

## KYANITE AND RELATED MATERIALS

(Data in thousand metric tons unless otherwise noted)

**Domestic Production and Use:** One firm in Virginia with integrated mining and processing operations produced kyanite from hard-rock open pit mines. Another company produced synthetic mullite in Georgia. Commercially produced mullite is synthetic, produced from sintering or fusing such feedstock materials as kyanite or bauxitic kaolin; natural mullite occurrences typically are rare and uneconomic to mine. Of the kyanite-mullite output, 90% was estimated to have been used in refractories and 10% in other uses. Of the refractory usage, an estimated 60% to 65% was used in ironmaking and steelmaking and the remainder in the manufacture of chemicals, glass, nonferrous metals, and other materials.

<b>Salient Statistics—United States:</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>	<b>2010<sup>e</sup></b>
Production:					
Mine <sup>e</sup>	100	118	97	71	70
Synthetic mullite <sup>e</sup>	40	40	40	40	40
Imports for consumption (andalusite)	4	2	6	5	6
Exports <sup>e</sup>	35	36	36	26	32
Consumption, apparent <sup>e</sup>	109	124	107	90	85
Price, average, dollars per metric ton: <sup>1</sup>					
U.S. kyanite, raw	NA	NA	229	283	283
U.S. kyanite, calcined	313	333	357	383	422
Andalusite, Transvaal, South Africa	248	235	263	352	352
Employment, kyanite mine, office, and plant, number <sup>e</sup>	135	130	120	120	120
Employment, mullite plant, office, and plant, number <sup>e</sup>	200	200	190	170	170
Net import reliance <sup>2</sup> as a percentage of apparent consumption	E	E	E	E	E

**Recycling:** Insignificant.

**Import Sources (2006–09):** South Africa, 89%; France, 6%; and other, 5%.

<b>Tariff: Item</b>	<b>Number</b>	<b>Normal Trade Relations 12-31-10</b>
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:** Following the recession in 2008 and 2009, steel production in the United States, which ranked third in the world, rebounded with an increase of 56% in the first 8 months of 2010 compared with that of the same period in 2009. (In the same period of 2009, steel production had declined by 49% from the first 8 months of 2008.) Potentially increasing the demand for kyanite-mullite, crude steel production in the other three of the world's four leading steel-producing countries also increased in the first 8 months of 2010 compared with that of the same period in 2009—in China, the leading producer, by about 15%; in Japan (second) by 38%; and in Russia (fourth) by 15%. Total world production rose by 22% during the same period. Of the total world refractories market, estimated to be approximately 23 million tons, crude steel manufacturing consumed around 70% of production.

Global demand for refractory products grew significantly in the fourth quarter of 2009 and during 2010 as a result of the recovery of steel production and sharp reductions of refractory inventory implemented in 2009 across the supply chain. With the steel recovery continuing, mullite received increasing interest, as many refractory customers sought alternative aluminosilicate refractory minerals to refractory bauxite. Industry sources in the United States, Europe, and Southeast Asia expressed concern regarding the supply of 60% Al<sub>2</sub>O<sub>3</sub> mullite grades from the United States. Such a potential shortage, along with the drive to reduce costs, resulted in a renewed interest in 60- and 70-grade mullite from China, although Chinese mullite prices were on the rise and the future availability there was uncertain. Because of increased demand, one company restarted all its kilns at Andersonville, GA, in late 2009, and in early 2010, brought onstream a new kiln, adding 75,000 tons annually to the company's existing production capacity.

### World Mine Production and Reserves:

	Mine production		Reserves <sup>3</sup>
	2009	2010 <sup>e</sup>	
United States <sup>e</sup>	71	70	Large in the United States.
France	65	65	
India	24	24	
South Africa	210	265	
Other countries	6	8	
World total (rounded)	375	430	

**World Resources:** 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 area 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.

**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.

<sup>1</sup>Source: Industrial Minerals.

<sup>2</sup>Defined as imports – exports + adjustments for Government and industry stock changes.

<sup>3</sup>See Appendix C for resource/reserve definitions and information concerning data sources.