Some principles of constructing a mathematical model and the results of studying catalytic reforming are discussed.

Рассмотрены принципы построения математической модели и результаты исследования процесса каталитического рформинга бензинов.

Specificity of petrochemical processes consists in the fact that crude oil and products of its refining have complex hydrocarbon compositions.

If one takes into account all reactions and substances that take part in the process, the mathematical description will be very complex. To overcome these difficulties, a so-called "continuous" approach has been suggested previously [1], which implies an infinite number of interacting components. For limited composition mixtures a constructive suggestion was [1] to establish some relationships between qualitative and quantitative (conversion mechanisms, concentrations, activation energies, bond dissociation probabilities) characteristics of hydrocarbon conversion and the number of carbon atoms in the molecule. We have used the regularities established to describe the catalytic reforming of benzinnes.
where Ar are aromatic hydrocarbons, \( N_6 \) are six-component naphthenes \((x_6 - x_{12})\), \( N_5 \) are five-component ones \((x_5 - x_{12})\), \( n-P \) are normal structure paraffins \((x_1 - x_{12})\), \( i-P \) are isostructural paraffins \((x_4 - x_{12})\), \( K \) is coke and \( J \) is gas.

A mathematical model that corresponds to the above scheme \([2]\) for the steady-state operating system of reactors for reforming can be represented by the set of equations

\[
\frac{dC_i(x)}{dv} = - \sum_{j=1}^{n} k_j(x)C_i(x) + \sum_{j=1}^{n} k_j(x)C_j(x) + \sum_{s=1}^{b} k_s(x')C_s(x') \delta(x' - x) dx' + \sum_{s=1}^{b} \frac{1}{G - C_m} \sum_{j=1}^{n} \Delta H_j \int_{x}^{x'} k_j(x')C_i(x') \frac{RT}{P} \delta(x' - x) dx' \]

\[
\frac{dT}{dv} = - \frac{1}{G - C_m} \sum_{j=1}^{n} \Delta H_j \int_{x}^{x'} k_j(x')C_i(x') \frac{RT}{P} \delta(x' - x) dx' \]

\[
\mu = 1, b
\]

Here \( C_i(x), k_i(x) \) are the concentration and rate constant distributions for the \( i \)-th group of hydrocarbons; \( v_s(x, x') \) are the distributions of bond dissociation probabilities in hydrocracking of paraffin hydrocarbons; \( V \) is the catalyst volume; \( G \) is the crude oil consumption; \( T \) is the reactor temperature; \( P \) is the system pressure, \( C_m \) is the mixture thermal capacity; \( \Delta H_j \) is the enthalpy that is average for this group of reactions; \( j \) is the number of group reactions taking part in the process \((j = 1 - 14)\) and \( l \) is the reaction order with respect to hydrogen.

The first term in the material balance equation 1 describes isomerization and dehydrocyclization reactions of paraffin and naphthene hydrocarbons, the second accounts for hydrogenation of aromatics and naphthene hydrogenolysis and the