Available online at www.sciencedirect.com

ScienceDirect

Procedia Engineering 150 (2016) 480 – 485

Procedia Engineering

www.elsevier.com/locate/procedia

International Conference on Industrial Engineering, ICIE 2016

Method of control the effect of temperature for the oxidation process of partially synthetic motor oils

B.I. Kowalski, D.D. Abasin, O.N. Petrov*

Siberian Federal University Institute of Oil and Gas, Prospekt Free 82 p. 6, Krasnoyarsk, 660041, Russia

Abstract

This article presents the results of a study of the oxidation process partially-synthetic motor oils in the temperature range from 170 to 200 °C. The oxidation process of oils evaluated on indicators of thermo-oxidative stability which characterizes the oil resistance to temperature influences. As indicators of thermal oxidative stability of selected: the absorption coefficient of the light flux, evaporation, kinematic viscosity and potential resource.

Peer-review under responsibility of the organizing committee of ICIE 2016

Keywords: absorption coefficient of luminous flux; a potential resource; temperature control; kinematic viscosity; volatility; oxidation resistance coefficient.

1. Main text

Thermo-oxidative stability of lubricating oils characterized by their resistance to aging. There are many methods of monitoring indicators, including changes in the definition of physical, chemical and performance properties, the amount of deposits, evaporation, optical density, kinematic viscosity, the induction period of precipitation, acidity, tar, carbon residue, etc. [1-5]. Most of the above methods are standardized, but the information on the resistance of the lubricating oil temperature influences are not available to consumers[6-8].

The objective of these studies is to expand the information on the resistance of the lubricating oil temperature effects with the use of simple means test and measurement, the use of which is possible both in the laboratory and in the conditions of the operating companies.

* Corresponding author. Tel.: +79504014163.
E-mail address: shram18rus@mail.ru

Peer-review under responsibility of the organizing committee of ICIE 2016
doi:10.1016/j.proeng.2016.07.021

To investigate the selected part-synthetic engine oil of the same viscosity grade: Mobil 10W-40 SJ/CH; Zic 5000 10W-40 CG4/SH and Zic A 10W-40 SL.

The checks provided for the use of the following means of test and measurement: temperature control device for oil; low-volume viscometer; photometer for direct photometry oxidation of oils and electronic scales. Technical characteristics of the instrument is shown in [9].

According to the method a sample oil weighing 100 g ± 0,1 poured into a glass beaker for temperature control device at temperatures of 170 to 200 °C at atmospheric pressure while stirring with a glass stirrer speed of 300 rev/min. The temperature of incubation was set discretely and automatically maintained to within -1 ...+ 2 °C. Test duration was 2, 5 and 8 hereinafter hours.

After each test period glass beaker was weighed to determine the mass of evaporated oil was selected portion of the sample (2 g) for direct photometry at a thickness of the photo- metric layer of 2 mm and a determination of the absorption coefficient of the light flux, and a portion of the sample (8 g) were taken at the temperature for measuring the kinematic viscosity 100 °C. Testing continued until the value of the coefficient = 0.7-0.8. The experimental data change rate, volatility, kinematic viscosity obtained at temperatures of 170-200 °C built graphics depending on the test of time, which compared the studied oils.

Fig. 1a, b, c are presented depending on the time factor and the oxidation temperature of the studied part-synthetic motor oils. It is found that for oils Mobil 10W-40 SJ/CH; Zic 5000 10W-40 CG4/SH first test there is an area of resistance to oxidation, the duration of which increases with decreasing temperature thermostat. More resistant to temperature effects is oil Zic A 10W-40 SL, but less stable even at 170 °C, oil is Mobil 10W-40 SJ/CH.

A common feature of the dependences obtained (Fig. 1) is the presence of portions regardless of the temperature incubation with greater speed change ratio, confirming the formation of two kinds of degradation products with different optical density in the oxidation process, called primary (formed in the initial test period) and secondary causing bending dependencies [10-14].

In addition to oil Zic 5000 10W-40 CG 4/SH and Zic A 10W-40 SL set the stabilization and even decrease in the value of the coefficient of temperature thermostat 190 and 180 °C, which can be explained by the fact that the transition of primary oxidation products in secondary formed coagulation centers (insoluble degradation products) tightening secondary products on its surface lightening oxidized oil.

Initially, the formation of coagulation centers dimensions are such that the light beam encloses them (diffraction), so that the coefficient value decreases.

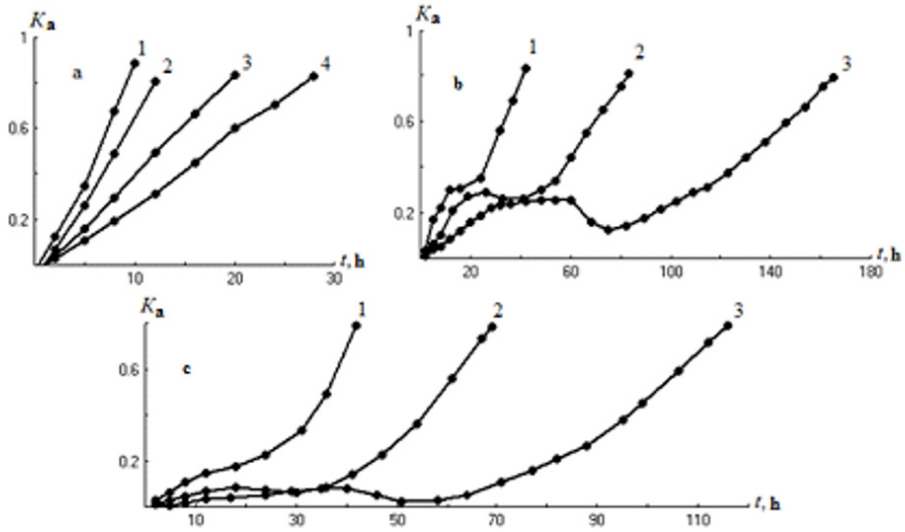

Fig. 1. The dependence of the absorption coefficient of the luminous flux of time and incubation temperature of partially-synthetic motor oils: a - Mobil 10W-40 SJ/CH; b - Zic 5000 10W-40 CG4/SH; c - Zic 5000 10W-40 CG4/SH; 1 - 200 °C; 2 - 190 °C; 3 - 180 °C; 4 - 170 °C