

## 40 Common Minerals and Their Uses

### Aluminum

The most abundant metal element in Earth's crust. Aluminum originates as an oxide called alumina. Bauxite ore is the main source of aluminum and is imported from Jamaica, Turkey, Guyana and Australia. It's used in transportation (automobiles), packaging, building/construction, electrical, machinery and other applications. The U.S. was 59 percent import reliant for aluminum in 2024.

### Antimony

A native element, antimony metal is extracted from stibnite ore and other minerals. It is used as a hardening alloy for lead, especially storage batteries and cable sheaths. It's also used in bearing metal, type metal, solder, collapsible tubes and foil, sheet and pipes and semiconductor technology. Antimony is used as a flame retardant, in fireworks and in antimony salts, which are used in the rubber, chemical and textile industries, as well as medicine and glassmaking. The U.S. was 85 percent import reliant in 2024.

### Barium

A heavy metal contained in barite. It's used as a heavy additive in oil well drilling; in the paper and rubber industries; as a filler or extender in cloth, ink and plastics products; in radiography ("barium milkshake"); as a deoxidizer for copper; a sparkplug in alloys; and in making expensive white pigments.

### Bauxite

Rock composed of hydrated aluminum oxides. In the U.S., it is primarily converted to alumina. See "aluminum." The U.S. was more than 75 percent import reliant on bauxite in 2024.

### Beryllium

Used in the nuclear industry and to make light, but strong alloys used by the aircraft industry. Beryllium salts are used in fluorescent lamps, X-ray tubes and as a deoxidizer in bronze metallurgy. It is used in computers, telecommunication and electronics products, aerospace and defense applications, appliances, automotive and consumer electronics, and medical applications. The U.S. was less than 6 percent import reliant in 2024.

### Chromite

The U.S. consumes about 5 percent of world chromite ore production in various forms of imported materials, such as chromite ore, chromite chemicals, chromium ferroalloys, chromium metal and stainless steel. It's used as an alloy in stainless and heat resisting steel products. It's also used in chemical and metallurgical industries (chrome fixtures, etc.). Superalloys require chromium. It is produced in South Africa, Turkey, Kazakhstan and India. The U.S. was 77 percent import reliant for chromium in 2024.

### Clays

It's used in floor and wall tile as an absorbent, in sanitation, mud drilling, foundry sand bonding, in iron pelletizing, brick, light weight aggregate and cement. Ball clay is used in floor and wall tile. Bentonite is used for drilling mud, pet waste absorbent, iron ore pelletizing and foundry sand bond. Kaolin is used for paper coating and filling, refractory products, fiberglass, paint, rubber and catalyst manufacture. Common clay is used in brick, light aggregate and cement. The U.S. was not import reliant in 2024.

## Cobalt

It's used primarily in superalloys for aircraft gas turbine engines, cemented carbides for cutting tools and wear-resistant applications, chemicals (paint dryers, catalysts, magnetic coatings) and permanent magnets. The U.S. has cobalt resources in Minnesota, Alaska, California, Idaho, Michigan, Missouri and Montana. Cobalt production comes principally from Congo, Indonesia, Russia, Canada and Australia. The U.S. was 76 percent import reliant in 2024.

## Copper

It's used in building construction; electric and electronic products (cables and wires, switches, plumbing, heating); transportation equipment; roofing; chemical and pharmaceutical machinery; and alloys (brass, bronze and beryllium alloyed with copper are particularly vibration resistant); alloy castings; electroplated protective coatings; and undercoats for nickel, chromium, zinc, etc. More recently, copper is being used in medical equipment due to its anti-microbial properties. The United States has copper mines in Arizona, Michigan, Missouri, Montana, Nevada and New Mexico. Leading producers are Chile, Peru, Congo, China and the U.S. The U.S. was 45 percent import reliant in 2024.

## Feldspar

A rock-forming mineral, it's industrially important in glass and ceramic industries; patten and enamelware; soaps; bond for abrasive wheels; cements; insulating compositions; fertilizer; tarred roofing materials; and as a sizing, or filler, in textiles and paper. In pottery and glass, feldspar functions as a flux. End uses for feldspar in the U.S. include glass (50 percent) and pottery and other uses (50 percent). The U.S. was 33 percent import reliant in 2024.

## Fluorite (fluorspar)

It's used in production of hydrofluoric acid, which is used in the pottery, ceramics, optical, electroplating and plastics industries; in the metallurgical treatment of bauxite; as a flux in open hearth steel furnaces and in metal smelting; in carbon electrodes; emery wheels; electric arc welders; toothpaste; and paint pigment. It is a key ingredient in the processing of aluminum and uranium. The U.S. was 100 percent import reliant in 2024.

