

## 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. The only source of commercially mined andalusite was produced in North Carolina as part of a mineral mixture of high-purity silica and alumina for use in a variety of refractory mineral products for the foundry and ceramics industries.

<b>Salient Statistics—United States:</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>	<b>2011<sup>e</sup></b>
Production:					
Mine <sup>1</sup>	120	97	71	93	95
Synthetic mullite <sup>e</sup>	40	40	40	40	40
Imports for consumption (andalusite)	2	6	5	2	7
Exports	36	36	26	38	40
Consumption, apparent <sup>e</sup>	124	107	90	97	102
Price, average, dollars per metric ton: <sup>2</sup>					
U.S. kyanite, raw	NA	229	283	283	300
U.S. kyanite, calcined	333	357	383	422	425
Andalusite, Transvaal, South Africa	235	263	352	336	347
Employment, kyanite mine, office, and plant, number <sup>e</sup>	130	120	110	115	120
Employment, mullite plant, office, and plant, number <sup>e</sup>	200	190	170	180	190
Net import reliance <sup>3</sup> as a percentage of apparent consumption	E	E	E	E	E

**Recycling:** Insignificant.

**Import Sources (2007–10):** South Africa, 85%; France, 7%; Peru, 3%; and other, 5%.

<b>Tariff: Item</b>	<b>Number</b>	<b>Normal Trade Relations 12-31-11</b>
Andalusite, kyanite, and sillimanite	2508.50.0000	Free.
Mullite	2508.60.0000	Free.

**Depletion Allowance:** 22% (Domestic), 14% (Foreign).

**Government Stockpile:** None.

## KYANITE AND RELATED MATERIALS

**Events, Trends, and Issues:** Steel production in the United States, which ranked third in the world, increased by 6% in the first 8 months of 2011 compared with that of the same period in 2010, indicating a similar increase in consumption for kyanite-mullite refractories. Crude steel production in three other top steel-producing countries increased in the first 8 months of 2011 compared with that of the same period in 2010. China, the leading producer, increased production by about 10%; India and Russia (fourth and fifth) increased production by nearly 5% each. Steel production in Japan (second) decreased slightly. Total world steel production rose by nearly 8% during the same period. Of the total world refractories market, estimated to be approximately 24 million tons, crude steel manufacturing consumed around 70% of refractories production.

Global demand for refractory products grew during 2010 and 2011 as a result of the continued recovery of steel production and reductions of refractory inventory implemented since 2009. With the steel recovery continuing, mullite received increasing interest, as many refractory customers sought alternative aluminosilicate refractory minerals to refractory bauxite. China is expected to continue to be the largest national market for refractories, comprising the majority of global demand, and the Asia Pacific region likely will continue to be the largest regional market. Above-average growth is expected in India. Eastern Europe, North America, and Western Europe had significant refractory demand because of their large industrial bases, but Eastern Europe is expected to have the highest growth of these regions, reflecting the area's continued industrialization. North America is expected to have solid growth prospects in the near term, showing continued recovery in manufacturing and steel production, but longer term expectations are for growth to lag behind the worldwide average, with steel production shifting to less-developed areas. Demand for refractories in iron and steel production is expected to have the strongest gain in the next several years owing to increasing steel production. Growth also is anticipated for refractories needed to produce other metals and in the industrial mineral market because of increasing production of cement, ceramics, glass, and other mineral products.

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

	Mine production		Reserves <sup>4</sup>
	2010	2011 <sup>e</sup>	
United States <sup>e</sup>	93	95	Large
France	65	65	NA
India	25	25	1,400
South Africa	240	270	NA
Other countries	6	8	NA
World total (rounded)	429	460	NA

**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>Production data are as reported in the trade literature.

<sup>2</sup>Source: Industrial Minerals Magazine.

<sup>3</sup>Defined as imports – exports + adjustments for Government and industry stock changes.

<sup>4</sup>[See Appendix C for resource/reserve definitions and information concerning data sources.](#)