Krastsvetmet JSC

Krastsvetmet is one of the world’s leading refiners of platinum group metals, gold and silver, processing all known types of raw materials
History

Krastsvetmet’s history dates back to the year of 1943, when Norilsk sludge was first refined into platinum and palladium in Krasnoyarsk. That historical day is now considered the official birthday of the Krasnoyarsk Refining Factory, now called Krastsvetmet.

In the very beginning Krastsvetmet was established as a branch of Norilsk Nickel. The first sludges were delivered to the plant in the end of 1942. Nowadays Norilsk Nickel still remains the main partner of Krastsvetmet.

In early 50s Russia was in great need of creating electronic industry. On February 29, 1956 a new period in the plant’s history began: the Soviet Ministry of Non-ferrous Metallurgy passed a resolution to start manufacture of silicon and germanium at Krastsvetmet. As its importance for the state was extremely high, this manufacture was given the highest priority.
History

So construction of the plant went on. In 1960 Krastsvetmet started producing polycrystalline silicon, and in 1963 – single-crystalline silicon. The technology of single-crystalline germanium production was developed in 1959–1962.

The most important event of the 90s was launching of jewelry manufacture, which became a new direction of Krastsvetmet’s business. In the new 21st century manufacture of chemical compounds and catalyst systems was put into operation.

On March 24, 2016 Krastsvetmet has presented R&D Park.

The history of the plant is not only represented by technologies, buildings, facilities and refined metals, but also by people who create this history. Their labour made the plant prosper and achieve its fame. Such were the gifted scientists of the enterprise: M.I. Gutman, N.D. Kuzhel, P.I. Rozhkov, B.M. Graiver, V.I. Dolgikh.
Divisional Organizational Structure

- Refinery Division
- Jewelry Division
- Industrial Appliances Division
- R&D
The implementation of precious metals and their compounds

Residential Development

Motor Car Construction

Jewelry

Petroleum Refining

Chemical Industry

Electronics

Pharmaceutics
Refinery Division
Types of precious metal bearing materials Krastsvetmet processes

Primary materials
- Alluvial, cathode, native gold
- Dore alloy (gold-silver and silver-gold)
- Silver-gold precipitate
- PGM concentrates
- Alluvial platinum
- Zinc concentrate

Secondary materials
- Jewellery scrap
- Electronic scrap
- Technical scrap
- Spent autocatalysts
- Spent petroleum and petrochemical catalysts
Refinery Division

Precious Metals Refining

Precious Metals Compounds Production
Refinery Division. Platinum Group Metals

Krastsvetmet produces platinum, palladium, rhodium, ruthenium, iridium and osmium in the form of bars and sponge
Refinery Division. Platinum Group Metals

Platinum Group Metals Refining, tons per year

<table>
<thead>
<tr>
<th>Year</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value</td>
<td>121</td>
<td>121</td>
<td>119</td>
<td>119</td>
<td>113</td>
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</tbody>
</table>

Kratsvetmet Market Share in Russia

- Krastsvetmet: 96%
- Other companies: 4%
Refinery Division. Gold

Krastsvetmet produces gold in the form of standard LGD gold bars, cast and minted small bars and gold granules.
Refinery Division. Gold

Gold Refining, tons per year

Year          2011  2012  2013  2014  2015
Gold Refining  89    97    131   184   185

Krastsvetmet Market Share in Russia

Krastsvetmet  63 %
Other companies 37 %
Refinery Division. Silver

Krastsvetmet produces silver in the form of standard LGD silver bars, cast and minted small bars and silver granules
Refinery Division. Silver

Silver Refining, tons per year

<table>
<thead>
<tr>
<th>Year</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value</td>
<td>694</td>
<td>563</td>
<td>774</td>
<td>589</td>
<td>772</td>
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</tbody>
</table>

Krastsvetmet Market Share in Russia

- Krastsvetmet: 62%
- Other companies: 38%
Refinery Division. Investment bars

Krastsvetmet also produces small gold investment bars in different denominations (from 1 g to 100 g) and of different fineness.
Precious metals compounds are the products of fine process chemistry.

Platinum group metals are applied in industry mainly as precious metal compounds.

