

**Timeline**

**1958:** A nickel mine, later named Jinchuan Nickel Mine, is found in Northwest China's Gansu province in July.

**1959:** Northwest China Metallurgical Construction Company is founded in June. Yongchang Nickel Mine is established in October; the first project of Jinchuan Nickel Mine starts construction.

**1964:** The first smelting process and the first large-scale operation in September. In the same year, it produces 2041 metric tons of high-purity nickel matte and 22.43 tons of electrolytic nickel.

**1968:** Eight varieties of precious metals, namely gold, silver, platinum, palladium, osmium, iridium, ruthenium and rhodium, are extracted from Jinchuan Nickel Mine in August. It lays a foundation for Jinchuan to become one of China's nickel and cobalt production and processing hubs for the extraction of platinum group metals.

**1978:** Jinchuan is listed as one of three major bases for comprehensive utilization of mineral resources in China.

**1989:** A Jinchuan-led resource development and comprehensive utilization project receives the Special Prize of the State Scientific and Technological Progress Award.

**1992:** A nickel flash smelting furnace, the first of its kind in Asia and the fifth in the world, is put into use. It indicates that China is a world leader in nickel smelting techniques, and marks another milestone in the history of Jinchuan and that of China's nickel industry.

**2001:** Jinchuan Group is founded and a modern corporate system is basically set up.

**2008:** Jinchuan Group acquires Resources Tyler, a company located in Canada, and obtains 100 percent of the equity of Bahawalnagar Copper Mine in Mexico.

**2010:** Manul Nickel Mine in Zambia, the first overseas nickel project controlled and managed by Jinchuan Group, resumes production. Jinchuan Group goes on to obtain 100 percent of the operating mine's equity three years later.

**2011:** The annual business turnover of Jinchuan Group exceeds 100 billion yuan, making it the first company in Gansu province to earn more than 100 billion yuan in annual revenue.

**2012:** Jinchuan Group plays an active part in the Belt and Road Initiative. Its overseas business achieve stable progress.

**2018:** Jinchuan Group works with Huanghe Hydro-power Development and Construction of Geological Exploration and Development of Qinghai Province to carry out the largest nickel-cobalt outside source in China.

**2019:** Jinchuan Group ranks 369th among Fortune Global 500 companies, becoming the first Gansu-based company on the list.

**2020:** A 5G-assisted track transportation drives project in Longshou Mine. A 5G-assisted mining truck remote control project in Mining Area II and a 5G-assisted self-operated crushing system in mineral processing plants are put into operation.

**2021:** Jinchuan Group's business turnover reaches 262.2 billion yuan and its total profit and sales surpass 27.7 billion yuan. All key indicators hit record highs, which gets the company off to good start in the 14th Five-Year Plan period (2021-25).



