oxidation and thermal decomposition, the lubricant is in the fourth zone - the lubricant that remained on the working surface of the cylinder during the movement of the piston from TDC to TDC on the expansion stroke. In this zone, hot gases heat the surface layer of the film to 300-350^{o}C to a depth of 1-3 microns. Oxidation of the lubricant leads to the appearance of substances that can form varnish deposits and carbon deposits on parts, sludge in the crankcase, and cause corrosion of non-ferrous metals.

Additives in lubricants are spent on the processes of neutralization of acidic products that accumulate in the lubricant due to its oxidation and fuel combustion, as well as dispersion of pollution products by sorption on their surface, to inhibit oxidation processes. The activation of additives is accompanied by the formation of insoluble metal oxides and salts, as well as organic products capable of interacting with oxidation products of the hydrocarbon base of the lubricant. A working lubricant always has both a activated and an active additive that characterizes the performance of the lubricant.

Lubricant pollution occurs due to the accumulation of soluble and insoluble substances in it, which are formed as a result of oxidation, activation of additives, thermo-oxidative destruction of the lubricant, as well as substances that enter from the outside: fuel, products of its incomplete combustion, water, air dust and wear products of engine parts. Contaminating impurities cause increased wear and burr of parts [1, 2]; contaminate oil channels and filters; depositing on the surfaces of the parts, impair the supply of lubricant to the friction pairs, which leads to a decrease in the reliability of the engine.

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