

The logo for Catachem Company features a stylized 'C' composed of red and grey rectangular blocks. A horizontal yellow banner with a gradient effect is positioned across the middle of the 'C', containing the text 'CATACHEM Company' in a red, serif font.

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## **“CATACHEM” Co.ltd.**

is in the market of catalysts and catalytic processes since **1992** year.

One of the basic directions of the company's activity is working out of catalysts for hydrogenation processes, catalytic cracking, and technologies of their operation.

49 patents of the Russian Federation are received by the “CATACHEM” Co.ltd during its operating time, published more than 50 articles about the basic directions of its activity. License contracts on manufacture of catalysts are concluded under 10 patents.

We work in close contact to manufacturers and consumers of catalysts. During the last years we developed, entered into industrial production and operation some brands of the catalysts intended for petrol's, middle distillate fraction's, vacuum gasoil's, oil raffinate's and paraffin's hydro upgrading, hydro cracking of vacuum gasoil.

Delivery of catalysts is preceded by the analysis of quality of feeds assumed to processing, technological possibilities of the existing equipment and requirements to a received product. On the basis of the spent analysis we develop the structure of catalytic system, the technology of its loading, commissioning, and technological settings of operation.

Key problem of a modern petroleum-refining industry is perfection of motor fuel's and oil's quality.

The policy of the oil product's ecological safety's increase, defined by the Technical regulations «About requirements to automobile and aviation gasoline, diesel and ship fuel, fuel for jet engines and to top internal black oil», enters new more strict requirements to the content in motor fuel of toxic heteronuclear and aromatic hydrocarbons, that corresponds to quality's indicators of standards: Euro-4, Euro-5.

The decision of this problem is impossible without perfection and working out of oil refining's new catalytic technologies.

The part of these requirements can be executed by the process's organization, but the basic problems can be composed only with the specialized selective catalysts, which properties can be generated only with application of reception's regulation and conditions on the nanolevel.

“CATACHEM“ Co.ltd. carries out delivery and service of hydrogenation process's catalysts of series «RK», which are outputted under license contracts under supervision of its experts on:

- *close corp. «Promcataliz», Ryazan, TNK,*
- *close corp. «Nizhegorodskiy sorbates», Nizhny Novgorod,*
- *limited liability company «Ishimbayskiy specialized chemical plant of catalysts», Ishimbay,*
- *limited liability company «Sterlitamakskiy plant of catalysts», Sterlitamak,*
  
- *public corp. «Electroceramica», Moscow reg.*

Catalysts of the most layer

Catalysts of protective layer and demetallization

# Hydrogenation process's catalysts of series RK

Brand	Purpose
RK-500, 510, 520, 530, 540	Catalysts of protective layer
RK-550	Catalysts of demetallization
RK-222 <i>is outputted in nickel modification</i>	Hydrogenation (hydro clearing and hydrogenation of polynuclear aromatic hydrocarbons) middle distillate fractions, pre-hydro clearing of reforming's feeds, paraffin's hydro upgrading.
RK-113	Hydro upgrading of gasoline, including gasoline of catalytic cracking
RK-231 <i>is outputted in cobalt and nickel modifications</i>	Cobalt modification - deep desulfuration of middle distillate fractions, pre-hydro clearing of feeds of reforming and isomerization. Nickel modification - desulfuration, diazotization, hydrogenation of non limiting and polynuclear aromatic hydrocarbons of petrol and middle distillate fractions.
RK-442 <i>is outputted in cobalt and nickel modifications</i>	Nickel modification - soft hydro cracking (deep hydro upgrading) of vacuum gasoil. Cobalt modification - hydro clearing of vacuum gasoil - feeds of catalytic cracking..
RK-442 Y	The catalyst of hydro cracking (hydro conversion)
RK-438	Hydro upgrading of middle distillate fractions and oil raffinate
RK-720	Reception of middle distillate fraction's components with improved low-temperature characteristics
RK-242	Hydro upgrading of a secondary origin's fractions , residual fractions, firm paraffin

Listed above brands of hydro upgrading's catalysts of oil fractions are synthesized with wide range attraction of aluminum-oxide carriers of various genesis, the preference is given for littlesewage and without waste of production engineering.

At synthesis the special processing methods, protected by patents of the Russian Federation, are applied.

*Responsibility for operational properties of catalysts and conformity of physical and chemical indicators of delivered catalysts to requirements of specifications, bears  
"CATACHEM" Co.ltd.*

# CATALYTIC SYSTEMS AND TECHNOLOGIES OF THEIR OPERATION.

With use of series RK catalysts are developed and realized technology of automobile gasoline components reception, summer and winter diesel petrol under EURO standards, hydro upgrading of vacuum gasoil, oil rafinate and firm hydrocarbon's paraffin. The listed technologies are protected by patents of the Russian Federation:

<b>№ 2245896</b>	<b>The way of low-sulfur oil fraction's reception</b>
<b>№ 2225433</b>	<b>The way of waxy oil fraction's reception</b>
<b>№ 2287555</b>	<b>The way of high-viscosity base oil's reception</b>
<b>№ 2277526</b>	<b>The way of paraffin hydrocarbon's C4 – C7 isomerization</b>
<b>№ 2311442</b>	<b>The way of reception of low-sulphur middle distillate fractions with improved low-temperature characteristics</b>
<b>№ 2316580</b>	<b>The way of secondary origin distillate's processing</b>
<b>№ 2372380</b>	<b>The way of catalytic cracking petrol fraction's selective clearing</b>

The potential of the catalysts, which are produced under brand «RK», at use of offered technologies, allows to receive the oil product, corresponding to requirements of the world standards, including petrol's Euro - 4, 5.