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Monday, October 17, 2022

**339<sup>th</sup>**  
among Fortune Global 500  
companies in 2022

**100<sup>th</sup>**  
among China's top 500  
companies in 2022



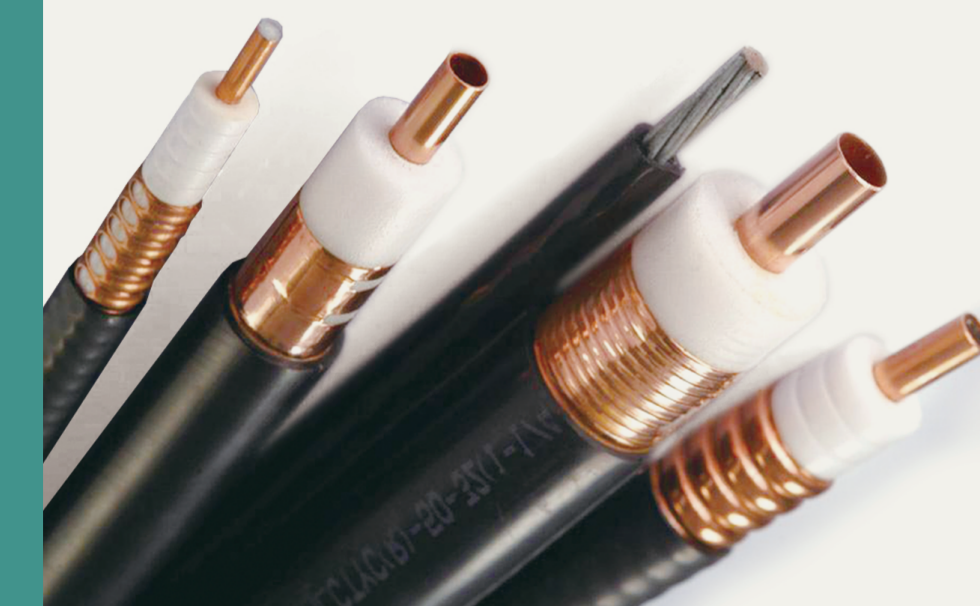
**Cu**  
銅

**Copper**  
Copper is a malleable nonferrous metal with excellent thermal and electrical conductivity, corrosion resistance, plasticity, ductility, diamagnetism and antibacterial properties.



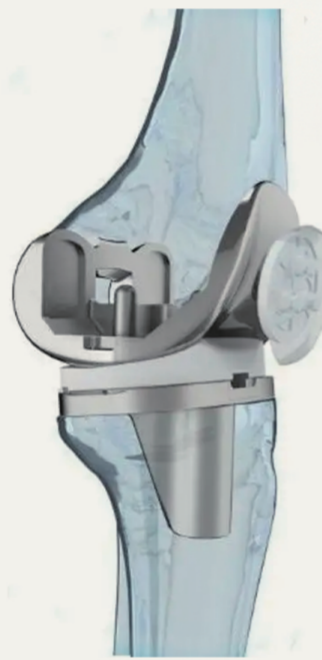
**Copper hotpot:** For thousands of years, China has used copper in the manufacturing of cookers with an attractive appearance. The typical copper hotpot made of red copper, also called pure copper, is a traditional cooker that is popular among the Chinese people. Copper cookers are durable and poison-free, with a high thermal conductivity.

**Wires and cables:** Copper wires and cables have good conductivity, high power and high signal transmission capability. They are widely used in power generation, transmission, distribution and transformation and also power supply lines.



**Co**  
钴

**Cobaltous oxide**  
Cobaltous oxide is a type of gray-black powder. It is usually used in manufacturing lithium battery materials and magnetic materials. The cobalt oxide helps to ensure the stability and conductivity of a ternary lithium battery.



**Artificial joints:** Cobalt is a ferromagnetic silver-white metal with a hard and brittle texture, and excellent physical, chemical and mechanical processing properties. A cobalt-based alloy is a common biomedical material. It is usually used to manufacture artificial joints due to its excellent corrosion and wear resistance, strength and machinability, which helps the joints to be more durable in a body.

**Cloisonne:** The famous "cobalt blue" color is an essential pigment in the painting of the unique traditional Chinese art Cloisonne. The color of cobalt blue is created by mixing cobalt oxide with aluminum oxide. It is bright with excellent weather, acid and alkali resistance and it has a heat resistance of up to 1,200°C.



**5G SYSTEM SIGNALS POSITIVE CHANGES FOR MINING INDUSTRY**

By PAN ZHONGMING  
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The efficiency and accuracy of the Product Distribution Center of the Nickel Smelter of Jinchuan Group has been greatly enhanced by 5G technology.

The smelter boasts one of the largest intelligent product packaging production lines in China. It includes intelligent electrohydraulic lifting packaging machines, a stock warehouse, distribution system, hoisting and comprehensive management, which enables the smelter to provide automatic, intelligent and informatized services from product unloading, pre-treatment, cutting and storage, to delivery.

Through its visual identification system, the nickel plates will first be sorted according to different product information and stored on different shelves in the warehouse.

Delivery starts at 4:30 pm every day. Once the product is identified for delivery, it will be taken from the shelf by the robot to go through the delivery procedure.

Before delivery, four cutting machines and four robots working in two pairs at the center will respond to the programmed instructions. They will cut off the handlers of the plate and then pile them up. Later, an automatic guided vehicle will transport the plate for pressing, weighing, code spraying, packing, film-wrapping and storing. After these procedures, the plates are ready for delivery.

The 5G-based system was in trial operation in December 2020 and put into operation in June 2021.

"Since then, the efficiency and accuracy of delivery have been greatly enhanced," said Bai Xiang, deputy director of the distribution center.

According to Bai, the procedure used to need 30 workers and now it only needs five to six workers while the number of workers for hoisting has been reduced from 10 to one.

"The 5G technology helps us to realize the seamless connection from nickel plate intelligent cutting to loading," Bai said. The system will precisely match the product amount, loading position, delivery vehicle and time to satisfy the loading on trucks or into trains from the workshop.

