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THE APLLYING OF MATHEMATICAL MODELLING METHOD FOR CONTROL OF THE CATALYTIC REFORMING INSTALLATION OF ACHINSK OIL–REFINING FACTORY

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Nowadays catalytic reforming is the one of the most important oil-refining processes. According to experience, optimal operation of a catalysis allows it to be used more effectively. Platinum catalysts, which is used in reforming, are very expensive, and in order to prolong the work period of the catalysts, it is necessary to research how effectively they are being used on oil-refining factories. The solution of this scientific task can only be performed by applying mathematical modelling.

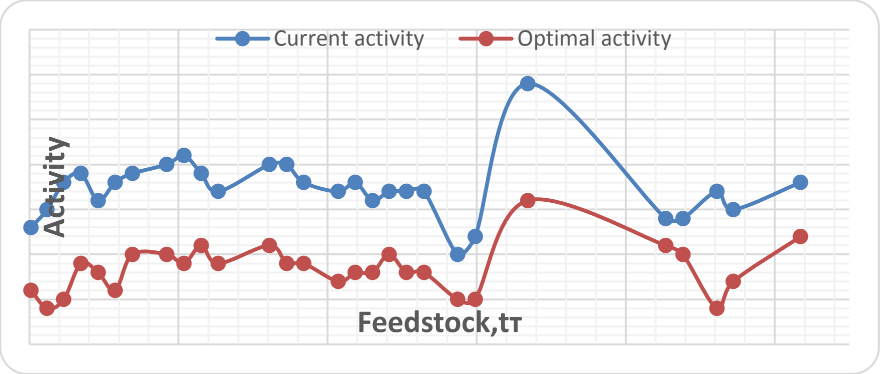

Fig. 1 The comparison of current and optimal activities of the catalyst

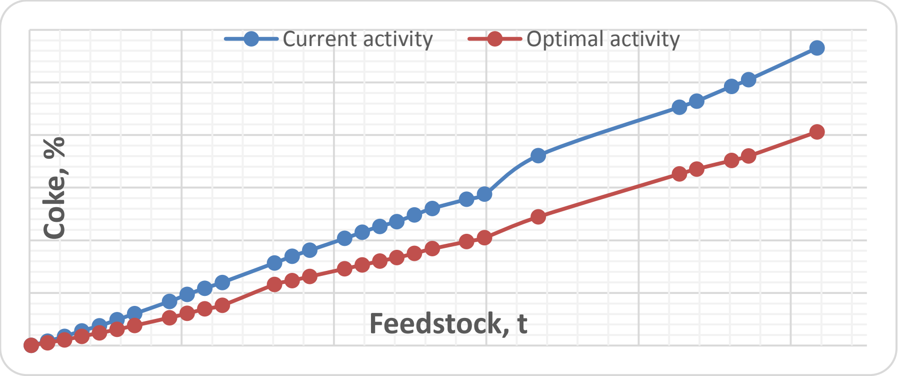

Fig. 2 The accumulation of coke

The goal of this is to determine the operating efficiency of the catalyst used at an oil-refining plant. To achieve this goal, the computer-based modeling system "Catalyst's Control" created at the Department of Chemical Technology of Fuel and Chemical Cybernetics was used. The system is based on the mathematical model of the benzene catalytic reforming, which takes both the physical and chemical mechanisms of hydrocarbon conversion reaction mixture as well as the catalyst deactivation into account. In assessing the effectiveness of the catalyst, the current and the optimal activity of the catalyst during its fifth work period were calculated using the program.

The results, which are shown on Figure 1, indicate that the amount of current activity during this work period is 0.8-0.85 points. However, a deviation from the optimal activity on 2.5 points in total can be observed. This deviation influences on the accumulation of coke (Fig. 2). For example, the total amount of coke in the catalysis is 34.92 % higher than the one, which could be observed during optimal operation (Fig. 2). This conclusion can be proven by analyzing the output product. During the end of the work period, juddering changes was observed, and the output of the product is between 81 and 84.5 % mass.

Furthermore, computer model is able to take the reactivity of the individual components into account. This makes it possible to evaluate the performance of the industrial reformer adequately. The juddering changes of activity confirms changes in the composition of the feedstock in this work period, namely reduction of aromatic hydrocarbons for 19.12.12 and 09.01.13 (from 60.96 to 68.88).

