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 2020. 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 2020 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:	**2016**	**2017**	**2018**	**2019**	**2020[e]**
Price, yearend:					
Compounds, dollars per gram:					
Acetate, 99.9% purity, 5-gram lot size[2]	44	44	44	45	45
Chloride, 99.9% purity, 5-gram lot size[2]	126	124	125	129	133
Fluoride, 99.9% purity, 1- to 5-gram lot size[3]	270	277	206	209	214
Iodide, 99.999% purity, 5-gram lot size[2]	149	183	165	157	161
Oxide, 99.99% purity, 5-kilogram lot size[4]	4.6	4.6	4.6	3.9	3.8
Metal:					
Scandium, distilled dendritic, 2-gram lot size,[2] dollars per gram	228	226	226	233	233
Scandium, ingot, 5-gram lot size,[2] dollars per gram	107	132	132	134	134
Scandium-aluminum alloy, 1-kilogram lot size,[4] dollars per kilogram	340	350	360	300	340
Net import reliance[5] as a percentage of apparent consumption	100	100	100	100	100

Recycling: None.

Import Sources (2016–19): Although no definitive data exist listing import sources, imported material is mostly from Europe, China, Japan, and Russia.

Tariff: Item	**Number**	**Normal Trade Relations 12–31–20**
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 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 decreased slightly compared with those in 2019. 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, the COVID-19 pandemic slowed the development of new projects.

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In the United States, environmental and construction permits were approved by the State of Nebraska on the polymetallic Elk Creek project; however, construction was pending additional financing. 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. The Bokan project in Alaska and the Round Top project in Texas also included scandium recovery in their process plans. In addition, research continued on the development of methods to separate scandium from coal and coal byproducts.

A global mining and polymetallic metal producer announced that it had developed a method to recover scandium from byproduct streams at its titanium slag operations in Sorel-Tracy, Quebec, Canada. The same company was piloting production of aluminum-scandium alloys. In Australia, several polymetallic projects were under development and seeking permitting, financing, and offtake agreements. Projects included the Owendale and Sunrise projects in New South Wales and the SCONI project in Queensland. In the Philippines, a commercial plant designed to recover scandium at the Taganito high-pressure acid-leach nickel operation entered its second year of operation. In the first half of 2020, production of scandium oxalate was reported to be about 5.7 tons. 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-plant 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. In Turkey, a pilot plant produced scandium from byproducts of a nickel and cobalt operation in Gordes; however, the plant produced less than one kilogram of ammonium-scandium-hexafluoride. 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. 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 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 Johnson Matthey company.

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

[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.