**Ternary lithium battery:** Ternary lithium batteries use three transition metal oxides of nickel, cobalt and manganese and are commonly used in new energy vehicles. The three metal oxides are used as positive electrode materials. Nickel is the element that determines the energy density of the battery. A relatively high nickel content in the battery means that the vehicle can go further.

**Ni-MH battery:** Nickel metal hydride batteries are a type of rechargeable battery commonly used in fields such as solar lighting, laptops and smartphones. A Ni-MH battery is a combination of hydrogen ions and nickel, and its power reserve is 30 percent higher than that of a nickel-cadmium battery. It is one of the most eco-friendly cells around.

**Stainless steel:** About 60 percent of globally produced nickel is used to manufacture stainless steel. Nickel-containing stainless steel has strong corrosion resistance and is suitable for high-temperature applications. The most common are Type 304, which has 8 percent nickel and Type 316, which has 11 percent nickel.

**Wheel hub:** Nickel plating is a surface finishing technique for decorative and engineering purposes. In automotive applications, nickel is used as a plating material to coat onto the surface of a wheel hub, by electrolytic or electrodeless processes, which can help with the durability of wheel hubs and their resistance to corrosion.

**Nickel for electroplating:** Nickel is mainly used in the electroplating process for automobile parts, hardware, electronics, jewelry, the shipping industry and other sectors. It is also used in the manufacturing of metallurgical products such as high-purity nickel profiles, nickel alloy, nickel powder, nickel salt, battery materials and metal catalysts.

**Jewelry:** Platinum is a silver-white soft metal with good ductility and thermal and electrical conductivity. Platinum is widely used in jewelry collections. It is rare and precious and has a white sheen that complements gemstone colors.

**Three-way catalysts:** Rhodium is a silver-white hard metal with good corrosion resistance and high reflectivity. It is widely used in automotive exhaust catalysts, which mainly contain the precious metals platinum, rhodium and palladium, and help to control vehicle emissions of harmful gases. Rhodium helps to eliminate nitrogen oxide, the cause of acid rain.

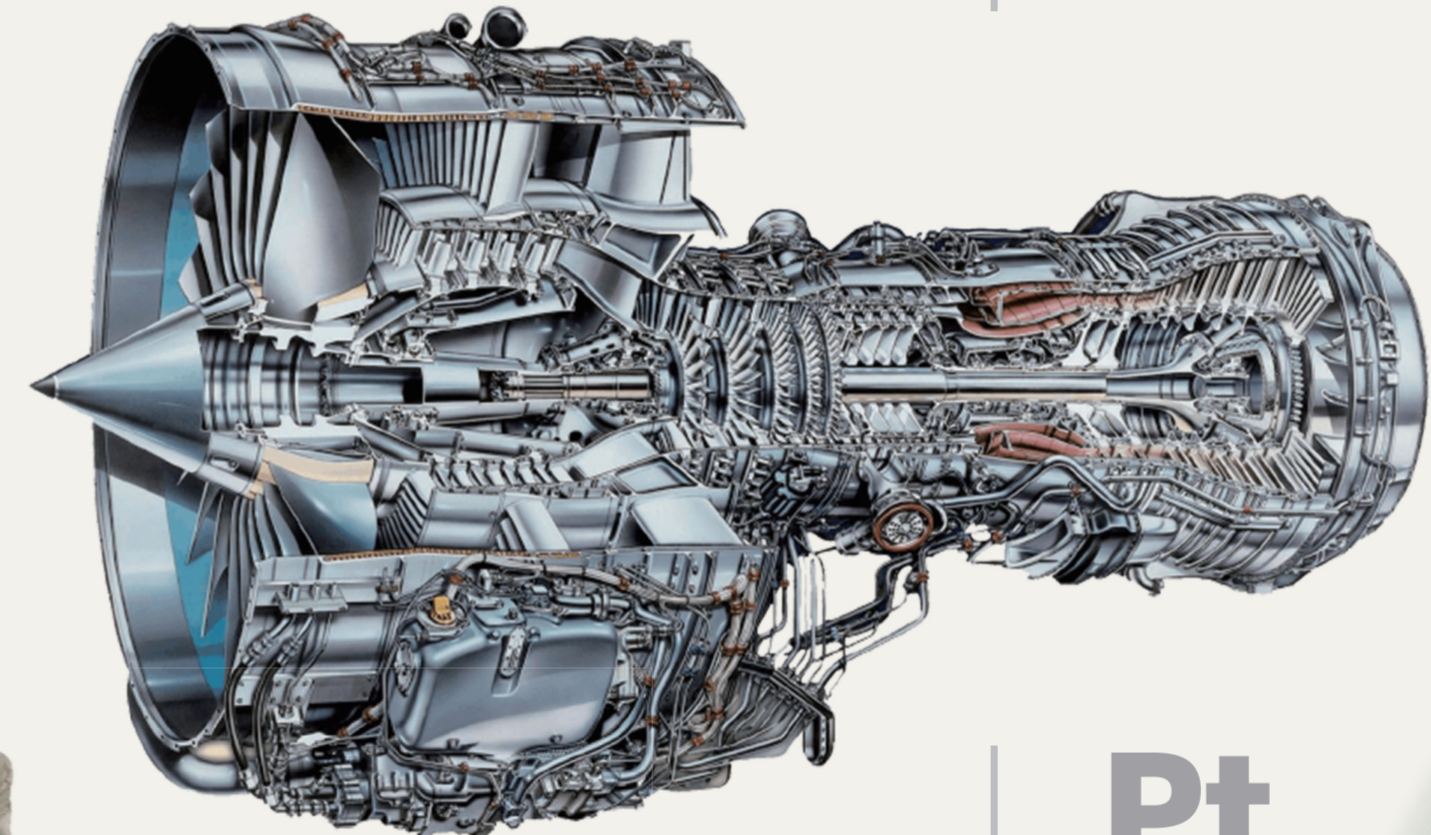
**Electronics:** Palladium is a silver-white soft metal with good ductility and plasticity in terms of electronic appliances, most palladium is used for multilayered ceramic chip capacitors, which store energy in electronic devices. Also, a palladium-coated copper bonding wire has excellent oxidation performance and is widely used in the packaging of semiconductor manufacturing.



