

KYANITE AND RELATED MINERALS

(Data in metric tons unless otherwise noted)

Domestic Production and Use: In Virginia, one firm with integrated mining and processing operations produced an estimated 100,000 tons of kyanite worth \$40 million from two hard-rock open pit mines and synthetic mullite by calcining kyanite. Two other companies, one in Alabama and another in Georgia, produced synthetic mullite from materials mined from four sites; each company sourced materials from one site in Alabama and one site in Georgia. Synthetic mullite production data were withheld to avoid disclosing company proprietary data. Commercially produced synthetic mullite is made by sintering or fusing such feedstock materials as kyanite, kaolin, bauxite, or bauxitic kaolin. Natural mullite occurrences typically are rare and not economical to mine.

Of the kyanite-mullite output, 90% was estimated to have been used in refractories and 10% in other uses, including abrasive products, such as motor vehicle brake shoes and pads and grinding and cutting wheels; ceramic products such as electrical insulating porcelains, sanitaryware, and whiteware; foundry products and precision casting molds; and other products. An estimated 60% to 70% of the refractory use was by the iron and steel industries, and the remainder was by industries that manufacture cement, chemicals, glass, nonferrous metals, and other materials.

Andalusite was commercially mined from an andalusite-pyrophyllite-sericite deposit in North Carolina and processed as a blend of primarily andalusite for use by producers of refractories in making firebrick. Another company mined mineral sands within the southeastern United States; product blends that included kyanite and (or) sillimanite were marketed to the abrasive, foundry, and refractory industries.

<u>Salient Statistics—United States:</u>	<u>2018</u>	<u>2019</u>	<u>2020</u>	<u>2021</u>	<u>2022^e</u>
Production:					
Kyanite, mine	189,200	191,300	167,100	1105,000	100,000
Synthetic mullite	W	W	W	W	W
Imports for consumption (andalusite)	8,590	6,960	714	1,390	6,200
Exports (kyanite)	43,000	40,100	37,400	48,000	46,000
Consumption, apparent ²	W	W	W	W	W
Price, average unit value of exports (free alongside ship), ^{3, 4} dollars per metric ton	347	358	369	369	400
Employment, number: ^{e, 5}					
Kyanite, mine, office, and plant	150	150	140	140	140
Synthetic mullite, office and plant	200	200	200	200	200
Net import reliance ⁶ as a percentage of apparent consumption	E	E	E	E	E

Recycling: Insignificant.

Import Sources (2018–21):⁴ South Africa, 72%; Peru, 14%; France, 9%; United Kingdom, 5%; and other, <1%.

<u>Tariff:</u>	<u>Item</u>	<u>Number</u>	<u>Normal Trade Relations</u>
			<u>12–31–22</u>
	Andalusite, kyanite, and sillimanite	2508.50.0000	Free.
	Mullite	2508.60.0000	Free.

Depletion Allowance: 22% (domestic), 14% (foreign).

Government Stockpile: None.

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Events, Trends, and Issues: Crude steel production in the United States, which ranked fourth in the world, decreased by about 4% in the first 8 months of 2022 compared with that in the same period in 2021, indicating a similar change in consumption of kyanite-mullite refractories. Total world steel production decreased by about 5% during the first 8 months of 2022 compared with that in the same period in 2021. The decrease in world steel production during the first 8 months of 2022 was the result of ongoing logistical issues and high input costs. The steel industry continued to be the largest consumer of refractories.

A company in South Africa that accounted for nearly one-third of global andalusite output remained in business rescue status. In mid-2019, the company entered into business rescue proceedings attributed to financial problems but was expected to emerge from business rescue status and be transferred to a new owner. In January 2021, the company announced that a new investor and owner had been approved.

Andalusite production in 2022 remained constrained by challenges that disrupted market conditions. Andalusite mines in South Africa were adversely affected by electricity supply issues, flooding, and shipping problems. Andalusite output from Peru was expected to remain significantly higher than that in 2020 but was not expected to meet overall market demand. Andalusite exports from France were higher than those from Peru, but reported production statistics remained unavailable. In India, mining of new groups of minerals, including andalusite, was approved, but some sillimanite mines had previously been reclassified as beach sand minerals mines and, as a result, those mines were no longer considered sillimanite-producing mines. Additional factors that contributed to market uncertainty included the conflict in Ukraine, increased costs for raw materials, increased rates for freight, and higher sales prices. If andalusite producers are unable to meet demand, market participants may consider alternatives such as bauxite and mullite. Development of and production from new bauxite sources in Brazil and Guyana continued to progress in 2022.

World Mine Production and Reserves:

	Mine production		Reserves ⁷
	<u>2021</u>	<u>2022^e</u>	
United States (kyanite)	¹ 105,000	100,000	Large
France (andalusite)	^e 65,000	65,000	NA
India (kyanite and sillimanite)	^e 15,000	15,000	7,200,000
Peru (andalusite)	^e 42,000	42,000	NA
South Africa (andalusite)	^e 170,000	<u>160,000</u>	<u>NA</u>
World total (rounded)	⁸ NA	⁸ NA	NA

World Resources:⁷ Large resources of kyanite and related minerals are known to exist in the United States. The chief resources are in deposits of micaceous schist and gneiss, mostly in the Appalachian Mountains and in Idaho. Other resources are in aluminous gneiss in southern California. These resources are not economical to mine at present. The characteristics of kyanite resources in the rest of the world are thought to be similar to those in the United States. Significant resources of andalusite are known to exist in China, France, Peru, and South Africa; kyanite resources have been identified in Brazil, India, and Russia; and sillimanite has been identified in India.

Substitutes: Two types of synthetic mullite (fused and sintered), superduty fire clays, and high-alumina materials are substitutes for kyanite in refractories. Principal raw materials for synthetic mullite are bauxite, kaolin and other clays, and silica sand.

^eEstimated. E Net exporter. NA Not available. W Withheld to avoid disclosing company proprietary data.

¹Source: Virginia Department of Energy.

²Defined as production + imports – exports.

³Calculated from U.S. Census Bureau export data.

⁴Includes data for the following Harmonized Tariff Schedule of the United States code: 2508.50.0000.

⁵Estimated based on data from the U.S. Department of Labor, Mine Safety and Health Administration.

⁶Defined as imports – exports.

⁷See Appendix C for resource and reserve definitions and information concerning data sources.

⁸In addition to the countries and (or) localities listed, Brazil and China may have produced kyanite and related minerals, but information was not available to make reliable estimates of output.