

**PETROLEUM PRODUCTS: technology, innovation, market**

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**The results of laboratory tests of locomotive diesel oils, containing a new non-sulfur detergent additive K-300** \_\_\_\_\_ **4-7**

*Keywords:* comparative tests of oils, new detergent additives.

*Abstract.* Oils for the diesel engines – M-6s/14D<sub>2</sub> and M-14D<sub>2</sub> are a complex composition including base oil and additives. In this paper, the results of tests of oils with a "classical" composition were compared with the involvement of the sulfur-containing phenate additive K-36 and new oils in which the K-36 additive was replaced by the sulfur-free phenant additive K-300. As a result of tests provided, some conclusions can be named:

- replacement of the additive K-36 with K-300 in oils does not change the basic physicochemical parameters of the oil, and the values of the tested similar samples of M-6s/14D<sub>2</sub> and M-14D<sub>2</sub> oil samples involving K-36 and involving K-300 are close to declared by the manufacturer;
- the data obtained during the testing of oils indicate that the K-300 additive gives a slightly higher level of performance than the K-36 additive, so K-300 can be recommended for use in oils M-6s/14D<sub>2</sub> and M-14D<sub>2</sub>.

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**Tribological properties enhancement of urea greases** \_\_\_\_\_ **8-12**

*Keywords:* urea greases, tribological characteristics, extreme pressure and antiwear additives.

*Abstract.* Tests of additives of various chemical natures in the composition of urea grease have been carried out to improve its tribological properties. Tests of lubricant compositions were carried out on a four-ball friction machine to determine the wear scar diameter, the critical load and the welding load. The increase in extreme pressure and antiwear properties of lubricant is experimentally confirmed when special additives are added to its composition. Conclusions are made about the prospects of adding EP additives to the composition of polyurea grease to improve their tribological properties.

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**Nickel salt of monoesters of alkenyl succinic acid as the component of conservation liquids** \_\_\_\_\_ **13-16**

*Keywords:* alkenylsuccinic acid, monoester salts, conservation liquids, corrosion inhibitors.

*Abstract.* One of the most effective means of protecting equipment against atmospheric corrosion is the use of conservation liquids. Atmospheric corrosion destruction of oilfield equipment, agricultural and military equipment is determined by the physicochemical properties of the water and hydrocarbon components of the system, their composition, the quantitative ratio. To increase the protective effect of conservation liquids, oil-soluble corrosion inhibitors are introduced into the mineral oil composition, relating to different classes of compounds. One of these classes is monoesters of alkenyl succinic acids obtained by esterification of the condensation product of high molecular weight oligomers with maleic anhydride.

Previously by reacting alkenyl succinic anhydride (ASA) with aliphatic and cyclic alcohols was synthesized mono- and diesters. Diesters of the ASA were proposed as the basis and components of synthetic lubricating oils.

The purpose of this work is to investigate the nickel salt of the monoester of ASA as the corrosion inhibitor in conservation liquids.

These mono-esters, as well as their nickel salt, were added to the mineral turbine oil T-30 as an inhibitor. The obtained compositions were investigated as conservation liquids.

Tests were conducted in accordance with GOST 9054-75 (the protective properties of conservation liquids were evaluated in 24 hours, as an aggressive environment, the G-4 hydro camera, sea water and 0.001% solution of sulfuric acid were chosen). The tests were performed with a conservation liquid containing 3, 5, 7 and 10% of inhibitors. Positive results were obtained.

Thus, it has been proved that monoethyl ester of HSA and its nickel salt can be used as a corrosion inhibitor in conservation liquids.

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## MATHEMATICAL SIMULATION TECHNOLOGICAL PROCESS

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### Development of technical solutions to increase of gasoline fraction yield and gases at catalytic cracking technology of vacuum gasoil \_\_\_\_\_ 17-24

*Keywords:* catalytic cracking, gasoline fraction, octane number, rich gas, coke, catalyst, mathematical modeling.

*Abstract.* A mathematical model of the vacuum gasoil catalytic cracking is developed. This model is oriented on the forecasting of the yield and the composition of cracking product, the content of propane-propylene (PPF) and butane-butylene (BBF) fractions of rich gas and coke taking into account the feedstock composition, the catalyst activity and the chemical reactions reversibility depending on the current concentrations and process temperature. It is shown that the decrease of the catalyst coke content from 0.92 to 0.82 wt% and the increase of the feedstock conversion by 8.1 wt%, during the vacuum gas oil processing with the saturated to aromatic hydrocarbons ratio is 2.2 units, is achieved by rising the reactor temperature to 529.8 °C due to an increase of the catalyst circulation ratio to 6.4 ton<sub>catalyst</sub>/ton<sub>feed</sub>. The cumulative production of gas and gasoline increases by 7.6 wt%, and the gasoline yield with the octane number by research method of 91.7 unit., rises by 1.3 wt% (82.1 tons per day). The PPF: BFB ratio in the rich gas increases from 0.84 to 0.92 units.