More than 60 years ago, Jinchuan Group in Jinchang, Northwest China's Gansu province, kicked off its nickel business with malachite, a green mineral of copper, discovered in the Gobi Desert. After decades of effort, the group is now a Fortune Global 500 company featuring competitive production and processing methods of nonferrous metals. Between 2011-21, Jinchuan produced 1.79 million metric tons of nickel; 8.81 million tons of copper; 110,000 tons of cobalt; and 43 tons of platinum group metals. As a forerunner in nickel and cobalt production and in the extraction of PGM, Jinchuan has a cornucopia of nonferrous metal products. Here, we have published stories about the group's development and describe some major nonferrous metals that Jinchuan produces, illustrating these metallic elements' applications and their roles in the national economy, people's daily lives, and the national defense industry as well as science and technology.

**Ni**  
镍

**Nickel**  
Nickel is a hard, silver-white nonferrous metal with the properties of ferromagnetism, ductility, plasticity and corrosion resistance.



**JINCHUAN GROUP SEALS POSITION AS KEY METALS MANUFACTURER**

*Conglomerate established in 1959 moves with the times to adopt latest technology, international outlook and environmental practices*

By LIANG KAIYAN  
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China's leading nonferrous metal manufacturer Jinchuan Group has made remarkable achievements in industrial upgrading, technological innovation and overseas cooperation and expansion over the past 10 years.

Headquartered in Jinchang, Northwest China's Gansu province, the conglomerate was founded in the 1950s when China was confronted with a severe shortage of nickel resources.

In 1958, an engineering team of Gansu's coalfield geology survey team found malachite, a green mineral of copper, at Bajiazi village, located at the foot of Longshou Mountain. The team reported this

discovery to local officials and collected a sample for laboratory tests. It turned out that the ore sample contained a copper content of 16.65 percent and a nickel content of 0.9 percent, and both were eligible for industrial production.

One year later, the nickel and copper deposit was officially confirmed and the group was established in June 1959.

Over the decades, Jinchuan has developed into one of China's nickel and cobalt production bases and a hub for the extraction of platinum group metals, or PGM, using a series of advanced technologies and equipment for mining, mineral processing and smelting. The group is home to the world's third-largest sulfide nickel and copper deposit, and has built facilities including the first nickel flash smelting furnace of its kind in Asia and the fifth in

the world. It has a complete business layout across the country with locations including Lanzhou in Gansu province; Qinghai province; Fuzhouqing in Guangxi Zhuang autonomous region; the Tibet autonomous region, Beijing and Shanghai, standing out among domestic peers in the nonferrous metal production and processing sector.

