

/ Business Overview /

Production

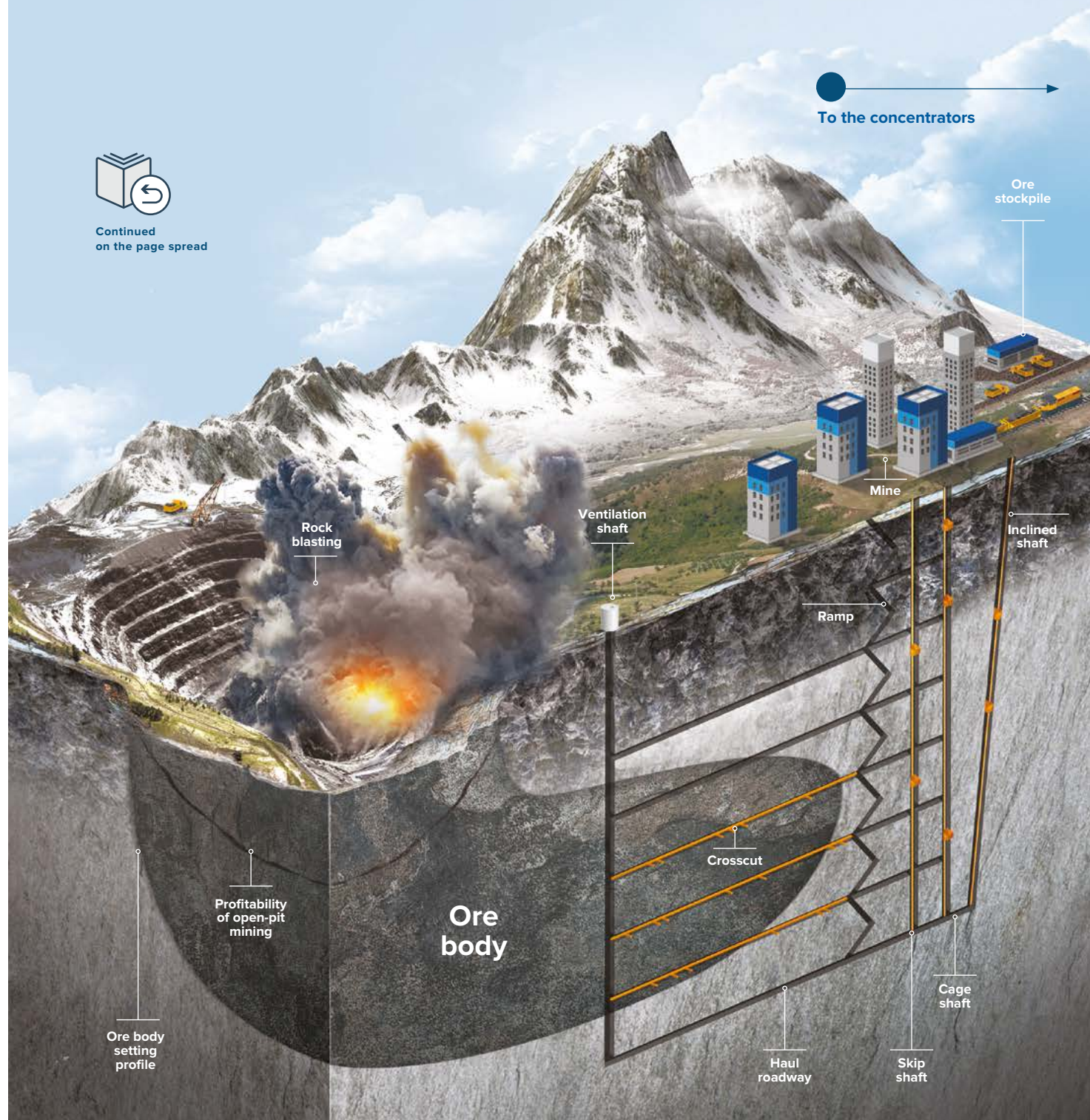
MINING

- 1 **Stripping**
Provides access from the surface to the deposit through underground workings used to transport mined ore, people, etc.
- 2 **Development workings**
The deposit is divided into separate sections, including mining levels, blocks, sublevels, stoops, etc.
- 3 **Stoping**
 - separation of ore from the rock;
 - delivery of ore from the mine face to the haulage level;
 - maintenance of the excavated area.
- 4 **Rock mass removal**
Ore is removed by load-haul dumpers and delivered to the surface by conveyor, railway and motor vehicles, or through skip shafts.