The specified technologies can be realized both on operating manufactures and at building of new objects. They are delivered to the Customer on the basis of license contracts "on a turn-key basis" with delivery (if necessary) of materials on base and working engineering.



"CATACHEM" Co.ltd. has a number of petrol fraction's hydro upgrading catalysts, and can offer to factories the catalytic systems on their basis, depending on quality of processed feeds, requirements shown to the received product, and technological possibilities of plant.

Particularly, the problem of rational use of catalytic cracking petrol fractions and other destructive processes as petrol's components, solves with the process organization on the selective catalyst of hydro cracking of sulfurous connections with the minimum hydrogenating function.

## Petrol fraction's hydro upgrading – feed's reception of reforming and isomerization

(into structure of every catalytic system along with catalysts of the basic layer are included the protective layer catalysts, which list is defined by a design of the reactor and feed's characteristics)

Catalysts of the most layer	Feeds		Operation parameters			Product quality
	Composition	Sulphur content, %weight	Pressure, kg*N/sm <sup>2</sup>	Temperature, C <sup>o</sup>	Volume speed, hour <sup>-1</sup>	
RK-231Co, RK-231Ni, RK-222, RK-113 .	Only straight-run fractions	Till 0,1	20-30	280- 340	Not over 8,0	Sulphur content≤0,2ppmw , nitrogen – absence
		0,1 ÷ 0,6			Not over 5,0	
		Over 0,6			Not over 3,0	
RK-231Co, RK-231Ni, RK-222, RK-242, RK-113.	To 20 % of fractions are secondary origin	Till 0,1	20-30	280- 340	Not over 5,0	Sulphur content≤0,2ppmw , nitrogen – absence
		0,1 ÷ 0,6			Not over 4,0	
		Over 0,6			Not over 3,0	
RK-231Co, RK-231Ni, RK-222, RK-242, RK-113.	Over 20 % of fractions are secondary origin	According to the technical decisions stated in the patent № 2316580 «The way of secondary origin's distillate's processing».			Sulphur content≤0,2ppmw , nitrogen – absence	
RK-113	100 % of catalytic cracking gasoline	According to the technical decisions stated in the patent № 2372380 «The way of catalytic cracking petrol fraction's selective clearing »			Sulphur content≤10ppmw. Decrease of octane rating no more then 0,5% .	

The catalysts developed by us and processing methods of their operation in process of diesel fraction's hydro upgrading allow to solve the following problems:

- Reception of diesel petrol with the content of sulfur till 10 ppm and the lowered content of aromatic hydrocarbons;
- Reception of low-sulphur products at processing of diesel fractions with involving in feeds of secondary origin;
- Reception of middle distillate petrol's components with set low-temperature characteristics.

For support of requirements to the sulphur content in diesel fuel no more than 10 ppm and to the content of polycyclic hydrocarbons no more than 11 % of weight (Euro-5), process of diesel fraction's hydro clearing should include course simultaneously two competing reactions – transformations of sulphur and nitrogen contain connections, and also hydrogenation of polycyclic aromatic hydrocarbons.

At involving in processing of secondary fractions with the raised content of no limiting hydrocarbons to the process of hydro clearing and to the catalyst also demands are accordingly made on high activity in reactions of no limiting hydrocarbon's hydrogenation.

## Hydro upgrading of middle distillate fractions – reception of diesel petrol's components corresponding to the EURO standard.

(into the structure of every catalytic system along with catalysts of the basic layer are included the protective layer catalysts, which list is defined by a design of the reactor and feed's characteristics)

Catalysts of the most layer	Feeds	Operation's parameters			Product's quality		
		Pressure, kg*N/cm <sup>2</sup>	Temperature, C <sup>o</sup>	Volume speed, h <sup>-1</sup>	Content		CN
					Sulphur, ppmw	polycyclic aromatic, % of weight	
RK-231Co, RK-231Ni, RK-438*	Only straight-run fractions	Not below 36	330-380	2,5	Not over 350	Not over 11	Not below 51
		Not below 40		2,0	Not over 50		
		Not below 40		1,5	Not over 10		
RK-231Co, RK-231Ni, RK-438, RK-242*	To 20% of fractions are secondary origin	Not below 36	330-380	2,5	Not over 350	Not over 11	Not below 51
		Not below 40		2,0	Not over 50		
		Not below 40		1,5	Not over 10		
RK-550, RK-231Co, RK-231Ni, RK-438, RK-242*	Over 20% of fractions are secondary origin	According to the technical decisions stated in the patent № 2316580 «The way of a secondary origin's distillate's processing».			Not over 350	Not over 11	Not below 51

**\* Specified catalytic systems are used at reception of diesel petrol's components for a temperate climate. For reception of diesel petrol's components for a cold and Arctic climate into the structure of the catalytic systems enters the catalyst RK-720.**

At deep processing of high-sulphur petroleum with reception of high-quality petrol the role of destructive catalytic processes, including soft hydro cracking (deep hydro upgrading) of vacuum gasoil, is rather actual.