However, relying exclusively on resources on home turf is not a long-term plan. The nonferrous metal manufacturer has gone the extra mile to broaden its international cooperation.

In the past 10 years, Jinchuan has organized five science and technology conferences, teaming up with colleges and businesses at home and abroad to tackle issues focused on the comprehensive utilization of nickel, cobalt, copper and PGM, and the research and development of new energy materials.

From 2012 to 2021, Jinchuan won four prizes at the State Scientific and Technological Progress Award and 57 technological progress awards at provincial level. Its revenue jumped to 262.2 billion yuan (\$38.27 billion) in 2021 from 120 billion yuan in 2012, according to the group's statement.

"The past decade was a significant and extraordinary period for Jinchuan. We have targeted high-quality development and kept upgrading and transforming, striving to play the role as a State-owned business with a vision to become a world-class enterprise," said Wang Yongqiang, chairman of the group.

To date, Jinchuan has expanded its footprint in more than 30 countries and regions. It has an

annual production capability of 200,000 metric tons of nickel, 1 million tons of copper, 15,000 tons of cobalt and 10 tons of PGM. In 2021, Jinchuan's nickel production ranked third and cobalt production ranked fourth in the world. Its copper production ranked fourth nationally and its production of mineral PGM ranked first in Asia.

"We've seen Chinese producers go overseas to invest in mining assets and the trend will continue," said Zhu Y, senior analyst with metals and mining at Bloomberg Intelligence.

In December, the ministry of industry and information technology, science and technology, and national resources jointly issued guidelines on the development of the raw material industry during the 14th Five-Year Plan period (2021-25). It highlighted an improved industrial development featuring higher quality, more efficiency, better layout and a greener and safer pattern.

Efforts should be made to increase R&D investment to realize high-level supply, improve the industry's structure, increase green development and reduce energy consumption, accelerate digital transformation and focus on safe production, according to the document.

"Chinese metal producers have been investing in R&D and upgrading production lines to manufacture more value-added products, which is in greater demand than the commodity-grade products," Zhu said. In recent years, Jinchuan has accelerated the

transformation of its nickel and cobalt business to meet the rapid development of the new energy battery sector. It has expanded the production of supply materials including nickel salt and sulfate, ternary precursors, and positive electrodes. By 2025, the output value of its new energy battery business is expected to reach 2.3 billion yuan.

With China's dual carbon goals, Zhu said, "Decarbonizing will boost demand for most of the metals, especially copper and nickel among nonferrous metals."

According to Jinchuan, the group has adopted environmentally friendly practices in its production. Since 2020, the group has invested about 400 million yuan in environmental protection of the treatment of waste water, waste gas and waste industrial residue.

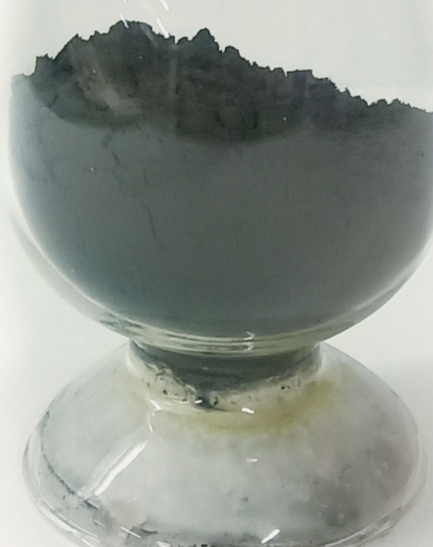
It has also introduced a digital transformation by cooperating with telecommunication operators to build 210 wireless network bases. These transmit signals across its mining areas and production sites of mineral processing and smelting.

"We will continue on the road of high-quality development to create a 'new Jinchuan,'" Wang said. "In the next 10 years, Jinchuan will strive to become a world-class business, taking a major place in international resource mobilization, and take the lead and occupy discourse on industrial technology and development," Wang added.