→
To the concentrators



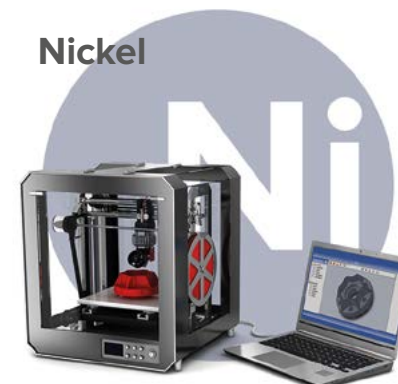
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Prospective metal applications

APPLICATION

Nickel



Important today, essential tomorrow

Today, nickel has a multitude of applications in the production of industrial and consumer goods, construction, aviation, space and transport industries. It is essential for the production of lithium-ion batteries and makes them safer, longer-lasting, more energy efficient and suitable for electric cars, which are becoming increasingly widespread all over the world. Nickel is also an important component of materials used in 3D printing, a technology that has gained immense popularity over the past decade.

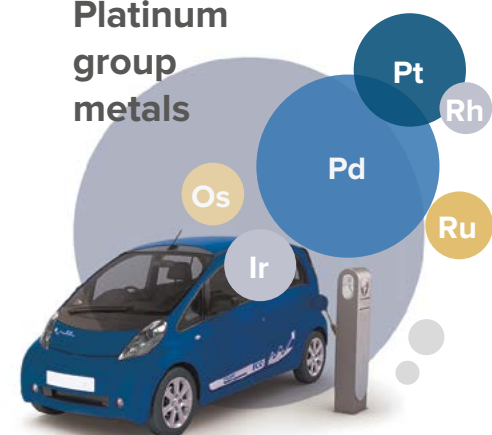
Copper



At the core of infrastructure projects and transport electrification

In recent years, many leading world economies have been increasingly focused on new large-scale infrastructure projects as a platform for economic growth, new industrialisation and ramp-up of domestic industrial output. These projects are dependent on copper, a basic element in construction, power grid building, vehicle manufacturing and heavy engineering. Another important area for copper application is electric engine manufacturing: compared to conventional cars, their hybrid and electric counterparts use twice and thrice as much copper, respectively.

Platinum group metals



Key to environmentally safe hydrogen power

PGM serve as a platform for transition to environmentally safe and sustainable energy. Platinum is used in fuel cell engines, a new type of engine that converts the chemical energy of hydrogen into electricity. In these engines, platinum acts as a catalyst in the reaction between hydrogen and oxygen, which generates energy and water, its only by-product. Compared to conventional internal combustion engines, fuel cell ones offer zero emissions and doubling of efficiency. Thanks to a compact size, they are widely used in vehicle manufacturing, and at stationary hydrogen power plants that have been growing in number.

Safeguarding our health

Owing to their unique cytostatic properties, non-toxicity and hypoallergenicity, PGM are widely used in medicine, including complex electronic medical devices in lasting contact with a human body, such as pacemakers and glucose meters, and in dental prosthetics as a material for dentures. Medications based on isotopes of palladium and platinum are the game changers in conservative (non-invasive) treatment of cancer, especially prostate and breast cancer.

