

SCANDIUM¹

(Data in metric tons of scandium oxide equivalent unless otherwise noted)

Domestic Production and Use: Domestically, scandium was neither mined nor recovered from process streams or mine tailings in 2019. Previously, scandium was produced domestically primarily from the scandium-yttrium silicate mineral thortveitite and from byproduct leach solutions from uranium operations. Limited capacity to produce ingot and distilled scandium metal existed at facilities in Ames, IA; Tolleson, AZ; and Urbana, IL. The principal source for scandium metal and scandium compounds was imports from China. The principal uses for scandium in 2019 were in aluminum-scandium alloys and solid oxide fuel cells (SOFCs). Other uses for scandium included ceramics, electronics, lasers, lighting, and radioactive isotopes.

| Salient Statistics—United States: | 2015 | 2016 | 2017 | 2018 | 2019^e |
|--|---------------------|---------------------|---------------------|---------------------|-------------------------|
| Price, yearend, dollars: | | | | | |
| Compounds, per gram: | | | | | |
| Acetate, 99.9% purity, 5-gram sample size ² | 43.00 | 44.00 | 44.00 | 44.00 | 45.00 |
| Chloride, 99.9% purity, 5-gram sample size ² | 123.00 | 126.00 | 124.00 | 125.00 | 129.00 |
| Fluoride, 99.9% purity, 1-to-5-gram sample size | ² 263.00 | ³ 270.00 | ³ 277.00 | ³ 206.00 | ³ 209.00 |
| Iodide, 99.999% purity, 5-gram sample size ² | 187.00 | 149.00 | 183.00 | 165.00 | 157.00 |
| Oxide, 99.99% purity, 5-kilogram lot size ⁴ | 5.10 | 4.60 | 4.60 | 4.60 | 3.90 |
| Metal: | | | | | |
| Scandium, distilled dendritic, per gram, 2-gram sample size ² | 221.00 | 228.00 | 226.00 | 226.00 | 233.00 |
| Scandium, ingot, per gram, 5-gram sample size ² | 134.00 | 107.00 | 132.00 | 132.00 | 134.00 |
| Scandium-aluminum alloy, per kilogram, metric-ton lot size ⁴ | 220.00 | 340.00 | 350.00 | 360.00 | 300.00 |
| Net import reliance ⁵ as a percentage of apparent consumption | 100 | 100 | 100 | 100 | 100 |

Recycling: None.

Import Sources (2015–18): Although no definitive data exist listing import sources, imported material is mostly from Europe, China, Japan, and Russia.

| Tariff: Item | Number | Normal Trade Relations 12–31–19 |
|---|---------------|--|
| Rare-earth metals, unspecified, not intermixed or interalloyed | 2805.30.0050 | 5.0% ad val. |
| Compounds of rare-earth metals: | | |
| Mixtures of oxides of yttrium or scandium as the predominant metal | 2846.90.2015 | Free. |
| Mixtures of chlorides of yttrium or scandium as the predominant metal | 2846.90.2082 | Free. |
| Mixtures of other rare-earth carbonates, including scandium | 2846.90.8075 | 3.7% ad val. |
| Mixtures of other rare-earth compounds, including scandium | 2846.90.8090 | 3.7% ad val. |

Depletion Allowance: 14% (Domestic and foreign).

Government Stockpile: None.

Events, Trends, and Issues: The global supply and consumption of scandium was estimated to be about 15 tons to 20 tons per year. Scandium was recovered from titanium, zirconium, cobalt, and nickel process streams. China, the Philippines, and Russia were the leading producers. Prices quoted for scandium oxide in the United States decreased compared with those in 2018. Owing in part to low capacity utilization, China's ex-works prices for scandium oxide were significantly less than United States quoted prices. Although global exploration and development projects continued in anticipation of increased demand, the global scandium market remained small relative to most other metals.