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
<b>Nickel</b> (Unit: 10,000 tons)	14	15.8	16.1	16.5	15.9	15.4	15.7	17	19.6	19.7
<b>Copper</b> (Unit: 10,000 tons)	60.8	73.3	77.4	80	73.3	88.6	78	91.7	101.2	104.3
<b>Cobalt</b> (Unit: 10,000 tons)	0.74	0.85	0.94	1	0.93	1.07	1.02	1.09	1.37	1.37
<b>PGM</b> (Unit: tons)	2.2	2.5	2.5	3.5	4.2	4	4	4.3	6.56	7

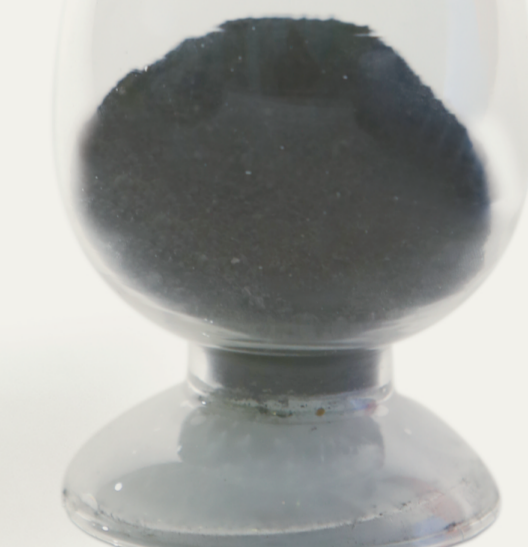
**Pt**  
铂

**Platinum black**  
Platinum black is a fine powder with good catalytic properties. It is soluble in aqua regia, an extremely caustic mixture, and insoluble in water and inorganic acids. This powder is used in sectors such as catalysts, electronic materials and surface-active agents.

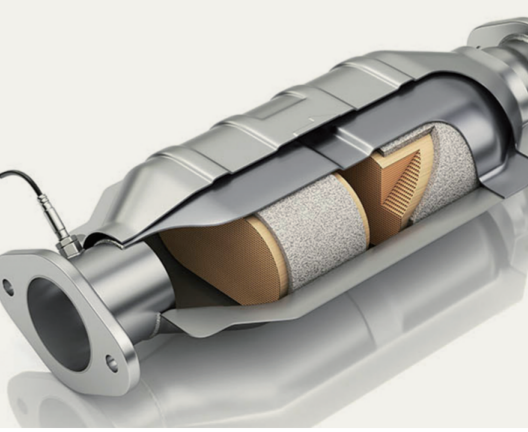


**Rh**  
铑

**Rhodium powder**  
Rhodium powder is a silver gray metal powder, which is very hard and has excellent wear resistance and ductility. It is used to manufacture hydrogenation catalysts, thermocouple and a platinum rhodium alloy.



**Three-way catalysts:**  
Rhodium is a silver-white hard metal with good corrosion resistance and high reflectivity. It is widely used in automotive exhaust catalysts, which mainly contain the precious metals platinum, rhodium and palladium, and help to control vehicle emissions of harmful gases. Rhodium helps to eliminate nitrogen oxide, the cause of acid rain.

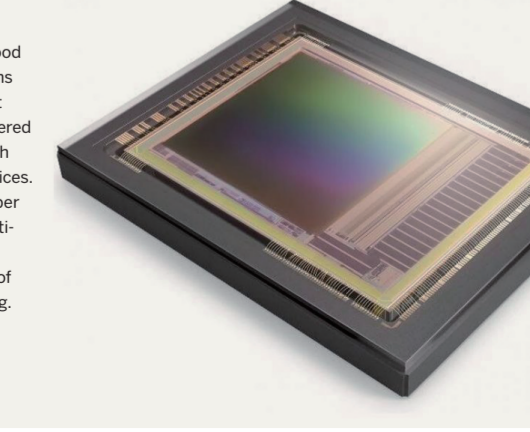


**Pd**  
钯

**Palladium powder**  
Palladium powder is a relatively high density is a gray precious metal retaining good chemical stability. It has strong acid and alkali corrosion resistance, good ductility, and excellent heat-resistant and thermoelectric properties. It is applied in industries including catalysts, electrical instruments and electrode materials.



**Electronics:**  
Palladium is a silver-white soft metal with good ductility and plasticity in terms of electronic appliances, most palladium is used for multilayered ceramic chip capacitors, which store energy in electronic devices. Also, a palladium-coated copper bonding wire has excellent oxidation performance and is widely used in the packaging of semiconductor manufacturing.



Annual nickel production capacity **200,000 tons**