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## ANALYTIC METHODS for OIL and PETROLEUM PRODUCTS

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### The study of the self-organization process of the oil system on the solid surface in the nonequilibrium conditions of the effect of vapors of *n*-hexane \_\_\_\_\_ 25-32

*Keywords:* oil, vapors of hexane, asphaltenes of oil system.

*Abstract.* This work deals with the study the process of the aggregation, the coagulation and the asphaltene deposition in the nonequilibrium conditions of the effect of vapors of *n*-hexane. Using the methods of the optical and atomic-force microscopy is ascertained that the average cluster size of the asphaltene nano unit is 28 nm, and the calculated critical value of the oil asphaltene interfacial tension at 298 K is  $0,8 \div 1,5 \cdot 10^{-4}$  J/m<sup>2</sup>. Using the methods of the capillary viscometry and Fourier-transform infrared spectroscopy (FTIR) was discovered that molecules, with rather high content of benzene hydrocarbon fragments and the groups of sulfoxide providing the formation of the volume bond net on oil restricting fluid phase mobility and making it hyper viscosity, are the first to precipitate in the process of the asphaltene deposition from oil under the effect of vapors of *n*-hexane. Diasphaltene oil film under even at low shearing stress is shown to separate from the asphaltene deposition and to spread over the solid surface with the adsorptive oil fractionation into tar and oil.

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### Determination of the molecular weight of poly- $\alpha$ -olefins by viscometric method \_\_\_\_\_ 33-37

*Keywords:* PAO, polyalphaolefin oils, molecular weight, viscometric method, macromolecule, structure, IR spectrum, equation of Mark-Kun-Houwink.

*Abstract.* The article provides a method for determining the molecular weight of selected PAO samples with kinematic viscosity at 100°C 2, 4, 6 and 12 by viscometric method using computer simulation. The popularity of this method is explained by the ease and accuracy of experimental data. Were recorded IR spectra of all the samples on the instrument Fourier transform infrared spectrometer FT-801 with attachment of multiple frustrated total internal reflection horizontal type MFTIR 36. The molecular masses of the oils were calculated based on the IR spectra obtained by the area occupied by the peaks; the results were compared with the literature data. Model structures of macromolecules, and a 3D model was built in the software package ChemOffice 13.0. The solvent is heptane, it has been selected to

determine the characteristic viscosity of the samples. It is known that n-heptane is a thermodynamically good solvent of polymers, because it forms powerful solvate shells around molecules, which reduces the possibility of conformational transitions. These characteristic viscosities of PAO determined the coefficients of the equation. The resulting equation Mark-Kuhn-Houwink with known coefficients allowed us to calculate the molecular mass of the samples of polyolefin oils.

Thus, the results of computer simulation were obtained structure and molecular weight of different poly- $\alpha$ -olefin structures, which are different brands of POAM. Using heptane as a solvent on a capillary viscometer, the kinematic viscosities of solutions of different concentrations were measured and the characteristic viscosity of each PAHOM grade was calculated. Further, to determine the molecular weight of poly- $\alpha$ -olefin oligomers by Mark-kun-Houwink, there were constant subsets.

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### QUALITY: documents and comments

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#### **Specifications of the US Department of Defense for lubricating oils for internal combustion engines of military equipment operating in the extreme north and the Arctic \_\_\_\_\_ 38-42**

*Keywords:* specification, lubricating oil, crankcase lubrication, piston internal combustion engine, ground military equipment, exploitation, climatic conditions, Extreme North, Arctic.

*Abstract.* Since the the early 1960s, the US Department of Defense has been carrying out systematic activities aimed at developing new specifications and improving its own specifications, which regulate the minimum performance requirements for lubricating oils intended for crankcase lubrication of reciprocating internal combustion engines that are equipped with all types of ground wheel and caterpillar military equipment for various purposes, operated in extreme climatic conditions of the Far North and Artics.

This article analyzes the scientific and technical information available in the open foreign and Russian press concerning the specifications of the US Department of Defense for lubricating oils.

Subsequently, this analysis will be used in the development of normative documentation for domestic universal multi-purpose lubricating oils intended for use in piston internal combustion engines operating in a wide range of climatic conditions (including extreme climatic conditions).

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### CHEMMOTOLOGOS

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#### **The role of operational methods in assessing the behavior of oil in the engine \_\_\_\_\_ 43-45**

### The VNIINP BULLETIN

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#### **Development of hydrogenation processes at Russian refineries \_\_\_\_\_ 45-49**

*Keywords:* Motor fuel, hydrotreatment, hydrocracking, catalytic dewaxing, deepening of oil refining, oil distillates, oil residues, catalyst, automotive fuel, diesel fuel.

*Abstract.* Considered the ways of development of hydrogenation processes of oil refining at domestic and foreign refineries. Noted the growth of hydrotreating and hydrocracking of distillates capacities. The issues of formation of hydrogenation processes in Russia since the beginning of the 20th century and the role of Russian scientists in their development are discussed. The great importance of catalysts for ensuring the effectiveness of these processes was noted. Given the list of new processes mastered at the refineries of our country in recent years, incl. - awarded by the Government of the Russian Federation.

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