Therefore, the calculations of the current and optimal activity of the catalysis were done, the degree of the composition feedstock influence was evaluated, and the impact of technological regimes was researched. Based on these calculations it is possible to conclude that:

1. The installation works relatively close to optimal. An insignificant deviation from the optimum current activity was observed at the end of the work period (0.4 points), which may be associated with a change in the feedstock composition.
2. The amount of coke used in the catalysis during the current activity is 34.92 % higher than the optimum value.
3. The output of product is in the range of from 81 to 84.5% mass.

PLATINUM–METAL MINERALIZATION OF THE WESTERN AND CENTRAL PARTS OF THE STANOVAYA METALLOGENIC ZONE (FAR EAST, RUSSIA)

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The Stanovaya metallogenic zone occurs along the southeastern margin of the Northern Asian Craton with a length of 1300 km and a width of ~250–300 km. The metallogenic zone is located in the eastern part of the Stanovoi megablock limited by the Stanovoi deep fault from the north and by the Mongol–Okhotsk deep fault from the south. A megablock surrounds the Aldan protomassif, represented by a folded–block or granite–greenstone area that underwent Mesozoic tectonomagmatic activization. The structure of the territory includes a number of blocks composed of Early Archean (Zverevsko–Chogarskii and Zeiskii Complexes) and Late Archean (Stanovoi and Gilyuiskii Complexes) metamorphic rocks. Intercratonic troughs are filled by formations of the Early Proterozoic Dzheltulakskii Complex represented by phyllite like, biotite, and twomicaschists, quartzites, metaconglomerates, and metaeffusive rocks [1].

Platinum mineralization of the Stanovaya metallogenic zone mainly belongs to the sulfide Pt–Cu–Ni formation [5]. It is genetically related to three basic–ultrabasic complexes of different ages: Archean–Proterozoic anorthosite, gabbro–anorthosite, and dun ite–troctolite–gabbro; Paleozoic ultrabasic; and Early Cretaceous cortlandite–pyroxenite–gabbro complexes. In our opinion, at the modern level of study, four potentially platiniferous ore regions may be distinguished on the territory of the Stanovaya metallogenic zone: Kalarskii, Luchanskii, KunMan’enskii, and Dambukinskii (Fig.).

The Kalarskii platiniferous massif composed of anorthosite, gabbro–anorthosite, gabbro–norite, and gabbro is distinguished in the Kalarskii region. Its isotope age is estimated as 2.62 Ga [2]. The massif contains deposits and ore occurrences of platinumbearing titanomagnetite (Bol’shoi Seiim, Kuranakh) and copper–nickel (Bayukit and others) ores. Thus, the Kalarskii massif is promising not only for accompanying production of platinoids from titanomagnetite ores, but also for searching for PGE mineralization of the lowsulfide type similar to that discovered in the Chineiskii massif of Transbaikalia.

Two platiniferous intrusions of the dunite–troctolite–gabbro composition (the Luchanskii and Il’deusskii massifs) with small sizes (from tens to several hundred km2) occur in the Luchanskii region. The Luchanskii massif is composed of troctolite and olivine gabbro with stratalike segregations of melanocratic troctolite and plagioclase dunite intruded by dykes of gabbro–diabase, pegmatoid gabbro, pyroxenite, and peridotite. The Zeiskoe (Luchanskoe) copper–nickel ore occurrence is located in the northwestern part of the massif. It occurs in the apical part of the massif and is composed of olivine gabbro–norite with cortlandite and websterite layers. Seven sulfidebearing zones with a length up to 1 km and a thickness of 75–150 m are revealed there. Ore minerals are represented by pyrrhotite, pentlandite, chalcopyrite, violarite, and pyrite. Ores are epigenetic. The following PGE concentrations (ppm) were registered in bulk samples collected in 2012: Pt, 0.075–0.2; Pd, 0.069–0.1 (sulfidized pyroxenite); Pt, 0.006 (gabbro); Pt, 0.001–0.01; Pd, 0.05 (gabbro–norite); Pt, 0.001–0.01 (troctolite); Pt, up to 0.01 (sulfidized gabbro). The predicted resources of PGEs are 50 t by the P3 category.