SCANDIUM[1]

(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 2021. 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 uses for scandium in 2021 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:	**2017**	**2018**	**2019**	**2020**	**2021[e]**
Price, yearend:					
Compounds, dollars per gram:					
Acetate, 99.9% purity, 5-gram lot size[2]	44	44	45	45	43
Chloride, 99.9% purity, 5-gram lot size[2]	124	125	129	133	137
Fluoride, 99.9% purity, 1- to 5-gram lot size[3]	277	206	209	214	216
Iodide, 99.999% purity, 5-gram lot size[2]	183	165	157	161	161
Oxide, 99.99% purity, 5-kilogram lot size[4]	4.6	4.6	3.9	3.8	2.2
Metal:					
Scandium, distilled dendritic, 2-gram lot size,[2] dollars per gram	226	226	233	233	238
Scandium, ingot, 5-gram lot size,[2] dollars per gram	132	132	134	134	137
Scandium-aluminum alloy, 1-kilogram lot size,[4] dollars per kilogram	350	360	300	340	350
Net import reliance[5] as a percentage of apparent consumption	100	100	100	100	100

Recycling: None.

Import Sources (2017–20): Although no definitive data exist listing import sources, imported material was thought to be mostly from Europe, China, Japan, and Russia.

Tariff: Item	**Number**	**Normal Trade Relations 12–31–21**
Rare-earth metals, unspecified	2805.30.0000	5.0% ad valorem.
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 valorem.
Mixtures of other rare-earth compounds, including scandium	2846.90.8090	3.7% ad valorem.

Depletion Allowance: 14% (domestic and foreign).

Government Stockpile: None.

Events, Trends, and Issues: The global supply and consumption of scandium oxide was estimated to be about 15 to 25 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 in 2021 decreased significantly compared with those in 2020. Owing in part to low capacity utilization, China's ex-works prices for scandium oxide were significantly less than United States quoted prices.

In the United States, a new metallurgical testing program for production of scandium recently achieved success at the bench scale for the Nebraska polymetallic Elk Creek project where additional financing for construction was being sought. Probable reserves were estimated to be 36 million tons containing 65.7 parts per million (2,400 tons) scandium. Plans for the project included downstream production of ferroniobium, titanium dioxide, and scandium oxide. At the La Paz Scandium and Rare Earths project in Arizona, necessary permits and approvals were in place for the core drilling campaign to determine if a primary scandium mine could be established.

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The Bokan project in Alaska and the Round Top project in Texas also included scandium recovery in their process plans. In addition, research continued to develop methods for separating scandium from coal and coal byproducts. SOFC sourcing of scandium is expanding beyond China to include Japan and the Philippines.

A global mining and polymetallic metal producer announced the commissioning of a new scandium plant in Sorel-Tracy, Quebec, Canada, with a capacity of 3 tons per year of 99.99% scandium oxide. The company announced completion of the first sale of high-performance aluminum-scandium alloy for metal additive manufacturing. In Australia, several polymetallic projects were under development and seeking permitting, financing, and offtake agreements. Projects and prospects included the Nyngan, Owendale, and Sunrise projects in New South Wales along with others. The SCONI project commissioned the construction phase of its pilot P-CAM production plant in North Queensland.

In the Philippines, a 7.5-ton-per-year scandium oxide equivalent commercial plant designed to recover scandium at the Taganito high-pressure acid-leach nickel operation produced an estimated gross output of about 13 dry tons of scandium oxalate in 2020 with 2021 first quarter production of 3.6 tons. In Russia, feasibility studies for making scandium oxide as a byproduct of alumina refining at a smelter in the Ural Mountains were ongoing. The pilot plant was reported to have produced scandium oxide with purity greater than 99%. Based on pilot-plant test results, plans were in place for a 3-ton-per-year scandium oxide plant. In the Kurgan region of Russia, two mobile sorption plants were put into operation and two additional sorption columns were mounted directly at the plant site with extractive purification technology to obtain scandium oxide with a purity of 99.9%. Another technology made it possible for production aluminum-scandium alloys as byproduct of uranium production. In 2019 (the most recent year for which there were published data), commercial production at the scandium project was 230 kilograms of metal produced and shipped to customers. At Agios Nikolaos, Greece, a pilot plant successfully demonstrated recovery of scandium from bauxite residue in industrial waste at a vertically integrated aluminum and alumina plant through a patented selective ion recovery technology as part of the European Union's Horizon 2020 research and development program.

The Kiviniemi scandium project in eastern Finland features a resource of 13.4 million tons at a grade of 163 parts per million scandium where scandium is mainly incorporated into the lattice of clinopyroxene and amphibole.

In China, a large state-owned enterprise in Shanghai was producing 50 tons per year of scandium oxide raw material with a long-term expected capacity of 100 tons per year. Another company in Henan Province had a 10-ton-per-year scandium oxide capacity with plans to increase annual output to 20 tons.

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. Historically, scandium was produced as byproduct material in China (iron ore, rare earths, titanium, and zirconium), Kazakhstan (uranium), the Philippines (nickel), Russia (apatite and uranium), and Ukraine (uranium). Foreign mine production data for 2020 and 2021 were not available.

World Resources:[6] 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, Finland, Guinea, Kazakhstan, Madagascar, Norway, South Africa, 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. Under certain conditions, light-emitting diodes may displace mercury-vapor high-intensity lamps that contain scandium iodide. In some applications that rely on scandium's unique properties, substitution is not possible.

[e]Estimated.

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

[2]Source: Alfa Aesar, a part of Thermo Fisher Scientific Inc.

[3]Source: Sigma-Aldrich, a part of MilliporeSigma.

[4]Source: Stanford Materials Corp.

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

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