ENRICHMENT



- 1 Crushing**
Ore pieces are squeezed and broken between the two surfaces of crushing machines
- 2 Screening**
Granulated ore material is separated by particle size
- 3 Grinding**
Crushed ore is ground in mills providing a water solution (pulp)
- 4 Sizing**
Ground ore is separated by size as a result of different settling rates of the moving pulp
- 5 Flotation**
Specific mineral particles suspended within the pulp attach to air bubbles, which leads to their separation

Tailings to be transported to tailings pits

Copper concentrate to be used in copper production



Talnakh Concentrator is the first Russian facility to be putting onstream three vertical fine grinding mills Vertimill VTM3000 by Metso Minerals.

35–50%
of energy savings compared to the traditional ball mill



The construction of a tailings pit with a capacity of up to 230 mln t of tailings in the vicinity of Talnakh Concentrator is nearing completion

STRATEGIC PRIORITY:



Major upgrade of production capacities

For more details, please see Our Strategy section on page 22

Slag cleaning furnace
Re-extraction of metals from metallurgical furnace slag

NICKEL PRODUCTION

Nickel concentrate to be used in nickel production



- 1 Thickening**
Partial concentrate dehydration
- 2 Concentrate drying**
Removal of moisture from concentrates (to a moisture level below 9%)
- 3 Flash smelter**
Smelting is achieved by mixing finely ground feedstock with a gaseous oxidiser, which holds melted metal particles suspended. The heat from oxidation reactions is actively used in the process
- 4 Slag cleaning furnace**
Re-extraction of metals from metallurgical furnace slag

COPPER PRODUCTION



- 1 Thickening**
Partial concentrate dehydration
- 2 Filtration**
The process of reducing the pulp's moisture level by forcing it through a porous medium
- 3 Concentrate drying**
Removal of moisture from concentrates (to a moisture level below 9%)
- 4 Vanyukov furnace**
Uses the feedstock energy without any external power sources
- 5 Basic oxygen furnace**
Oxidation and removal of slag iron and other contaminants
- 6 Anode electric furnace**
Smelting of the fluidised bed furnace product to produce crude nickel anodes
- 7 Casting wheel**
Casting of anode metal to the moulds to produce copper anodes
- 8 Electrolysis baths**
Electrochemical oxidation at the electrolyte-immersed electrodes driven by the electric current coming from an external source

Nickel slag to be used in nickel production

Sludge to be used in precious metals production

Cu



Delivery to end consumers



Kola MMC completed the transition from the obsolete pelletisation and roasting technology to the briquetting of copper-nickel concentrate. The introduction of the new feedstock preparation technology aims to improve environmental conditions in Zapolyarny.



- C Ore-thermal furnace**
Smelting occurs due to the heat released from passing electrical current through melted slag
- B Agglomeration**
A method for forming relatively large porous blocks by roasting fine or powder ore
- A Filtration**
The process of reducing the pulp's moisture level by forcing it through a porous medium



- 5 Basic oxygen furnace**
Oxidation and removal of slag iron and other contaminants
- 6 Casting mould**
Converter matte is cast into the moulds and cooled
- 7 8 9 Crushing Grinding Flotation**
- 10 Fluidised bed furnace**
Oxidising concentrate roasting with conversion of metals from sulphides into oxidised powder
- 11 Anode electric furnace**
Smelting of the fluidised bed furnace product to produce crude nickel anodes
- 12 Casting wheel**
Casting of anode metal to the moulds to produce nickel anodes
- 13 Electrolysis baths**
Electrochemical oxidation at the electrolyte-immersed electrodes driven by the electric current coming from an external source

Granulated slag is used to fill underground workings

Copper concentrate to be used in copper production

Iron-cobalt alloy to be used in cobalt production

Cu

Co



Kola MMC started migration to a ground-breaking electrowinning technology to reduce metal loss and emissions.

RUB 18 bn
of project investments



Kola MMC's Smelting Shop completed the overhaul of its ore-thermal furnace No. 5, which included the use of more reliable sealing technologies to reduce pollutant emissions and the facility's environmental footprint.

Ni



Ore mined at Nornickel's deposits are uniquely rich

For more details, please see the Mineral Resource Base section on page 44