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In the United States, a feasibility study was completed on the polymetallic Elk Creek project in Nebraska. Probable reserves were estimated to be 36 million tons containing 65.7 parts per million (2,400 tons) of scandium. Plans for the project included downstream production of ferroniobium, titanium dioxide, and scandium oxide. The Bokan project in Alaska and the Round Top project in Texas also included scandium recovery in their process plans. In addition, Federal and State agencies were funding the development of methods to separate scandium from coal and coal byproducts.

Globally, several projects were under development while seeking permitting, project financing, and offtake agreements. Reserves at the Nyngan project in New South Wales, Australia, were estimated to be 1.4 million tons containing about 590 tons of scandium. The developer expected to begin commissioning 38.5 tons per year of scandium oxide production capacity in 2021. A definitive feasibility study on the polymetallic Owendale Project in New South Wales was completed in 2018 with the potential to produce 20 tons per year of scandium oxide from reserves of 4.0 million tons containing 570 parts per million scandium (3,500 tons of scandium oxide equivalent). Engineering and design plans for the polymetallic Sunrise Project in New South Wales, continued to advance following an offtake agreement for nickel and cobalt in 2019 and the completion of a definitive feasibility study in 2018. Proven and probable reserves for the Sunrise Project were 147 million tons containing 53 parts per million (7,800 t) scandium. In Queensland, following the completion of a bankable feasibility study on the polymetallic SCONI project in 2018, reserves were updated to 57 million tons containing 35 parts per million (2,000 tons) scandium.

In the Philippines, a plant designed to recover 7.5 tons per year of scandium oxide equivalent began commercial production at the Taganito high-pressure acid-leach nickel operation. An intermediate scandium concentrate was exported to Japan.

In Russia, feasibility studies for making scandium oxide as a byproduct of alumina refining in the Ural Mountains were ongoing. The pilot plant was reported to have produced scandium oxide with purity greater than 99%. Based on pilot test results, plans were in place for a 3-ton-per-year scandium oxide plant. In Dalur, Kurgan region, development of scandium recovery as a byproduct of uranium production continued, and production capacity included scandium oxide (570 kilograms per year) and aluminum-scandium alloy (24.5 tons per year).

In the European Union, recovery methods were being developed to produce scandium compounds and aluminum-scandium alloys from byproducts of aluminum and titanium mining and processing. Globally, several projects were underway to commercialize new aluminum-scandium alloys for casting and additive manufacturing.

World Mine Production and Reserves:⁶ No scandium was recovered from mining operations in the United States. As a result of its low concentration, scandium is produced exclusively as a byproduct during processing of various ores or recovered from previously processed tailings or residues. In recent years, scandium was produced as byproduct material in China (iron ore, rare earths, titanium, and zirconium), Kazakhstan (uranium), Philippines (nickel), Russia (apatite and uranium), and Ukraine (uranium). Foreign mine production data for 2019 were not available.

World Resources: Resources of scandium are abundant. Scandium's crustal abundance is greater than that of lead. Scandium lacks affinity for the common ore-forming anions; therefore, it is widely dispersed in the lithosphere and forms solid solutions with low concentrations in more than 100 minerals. Scandium resources have been identified in Australia, Canada, China, Kazakhstan, Madagascar, Norway, the Philippines, Russia, Ukraine, and the United States.

Substitutes: Titanium and aluminum high-strength alloys, as well as carbon-fiber materials, may substitute in high-performance scandium-alloy applications. Light-emitting diodes displace mercury-vapor high-intensity lights in some industrial and residential applications. In some applications that rely on scandium's unique properties, substitution is not possible.

⁰Estimated.

¹See also Rare Earths. Scandium is one of the 17 rare-earth elements.

²Prices from Alfa Aesar, a Johnson Matthey company.

³Prices from Sigma-Aldrich, a part of Millipore Sigma.

⁴Prices from Stanford Materials Corp.

⁵Defined as imports – exports. Quantitative data are not available.

⁶See Appendix C for resource and reserve definitions and information concerning data sources.