KYANITE

By Michael J. Potter

Kyanite, when heated at high temperatures, is converted to mullite. Mullite in refractories and ceramic bodies will increase the fired strength, resistance to deformation under load, thermal resistivity, etc. Also, kyanite expands when calcined and this can offset shrinkage of other ingredients and produce a stable refractory body.[1]

Production

Kyanite was mined at two open-pit locations by Kyanite Mining Corp. in Buckingham County, VA. The company also operated benefication plants and calcining facilities for conversion of kyanite to mullite. High-temperature sintered mullite was produced by C-E Minerals at Americus, GA, and North American Refractories Co. at Greenup, KY. Electric-furnace-fused mullite was produced by Washington Mills Electro Minerals Corp. at Niagara Falls, NY. Data obtained from the kyanite and synthetic mullite producers are not publishable because of company proprietary data.

Consumption

The U.S. Bureau of Mines does not collect data on end uses of kyanite and synthetic mullite. However, refractories were a major end use, including cements/mortars, ramming mixes, and castables. With clay or other ingredients, kyanite is also used in firebrick, insulating brick, and kiln furniture. Finely ground kyanite, in the 200-mesh range, is used in body mixes for sanitary porcelain, wall tile, casting molds, special purpose ceramics, etc.[2]

Foreign Trade

Shipments of U.S. kyanite, mullite, and synthetic mullite were believed to have been made to foreign destinations, including Asia and Europe. Imports of andalusite in recent years have been largely from the Republic of South Africa.

World Review

Capacity.—Rated capacity is defined as the maximum quantity of product that can be produced in a period of time on a normally sustainable long-term operating rate, based on the physical equipment of the plant, and given acceptable routine operating procedures involving labor, energy, materials, and maintenance. Capacity includes both operating plants and plants temporarily closed that, in the judgement of the author, can be brought into production within a short period of time with minimum capital expenditure.

The data in table 3 are estimated rated capacity for marketable product as of December 31, 1994. Actual capacity data were generally not available. For most countries, recent peak production or estimated production was considered to be equal to rated capacity.

Outlook

The iron and steel industry is a major user of refractories in general. Other users are the nonferrous metals, glass, cement, petroleum, and other industries. Advances in steelmaking and other process technology will require new and/or improved refractories because of more severe thermal and/or chemical exposure. There has been an increase in monolithic refractories, i.e., castables, plastics, and gunning mixes, which do not require firing for manufacture. Monolithics now comprise about 50% of the refractories market and are expected to continue to increase.[3]

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[1]Sweet, P. C. Kyanite and Related Minerals. Ch. in Industrial Minerals and Rocks. AIME, 6th ed., 1994, p. 926.

[2]Work cited in footnote 1.

[3]Semler, C. E. Overview of the U.S. Refractories Industry. Ceramic Industry, v. 143, No. 2, Feb. 1994, pp. 33, 35, and 36.

TABLE 1
PRICE OF KYANITE AND RELATED MATERIALS

(Dollars per metric ton)

	1994
Andalusite, transvaal, 57.5% Al_2O_3, 2,000 metric ton bulk, f.o.b.	160 -180
Andalusite, transvaal, 59.5% Al_2O_3, 2,000 metric ton bulk, f.o.b.	180 -200
Kyanite, USA, 54% to 60% Al_2O_3, 35-325 Tyler mesh, 18 ton lots, f.o.b. plant	
Raw	110 -140
Calcined	202 -232
Sillimanite, South African, 70% Al_2O_3, bags, c.i.f. main European port	285

Source: Industrial Minerals (London). Dec. 1994, No. 327, p. 63.

TABLE 2
U.S. IMPORTS 1/ FOR CONSUMPTION
OF ANDALUSITE

Year	Quantity (metric tons)	Value2/ (thousands)
1993	12,200	$2,130
1994	7,900 e/	1,290 e/

e/ Estimated.
1/ Most material is from the Republic of South Africa.
2/ Customs value.

Source: Bureau of the Census.

TABLE 3
WORLD KYANITE AND RELATED MINERALS CAPACITY
DECEMBER 31, 1994
(Thousand metric tons)

	Capacity
North America:	
United States:	
Kyanite	W
Synthetic mullite	W
Total	W
South America:	
Brazil: Kyanite	1 e/
Europe:	
France: Andalusite	60
Germany: Synthetic mullite	15 e/
Spain: Andalusite	5
United Kingdom: Synthetic mullite	10
Other countries	120 e/
Total	210 e/
Africa:	
South Africa, Republic of:	
Andalusite	300 e/
Sillimanite	1 e/
Zimbabwe: Kyanite	2
Total	303 e/
Asia:	
China: Unspecified	3
India:	
Kyanite	30
Sillimanite	15
Total	45
Japan: Synthetic mullite	40 e/
Total	88 e/
Oceania:	
Australia:	
Kyanite	1 e/
Sillimanite	1 e/
Total	2 e/
World total 1/ 2/	600 e/

e/ Estimated. W Withheld to avoid disclosing company proprietary data.
1/ Excludes U.S. kyanite and synthetic mullite.
2/ Data do not add to total shown because of independent rounding.