

**CHEMISTRY AND TECHNOLOGIES OF OIL-REFINING**

**Pp. 6–11**

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**Investigation of the process of coke formation with the introduction of specialized additives at tarp visbreaking installations**

**Keywords:** visbreaking, coke formation, thermal treatment of hydrocarbon feedstock, inhibitor, tar.

**Abstract.** Based on the analysis of the use of known and developed additives to reduce coke formation in the process of tar visbreaking, sulfur-containing and phosphorus-containing additives were identified. The influence of sulfur-containing, phosphorus-containing compounds, developed reagents containing combined organic and inorganic compounds in their composition, on the process of tar coke formation during visbreaking has been studied.

The process of tar coke formation in the process of visbreaking in the presence of DMDS, DMSO, DMS, TPP, TPPO in the amount of 5, 10, 15 ppm was studied; developed inhibitors of coke formation (IK-1, IK-2, IK-3) at a dosage of 5, 10 and 15 ppm.

The study of the process was carried out on a laboratory delayed coking unit with appropriate temperature conditions.

It has been shown that the use of dimethyl disulfide (DMDS), triphenylphosphine oxide (TPPO), developed reagents (IK-1, IK-2, IK-3) as coke formation inhibitors in the process of tar visbreaking contributes to an increase in the operating time of coils and furnace columns, and also reduce the pressure drop at the inlet and outlet of the furnaces.

**Pp. 12–19**

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**Synergetic effect in modification of oxidized road bitumens of different group composition**

**Keywords:** road bitumen, tar oxidation, modified bitumen, styrene-butadiene-styrene, sulfur, polyphosphoric acid.

**Abstract.** The physico-chemical-rheological properties of the asphalt binder are critical to the long-term performance of the asphalt pavement infrastructure. The objectives of this investigation are to characterize the physico-rheological properties of unmodified pure and polymer-modified bituminous binders using rheological performance tests. The rheological properties of three pure oxidized bitumen, three SBS with sulfur-modified bituminous binders, and three bituminous binders modified with SBS+S+PPA were studied in this work. Various amounts of styrene-butadiene-styrene (SBS), sulfur (S) and polyphosphoric acid (PPA) modifiers were added to the pure binder for this purpose. The tested physical properties of the bituminous binder include traditional penetration and softening temperature. Group composition studies (saturates, aromatics, tars and asphaltenes; SARA) were respectively conducted to quantify the chemical composition and structural properties of pure oxidized bitumen. A dynamic shear rheometer (DSR) was used to evaluate the durability (PG) of virgin, thin film oxidized (RTFO-aged) and pressure vessel (PAV-aged) bitumens. The resistance to rutting and fatigue failure was evaluated using the test for creep recovery after repeated loading (MSCR). A bending beam rheometer (BBR) was used to study the low temperature properties of bituminous binders. All modifiers have been

found to improve the high temperature properties of clean asphalt. In addition, these modifiers have not been found to have a significant effect on the low temperature continuous grade of the binders.

## **ANALYTICAL CONTROL OF PETROLEUM AND PETROLEUM PRODUCTS**

**Pp. 20–23**

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### **The composition and properties of oil fractions of unique Azerbaijan oils (review)**

**Keywords:** unique Azerbaijan oils, Balakhani oil, oil fractions, additives.

**Abstract.** This review article presents the results of a study of Azerbaijan oils for their scientifically based sorting and processing, since they are a valuable raw material for petrochemical processes. Particular attention is paid to the study of light oil products, their qualities are decisive for the assessment of the oil itself. In oils, the qualities of fuel oils, distillate and oil fractions are also determined. Azerbaijan oils, due to their uniqueness, are used as a valuable raw material for petrochemistry. In addition, in connection with the export of oil to world markets, it is important to identify the valuable properties of Azerbaijani oils that allow them to compete with well-known marker oils. Also relevant is the assessment of the qualities of fuel oils and oil fractions of Azerbaijani oils.

The review article discusses the quality of oil fractions from offshore fields oils in the Azerbaijan and Turkmen sectors of the Caspian Sea, containing 9–13% paraffin, 14–36% aromatic hydrocarbons. It has been established that base oils with a VI of 80–90 units (I group by API) are obtained by processes of selective purification and dewaxing, as we showed earlier when obtaining oil fractions from promising Azerbaijan oils Azeri, Chirag, etc.