## Gallium

Gallium is used in integrated circuits, light-emitting diodes (LEDs), photodetectors and solar cells. It has a new use in chemotherapy for some types of cancer. Integrated circuits are used in defense applications, high performance computers and telecommunications. Optoelectronic devices were used in areas such as aerospace, consumer goods, industrial equipment, medical equipment and telecommunications. Leading sources are China, Russia, Japan and South Korea. The U.S. was 100 percent import reliant in 2024.

## Gold

Gold is used in jewelry and arts; dentistry and medicine; medallions and coins; ingots as a store of value; scientific and electronic instruments; and as an electrolyte in the electroplating industry. It is mined in Alaska and several western states. Leading producers are China, Russia, Australia, Canada and the U.S. The U.S. was a net exporter in 2024.

## Gypsum

Processed and used as prefabricated wallboard or an industrial or building plaster; used in cement manufacturing; agriculture and other uses. The U.S. was 17 percent import reliant in 2024.

## **Halite** (sodium chloride salt)

It's used in human and animal diet, both a seasoning and a preservative. It's also used to prepare sodium hydroxide, soda ash, caustic soda, hydrochloric acid, chlorine, metallic sodium, ceramic glazes, metallurgy, curing of hides, mineral waters, soap manufacturing, home water softeners, highway de-icing, photography and in scientific equipment for optical parts. Single crystals used for spectroscopy, ultraviolet and infrared transmission. The U.S. was 24 percent import reliant for salt in 2024.

## **Indium**

Indium tin oxide is used for electrical conductivity purposes in flat panel devices most commonly in liquid crystal displays (LCDs). It is also used in solders, alloys, compounds, electrical components, semiconductors and research. Indium ore is not recovered from ores in the U.S. China is the leading producer. It is also produced in South Korea, Japan, Canada, France, Russia and Belgium. The U.S. was 100 percent import reliant in 2024.

## **Iron Ore**

Used to manufacture steels of various types. It's used in powdered iron, metallurgy products, magnets, high-frequency cores, auto parts, catalysts. Radioactive iron (iron 59) is used in medicine and in biochemical and metallurgical research. Iron blue is used in paints, printing inks, plastics, cosmetics and paper dyeing. Black iron oxide is used as pigment, polishing compounds, metallurgy, medicine and magnetic inks. Most U.S. production is in Michigan, Minnesota and Utah. Australia, Brazil, China and India are the major producers. The U.S. was not import reliant in 2024.

## **Lead**

It's used in lead-acid batteries, tanks, solders and seals or bearings. It's also used in electrical and electronic applications (TV tubes and glass); construction, communications and protective coatings; ballast or weights; ceramics or crystal glass; X-ray and gamma radiation shielding; soundproofing material and ammunition. Industrial type batteries are used as a source of uninterrupted power equipment for computer and telecommunications networks and mobile power. Lead is mined mainly in Missouri, but also in Alaska and Idaho. The U.S. was 28 percent import reliant in 2024.

## **Lithium**

Lithium and lithium compounds are used in batteries; ceramics and glass; lubricating greases; air treatment and medicine. Lithium consumption for batteries has increased significantly in recent years due to more extensive use of lithium in batteries for hand held/portable electronic devices, electric tools, electric vehicles and grid storage. Lithium supply has become a top priority for U.S. technology companies in need of a reliable and diverse supply. There is one brine operation in Nevada, and others that can produce a wide range of downstream lithium compounds, and brine-sources tailings. Australia, Chile, China and Argentina are major producers. The U.S. was more than 50 percent reliant for lithium in 2024.

## **Manganese**

Ore is essential to iron and steel production. It's also used in the making of manganese ferroalloys. Construction, machinery and transportation end uses account for most U.S. consumption of manganese. Manganese dioxide was produced for pig iron manufacturing. Major producers are South Africa, Gabon and Australia. The U.S. was 100 percent import reliant in 2024.

## Mica

Mica commonly occurs as flakes, scales or shreds. Ground mica is used in paints, joint cement, dusting agents, oil well-drilling muds and plastics, roofing, rubber and welding rods. Sheet mica is fabricated into parts for electronic and electronic equipment. Madagascar, China and Finland are leading producers. The U.S. was 100 percent import reliant in 2024.

## Molybdenum

It's used in alloy steels to make automotive parts, construction equipment, gas transmission pipes, stainless steels, tool steels, cast irons, super alloys and chemicals and lubricants. As a pure metal, molybdenum is used because of its high melting temperature (4,730 F) as filament supports in light bulbs, metalworking dies and furnace parts. Major producers are China, Peru, Chile and the U.S. The U.S. was not import reliant in 2024.

