

SCANDIUM¹

(Data in kilograms of scandium oxide content unless otherwise noted)

Domestic Production and Use: Domestically, scandium-bearing minerals have been neither mined nor recovered from mine tailings in 2014. Domestic capacity to produce ingot and distilled scandium metal was at three facilities in Ames, IA; Phoenix, AZ; and Urbana, IL. The principal source for scandium metal and scandium compounds was imports from China.

The principal uses for scandium in 2014 were in solid oxide fuel cells (SOFCs) and aluminum-scandium alloys. Other uses for scandium included ceramics, electronics, lasers, lighting, and radioactive isotopes. In SOFCs, electricity is generated directly from oxidizing a fuel. Scandium is added to a zirconia-base electrolyte to improve the power density and lower the reaction temperature of the cell. For metal applications, scandium metal is typically produced by reducing scandium fluoride with calcium metal. Scandium-aluminum alloys are produced for sporting goods, aerospace, and other high-performance applications. Scandium is used in small quantities in a number of electronic applications. Some lasers that contain scandium are used in defense applications and in dental treatments. In lighting, scandium iodide is used in mercury vapor high-intensity lights to simulate natural light. Scandium isotopes were used as a tracing agent in oil refining.

Salient Statistics—United States:	2010	2011	2012	2013	2014^e
Price, yearend, dollars:					
Compounds, per gram:					
Acetate, 99.9% purity, 5-gram sample size ²	47.00	48.40	50.10	51.90	43.00
Chloride, 99.9% purity, 5-gram sample size ²	62.40	138.00	143.00	148.00	123.00
Fluoride, 99.9% purity, 5-gram sample size ²	229.00	235.80	244.00	253.00	263.00
Iodide, 99.999% purity, 5-gram sample size ²	207.00	213.00	220.00	228.00	187.00
Oxide, 99.99% purity, 5-kilogram lot size ³	1.62	4.70	4.70	5.00	NA
Metal:					
Scandium, distilled dendritic, per gram, 2-gram sample size ³	193.00	199.00	206.00	213.00	221.00
Scandium, ingot, per gram, 5-gram sample size ³	158.00	163.00	169.00	175.00	134.00
Scandium-aluminum alloy, per kilogram, metric-ton lot size ²	74.00	220.00	220.00	155.00	NA
Net import reliance ⁴ as a percentage of apparent consumption	100	100	100	100	100

Recycling: None.

Import Sources (2010–13): Although no definitive data exist listing import sources, imported material is mostly from China.

Tariff: Item	Number	Normal Trade Relations 12–31–14
Rare-earth metals, scandium and yttrium, whether or not intermixed or interalloyed, including scandium	2805.30.0000	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 rare-earth carbonates, other, including scandium	2846.90.8075	3.7% ad val.
Other rare-earth compounds, including scandium	2846.90.8090	3.7% ad val.

Depletion Allowance: 14% (Domestic and foreign).

Government Stockpile: None.

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Events, Trends, and Issues: The global supply and consumption of scandium was estimated to be about 10 to 15 tons per year. Consumption of scandium contained in SOFCs was reported to be increasing. Prices for small samples of scandium metal and scandium compounds varied significantly, but generally decreased compared with those in 2013. Published prices for scandium oxide and scandium-aluminum alloys were not available. The global scandium market remained very small relative to most other metals.

In New South Wales, Australia, a preliminary economic assessment of the Nyngan scandium project was completed. The assessment concluded the project had the potential to produce 36 metric tons of scandium oxide per year using high pressure acid leach and solvent extraction techniques. In Northern Queensland, Australia, measured and indicated resources of a scandium-cobalt-nickel deposit near Greenvale were estimated to include 3,970 tons of scandium oxide, using a 1% nickel-equivalent cut-off grade. If developed, the deposit could become a leading source of scandium.

In Japan, efforts were underway to recover scandium and other metals from a titanium dioxide pigment production facility. If a pilot-plant study is successful, the proprietary technology could be scaled up and employed on other titanium dioxide production facilities.

In the Philippines, a 10-kilogram-per-month pilot-plant study planned to recover scandium oxide following the leaching of nickel laterite for nickel-cobalt sulfide. A commercial scale plant was contemplated for 2015.

In Russia, an aluminum producer was conducting a pilot-plant study to produce scandium concentrate from red mud (a residue generated during the production of aluminum). The plant was reported to be capable of producing 2.5 tons per year of concentrate. Additional plans called for an additional 500-kilogram-per-year pilot plant to process the scandium concentrate into scandium oxide. In Lermontov, Kurgan region, a pilot study was underway to recover scandium as a byproduct of uranium production.

World Mine Production and Reserves:⁵ No scandium was mined 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 (titanium and rare earths), Kazakhstan (uranium), Russia (apatite), and Ukraine (uranium). Foreign mine production data in 2014 were not available.

World Resources: Resources of scandium are abundant in relation to demand. Scandium is rarely concentrated in nature because of its lack of affinity for the common ore-forming anions. It is widely dispersed in the lithosphere and forms solid solutions in more than 100 minerals.

Scandium that was previously produced domestically was primarily from the scandium-yttrium silicate mineral thortveitite and from byproduct leach solutions from uranium operations. One of the principal domestic scandium resources is the fluorite tailings from the mined-out Crystal Mountain deposit near Darby, MT. Resources also are contained in the tantalum residues previously processed at Muskogee, OK. Smaller resources are associated with molybdenum, titanium, and tungsten minerals in Colorado and in scandium-bearing aluminum phosphate minerals in Utah. Other lower grade domestic resources are present in ores of aluminum, cobalt, iron, molybdenum, nickel, phosphate, tantalum, tin, titanium, tungsten, zinc, and zirconium. There are identified scandium resources in Australia, China, Kazakhstan, Madagascar, Norway, Russia, and Ukraine.

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

⁰Estimated. NA Not available.

¹See also Rare Earths.

²Prices from Alfa Aesar, a Johnson Matthey company.

³Prices from Stanford Materials Corp.

⁴Defined as imports – exports + adjustments for stock changes.

⁵See [Appendix C](#) for resource/reserve definitions and information concerning data sources.