To obtain modern high-quality oils with IV 100 and higher, it is possible to use refined oil components from Azerbaijan oils (for example, from Balakhani oil) using and involving hydrocracking oils (20–40%) and a package of additives from foreign companies.

## **PETROCHEMISTRY: TECHNOLOGY, PROCESSES**

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### **Features of the I–IV groups of aromatic hydrocarbons of the West-Apsheron oil**

**Keywords:** aromatic hydrocarbons (AU); EPR of substituted hydrocarbon radicals; asphaltenes;  $Mn^{+2}$ ; Co; UV spectra of I–IV groups of AU.

**Abstract.** The composition and paramagnetism of groups I–IV of aromatic hydrocarbons of the West-Apsheron oil were studied by UV and EPR spectroscopy. It was found that in all I–III groups of heavy oil there are derivatives of benzene, naphthalene, phenanthrene and anthracene, the quantitative content of which increases as they are fractionated. It is shown that there are no paramagnetic particles in the EPR spectrum of group I AU of the West-Apsheron oil. In group II of the AU, the EPR spectrum of the substituted hydrocarbon radical with  $\Delta H_{width} = 7,5 \text{ mt}$ ,  $g = 2,07$   $Mn^{+2}$  is recorded in a small amount, and in a small amount it is closely related to asphaltene radicals with  $\Delta H_{width} = 1.1 \text{ mt}$ ,  $g = 2.0028$  and a small amount of  $Mn^{+2}$  ions. A small amount of Co, shielded by asphaltene radicals, is recorded on the

spectrum.

## CHEMOTOLOGY

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### Corrosion tests of working – preservation oil in various climatic zones

**Keywords:** working-preservation oil; additive composition; protective properties; climatic testing station; corrosion damage; product protection period; complex indicator of protective ability.

**Abstract.** The protection period of equipment with an analogue of the K-17 working-preservation oil calculated on the basis of laboratory tests according to GOST RV 9.513-97 correspond to the terms of protection of the K-17 working-preservation oil, established by GOST 9.014–78. Corrosion tests of the developed preservation oil were carried out in comparison with the K-17 working preservation oil at test climatic stations corresponding to the conditions of subtropical, mountainous and continental climate. The results of climatic tests of the analogue of the K-17 preservation oil made it possible to establish that the developed sample has high protective properties and can be used as an effective means of anticorrosive protection of various metal products during transportation and storage.

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### Some recommendations for improving the effectiveness of the assessment of the neutralizing ability of motor oils

**Keywords:** motor oil; detergents; base number; acid number; blocking of alkaline centers.

**Abstract.** Motor oils are evaluated according to a number of indicators, among which a significant role belongs to the characteristics that determine the alkaline and acid numbers of oils. The article considers the level of objectivity of both indicators in determining them in working oil.

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### Kinetic approach applied to the study of tribological characteristics of sulfonate greases

**Keywords:** temperature-kinetic method; conditional activation energy; coefficient of friction; wear index; chemically modified layer; probability of metal contact; sulfonate greases; thickener; dispersion medium; four-ball machine; transition temperature; boundary lubrication.

**Abstract.** It is shown that it is possible to evaluate the anti-wear properties of sulfonate greases using a temperature-kinetic method, in which the processing of experimental results allows us to obtain the values

of the conditional activation energy of the process of destruction of the modified layer. A method has been developed for estimating the conditional activation energy of the wear process of the modified layer, which ensures the separation of contacting bodies during friction in the mode of boundary lubrication at high temperatures. For sulfonate greases obtained on various thickeners and dispersion media, the values of the activation energy of the process of destruction of modified layers were determined and the ratio between the activation energy value and the values of wear indicators according to GOST 9490-75 was established.

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### **Engine oils aeration**

**Keywords:** engine oils; aeration; performance characteristics; specification; additives; test methods.

**Abstract.** Aeration of engine oil can cause big problems in engine operation. Air is entrained in oil when it experiences turbulation or agitation in engine carter and when the oil goes through bearings, couplings, gears in the pump and oil-return lines. The article analyses physics and chemistry of this phenomenon, causing cavitation and microdieseling, influence of base mineral (API Groups), synthetic oils and additives on aeration, reviews actual bench and motor test methods.