## Nickel

Vital as an alloy to stainless steel, it plays a key role in the chemical and aerospace industries. End uses are transportation, fabricated metal products, electrical equipment, petroleum and chemical industries, household appliances and industrial machinery. Major producers are the Indonesia, Philippines, Russia, Canada and Australia. The U.S. was 48 percent import reliant in 2024.

## Perlite

Expanded perlite is used in building construction products like roof insulation boards and as fillers. It's also used for horticulture aggregate and filter aids. It's produced in New Mexico, Oregon and other western states and processed in more than 20 states. Leading producers are China, Turkey, Greece, U.S. and Hungary. The U.S. was 26 percent import reliant in 2024.

## Platinum Group Metals (PGMs)

PGMs includes platinum, palladium, rhodium, iridium, osmium and ruthenium. They commonly occur together in nature and are among the scarcest of the metallic elements. Platinum is used principally in catalysts for the control of automobile and industrial plant emissions, jewelry, catalysts to produce acids, organic chemicals and pharmaceuticals. PGMs are found in bushings for making glass fibers used in fiber-reinforced plastic and other advanced materials, electrical contacts, capacitors, conductive and resistive films used in electronic circuits and dental alloys used for making crowns and bridges. South Africa, Russia, Zimbabwe, Canada and the U.S. are major producers. The U.S. was more than 36 percent import reliant for most PGMs in 2024.

## Phosphate Rock

It's used to produce phosphoric acid for ammoniated phosphate fertilizers, feed additives for livestock, elemental phosphorus, and a variety of phosphate chemicals for industrial and home consumption. U.S. production occurs in Florida, Idaho, North Carolina and Utah. China, Morocco and the U.S. are major producers. It was 13 percent import reliant in 2024.

## Potash

It's a carbonate of potassium. It's used as a fertilizer, in medicine, in the chemical industry. It also can produce decorative color effects on brass, bronze and nickel. The leading producers are Canada, Russia, Belarus and China. The U.S. was 90 percent import reliant in 2024.

## Pyrite

It's used in the manufacture of sulfur, sulfuric acid and sulfur dioxide. Pellets of pressed pyrite dust are used to recover iron, gold, copper, cobalt and nickel. It's also used to make inexpensive jewelry.

## **Quartz** (Silica)

As a crystal, quartz is used as a semiprecious gemstone. Crystalline varieties include amethyst, citrine, rose quartz, smoky quartz, etc. Cryptocrystalline forms include agate, jasper, onyx, etc. Because of its piezoelectric properties, quartz is used for pressure gauges, oscillators, resonators and wave stabilizes. Because of its ability to rotate the plane of polarization of light and its transparency in ultraviolet rays, it's used in heat-ray lamps, prism and spectrographic lenses. It's also used in manufacturing glass, paints, abrasives, refractory materials and precision instruments.

## **Rare Earth Elements** (lanthanum, cerium, praseodymium, neodymium, promethium, samarium, europium, gadolinium, terbium, dysprosium, holmium, erbium, thulium, ytterbium and lutetium)

They are used mainly in petroleum fluid cracking catalysts, metallurgical additives and alloys, glass polishing and ceramics, permanent magnets and phosphors. It is estimated that 40 pounds of rare earths are used in a hybrid car for rechargeable battery, permanent magnet motor and regenerative braking systems. The U.S. produced rare earth (bastnasite) in California in 2024. About 70 percent of global production is in China. The U.S. was import reliant for 80 percent of its rare earth metals in 2024.

## **Silica**

Aluminum and aluminum alloy producers and the chemical industry are major users of silicon metal. Silica is also used in manufacture of computer chips, glass and refractory materials, ceramics, abrasives, water filtration systems, component of hydraulic cements, filler in cosmetics, pharmaceutical, paper, insecticides, anti-caking agents in foods, flattening agents in paints, thermal insulators, and photovoltaic cells. China is the

leading producer. The U.S. was more than 50 percent reliant on silicon metal in 2024.

## **Silver**

It's used in coins and medals, electrical and electronic devices, industrial applications, jewelry, silverware and photography. The physical properties of silver include ductility, electronics conductivity, malleability and reflectivity. It's used in lining vats and other equipment for chemical reaction vessels, water distillation, in the manufacture of ethylene, mirrors, silver plating, table cutlery, dental, medical and scientific equipment, bearing metal, magnet windings, brazing alloys and solder. It's also used in catalytic converters, cell phone covers, electronics, circuit boards, bandages for wound care and batteries. Silver is produced in the U.S. at more than 30 base and precious metal mines primarily in Alaska and Nevada. The leading global producers include Mexico, China, Peru and Bolivia. The U.S. was 64 percent reliant in 2024.