Deep hydro upgrading of vacuum gasoil (feeds of catalytic cracking) on the catalyst of series RK has entered into practice on Russia's oil refineries.

"CATACHEM" Co.ltd. has in the portfolio the working out of catalysts and technological decisions for processes of hydro cracking and soft hydro cracking of heavy oil and condensed gas fractions.

The catalyst of hydro cracking is focused on reception as a target product of diesel fraction.

## Hydro upgrading of vacuum gasoil – feeds of catalytic cracking.

(into the structure of every catalytic system along with catalysts of the basic layer are included the protective layer catalysts, which list is determined by a design of the reactor and feed's characteristics)

The composition of catalytic system				
<b>RK-550 + RK-242 + RK-442Co + RK-442Ni</b>				
Guaranteed quality of the obtained product				
Sulphur's content, % of weight, not over	0,3	0,15	0,05	0,03
Fraction's gain,boiled out till 350°C,% of weight,not below	5	10	25	35
Service conditions of catalytic system				
<b>Feeds:</b>				
Vacuum gasoil with the end of boiling, C°, not over	550			
<b>Technological parameters of the process:</b>				
Pressure on the reactor's enter, kg*N/cm <sup>2</sup> , not below	40	50	60	
Volume speed of feed's giving, h <sup>-1</sup> , not over	1,5	1,2	1,0	
Correlation of CHCG:feeds, м <sup>3</sup> /m <sup>3</sup> , not below	400	450	480	550
Concentration of hydrogen in CHCG, % of volume.	not below 90			
<b>Temperature on the reactor's enter, C°</b>				
- on the cycle's start	330	330	320	360
- on the cycle's end	400	400	400	



Application of catalysts and technologies of "CATACHEM" Co.ltd at hydro upgrading of oil rafinate allows to receive on operating manufactures of oils, the base oils, corresponding to requirements of the world standards.

Particularly, the viscosity index of de-embedded hydro upgraded rafinate raises on 11-14 %.



## Hydro upgrading of raffinate of oil's selective clearing

Catalyst of the most layer RK-438		
Service conditions of the catalytic system		
Raffinate :	middle viscous	viscous
Flash's temperature, C°	206 - 214	224 - 225
Kinematic viscosity at 100°C, cSt	4,16 - 4,77	7,18 - 7,44
Sulphur's content,% of weight	0,6 – 0,8	0,91 – 0,98
Refraction indicator at 60°C	1,4623 – 1,4649	1,4713 – 1,4737
Technological process's parameters:		
Pressure, kg*N/cm <sup>2</sup>	32 -34	
Volume speed of feed's giving, hour <sup>-1</sup>	1,2- 1,5	
Temperature on the reactor's enter, C°	330 – 340	
Correlation of HCG/feeds, м <sup>3</sup> /m <sup>3</sup>	390 - 400	
Product's quality		
Temperature of flash, C°	205 - 210	219 -220
Kinematic viscosity at 100 °C, cSt	3,91 – 4,69	7,02 -7,15
Sulphur's content ,% of weight	0,07 – 0,10	0,12 – 0,15
Refraction indicator at 60°C	1,4600-1,4591	1,4669 – 1,4692
Viscosity's index of a product after de-embedding	100 -110	95 - 98

## Services

As much as possible to use the potential of any catalytic system probably only by optimization of all stages of its operation, including loading, preparation for operation and regeneration.

By delivery of catalysts, "CATACHEM" Co.ltd. renders following services:

- working out of catalytic system's structure depending on quality of feeds, type and appointment of plant, prospective service conditions and the requirements, shown to quality of the received product;
- working out and delivery of recommendations about loading, activation and commissioning of catalytic system;
- carrying out of uniform loading of catalysts with granting of the loading device;
- rendering of practical assistance at carrying out of catalytic system's sulphurizing and its commissioning;
- working out and delivery of recommendations and rendering assistance at carrying out of the catalyst's passivation;
- assistance rendering at carrying out of regeneration of the catalyst out of the reactor on the special plant;
- working out and delivery of recommendations and rendering assistance at carrying out of regeneration of the catalyst in the reactor of technological plant;
- carrying out of monitoring of catalytic system's operation during all warranty period of operation.

The processing methods used at carrying out of listed above operations, are protected by the following patents of the Russian Federation :

№ 2252067	The way of catalyst's loading in reactors of technological plants
№ 2282501	The way of hydro upgrading of hydro carbonic feeds catalytic system's activation
№ 2290996	The way of hydrogenation process's catalytic system's regeneration
№ 2358805	The way of hydrogenation process's catalyst's activity's restoration