Precious metals compounds are applied in all primary industries.
Refinery Division. Precious Metals Compounds

Chloroplatinic acid, Palladium Chloride as solution and powder

Amonium Perrhenate, Perrhenic Acid

Ruthenium (III) Chloride hydrate and solution, Ruthenium (IV) Chloride hydrate and solution

Palladium, Platinum and Rhodium Nitrates
Jewelry Division
Jewelry Division

Krastsvetmet specializes in manufacturing machine-woven chains and bracelets made of 14, 18, 22 and 24k gold, platinum of 950 fineness, palladium of 850 fineness and silver of 925 fineness
Jewelry Division

Production Volume, tons per year

<table>
<thead>
<tr>
<th>Year</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
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<tr>
<td>Value</td>
<td>4.8</td>
<td>6.8</td>
<td>9.9</td>
<td>12.9</td>
<td>6.3</td>
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</tbody>
</table>

Machine-woven Chains Market Share in Russia

- **Krastsvetmet**
  - 35%
- **Other companies**
  - 65%
Industrial Appliances Division

- Catalyst systems
- Thermo-electrode and thermocouple wire
- Targets of sterling silver
- Compounds for the production of anticancer substances and Generic API's
- Glass and basalt fiber bushings
- Certified reference materials and mixtures of precious metals
- Laboratory equipment
Industrial Appliances Division. Smart Close Loop Solutions

Krastsvetmet proposes complex services for the customer including Industrial Appliances manufacturing, scrap refining and lost PGMs recovery from equipment including subsequent cleaning sludge refining.
Industrial Appliances Division

PGM Appliances Production
Volume, tons per year

Silver Appliances Production
Volume, tons per year

<table>
<thead>
<tr>
<th>Year</th>
<th>PGM Production</th>
<th>Silver Production</th>
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</thead>
<tbody>
<tr>
<td>2011</td>
<td>2.3</td>
<td>8.1</td>
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<tr>
<td>2012</td>
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<td>5.7</td>
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<td>2013</td>
<td>3.2</td>
<td>9.9</td>
</tr>
<tr>
<td>2014</td>
<td>5.1</td>
<td></td>
</tr>
<tr>
<td>2015</td>
<td>5.9</td>
<td>5.1</td>
</tr>
<tr>
<td>2016</td>
<td></td>
<td>3.6</td>
</tr>
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</table>
R&D

Krastsvetmet Research and Development Department provides a comprehensive range of services that includes:

– Development of new technologies of precious metals extraction from all types of raw materials
– Development of wastes recycling technologies
– Development of new technologies of precious metals refinery and concentration
– Experimental batches of new kinds of precious metals production
R&D Park

R&D Park – Russia’s first infrastructure focused on supporting and implementing commercial developments in cooperation with independent researchers, technology companies, institutes and venture capital funds.

Krastsvetmet fully supports the R&D Park residents particularly in project financing, participation in major Russian and international tenders with difficult access for startups and small businesses to.
Analytical Support

Conducting trials of raw materials and finished products

Control of chemical and physical factors at working places

Development and manufacture of CRMs for precious metals and certified mixtures. Techniques development for quantitative chemical analysis

Mineral raw materials and by-products analysis (for mineral exploration, reserve assessment, geo-environmental and others)
Analytical Support

As one of the ten leading laboratories in the world, Krastsvetmet Analytical Laboratory belongs to the most innovative international high-tech Institutions (according to ASTM).

The laboratory is certified with an International accreditation testimonials issued by the Authority for the accreditation of laboratories AAC “Analytics” and Federal Agency for Technical Regulation and Metrology.
Certificates


Krastsvetmet is an “Approved Good Delivery Referee” of both the London Bullion Market Association (LBMA) and London Platinum and Palladium Market (LPPM) for its platinum, palladium, gold and silver ingots. The company is responsible for the testing of samples, the provision of reference samples and other functions in support of the Good Delivery system.

Besides, Krastsvetmet meets the demands of New York Mercantile Exchange (NYMEX) for its platinum and palladium bars, Tokyo Commodity Exchange (TOCOM) for palladium bars, Dubai Multi Commodities Centre (DMCC) for gold and silver bars, Shanghai Gold Exchange for gold bars.