## **Sodium Carbonate** (soda ash or trona)

Used in glass container manufacture; in fiberglass and specialty glass; also used in production of flat glass; in liquid detergents; in medicine; as a food additive; photography; cleaning and boiler compounds; pH control of water. Most U.S. production comes from Wyoming and California. The U.S. is a major producer and was not import reliant in 2024.

## **Sulfur**

It's used in the manufacture of sulfuric acid, fertilizers, petroleum refining and metal mining. Elemental sulphur and byproduct sulfuric acid were produced in more than 80 operations in 26 states. The China, the U.S., Russia, Saudi Arabia and Canada are major producers. The U.S. was 7 percent import reliant in 2024.

## Tantalum

Tantalum is a refractory metal with unique electrical, chemical and physical properties used to produce electronic components, including tantalum capacitors (found in auto electronics, pagers, personal computers and portable telephones). High-purity tantalum metals can be found in products ranging from weapon systems to superconductors, high-speed tools, catalysts, sutures and body implants, electronic circuitry and thin-film components. It's used in optical glass and electroplating devices. Leading producers are Congo, Nigeria, Rwanda and Brazil. The U.S. was 100 percent reliant in 2024.

## Titanium

Titanium mineral concentrates are used primarily by titanium dioxide pigment producers. A small amount is used in welding rod coatings and for manufacturing carbides, chemicals and metals. It is produced in Georgia and Florida. Leading producing countries are China, Mozambique, South Africa and Australia. The U.S. was 86 percent reliant in 2024.

Titanium and titanium dioxide are used in aerospace applications (i.e., jet engines, airframes and space and missile applications). It is also used in armor, chemical processing, marine, medical, power generation, sporting goods and other non-aerospace applications. Titanium sponge metal was produced in one operation in Utah. The leading global producers are Canada, Japan, Russia and Saudi Arabia. The U.S. was more than 95 percent reliant in 2024.

## Tungsten

More than half of the tungsten consumed in the U.S. was used in cemented carbide parts for cutting and wear-resistant materials - primarily in the construction, metalworking, mining, and oil- and gas-drilling industries. The remaining tung-

sten was consumed to make tungsten heavy alloys for applications requiring high density, including electrodes, filaments, wires, and other components for electrical, electronic, heating, lighting, and welding applications. It can also be found in steels, superalloys, wear-resistant alloys and chemicals for various applications. China is by far the leading producer. Vietnam, Russia, Bolivia and Rwanda also produce tungsten. The U.S. is not a producer and was more than 50 percent import reliant in 2024.

## Uranium

About 20 percent of U.S. electricity is produced using uranium in nuclear generation. It is also used for nuclear medicine, atomic dating, powering nuclear submarines and other uses in the U.S. defense system. The U.S. received more than 90 percent of its uranium from other countries in 2024.

## Vanadium

Vanadium's metallurgical use is primarily as an alloying agent for iron and steel - accounting for more than 90 percent of domestic vanadium consumption. Of the other uses for vanadium, the major non-metallurgical use is in catalysts for the production of maleic anhydride and sulfuric acid. China, Russia, South Africa and Brazil are large producers. The U.S. was 40 percent reliant in 2024.

## Zeolites

Zeolites are used in animal feed, cat litter, cement, aquaculture (fish hatcheries for removing ammonia from the water), water softener and purification, catalysts, odor control and for removing radioactive ions from nuclear plant effluent. The U.S. was not import reliant in 2024.



## Zinc

Of the total zinc consumed in the U.S., most was used in galvanizing. Other primary uses included brass, bronze and zinc-based alloys. Zinc compounds and dust were used principally by the agriculture, chemical, paint, and rubber industries.

Major co-products of zinc mining and smelting were lead, sulfuric acid, cadmium, silver, gold and germanium. Zinc is used as protective coating on steel, as die casting, as an alloying metal with copper to make brass and as chemical compounds in rubber and paints. It's also used as sheet zinc and for galvanizing iron; electroplating; metal spraying; automotive parts; electrical fuses; anodes; dry cell batteries; nutrition; chemicals; roof gutter; engravers' plates; cable wrappings; organ pipes; and pennies. Zinc oxide is used in medicine, paints, vulcanized rubber and sun block. Zinc dust can be used for primers, paints, precipitation of noble metals and removal of impurities from solutions in zinc electrowinning. U.S. production is in five states and 6 mines. Leading producers are China, Peru, Australia, India, the U.S. and Mexico. The U.S. was 73 percent import reliant in 2024.

Sources: The U.S. Geological Survey; the Energy Information Administration

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