

## 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 85,000 tons of kyanite worth \$30 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 are 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.

<b>Salient Statistics—United States:</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>	<b>2019</b>	<b>2020<sup>e</sup></b>
Production:					
Kyanite, mine	179,700	191,300	189,200	191,300	85,000
Synthetic mullite	W	W	W	W	W
Imports for consumption (andalusite)	2,510	7,420	8,590	6,960	1,000
Exports (kyanite)	37,100	42,300	43,000	40,100	37,000
Consumption, apparent <sup>2</sup>	W	W	W	W	W
Price, average, kyanite, <sup>3</sup> dollars per metric ton:					
Raw concentrate	270	270	NA	NA	NA
Calcined	420	420	NA	NA	NA
Employment, number: <sup>e</sup>					
Kyanite, mine, office, and plant	150	140	150	150	140
Synthetic mullite, office and plant	210	200	200	200	200
Net import reliance <sup>4</sup> as a percentage of apparent consumption	E	E	E	E	E

**Recycling:** Insignificant.

**Import Sources (2016–19):**<sup>5</sup> South Africa, 79%; Peru, 11%; France, 6%; United Kingdom, 3%; and other, 1%.

<b>Tariff:</b>	<b>Item</b>	<b>Number</b>	<b>Normal Trade Relations 12–31–20</b>
	Andalusite, kyanite, and sillimanite	2508.50.0000	Free.
	Mullite	2508.60.0000	Free.

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

**Government Stockpile:** None.

**Events, Trends, and Issues:** Crude steel production in the United States, which ranked fourth in the world, decreased by about 20% in the first 8 months of 2020 compared with that of the same period in 2019, indicating a similar change in consumption of kyanite-mullite refractories. Total world steel production decreased by about 4% during the first 8 months of 2020 compared with that of the same period in 2019. The decrease in world steel production during the first 8 months of 2020 was the result of economic disruptions owing to the global COVID-19 pandemic. The steel industry continued to be the largest market for refractories.

In March 2020, mines in India, Peru, and South Africa were temporarily closed in response to national lockdowns imposed to limit the spread of COVID-19. Mines gradually reopened as restrictions eased, but production recovery efforts were complicated by logistical issues as well as new health and safety guidelines implemented to help protect workers. The resulting loss of industrial output may correspond with reduced global demand in 2020.

### **World Mine Production and Reserves:**

	Mine production		Reserves <sup>6</sup>
	2019	2020 <sup>e</sup>	
United States (kyanite)	191,300	85,000	Large
India (kyanite and sillimanite)	72,700	69,000	7,200,000
Peru (andalusite)	40,000	37,000	NA
South Africa (andalusite)	190,000	180,000	NA
World total (rounded)	<sup>7</sup> NA	<sup>7</sup> NA	NA

**World Resources:**<sup>6</sup> 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.

<sup>e</sup>Estimated. E Net exporter. NA Not available. W Withheld to avoid disclosing company proprietary data.

<sup>1</sup>Source: Virginia Department of Mines, Minerals and Energy.

<sup>2</sup>Defined as production + imports – exports.

<sup>3</sup>Source: Industrial Minerals, average yearend price.

<sup>4</sup>Defined as imports – exports.

<sup>5</sup>Includes data for the following Harmonized Tariff Schedule of the United States code: 2508.50.0000.

<sup>6</sup>See Appendix C for resource and reserve definitions and information concerning data sources.

<sup>7</sup>In addition to the countries listed, France continued production of andalusite, and Cameroon and China produced kyanite and related minerals. Output was not reported quantitatively, and no reliable basis was available for estimation of output levels.