MICA

By James B. Hedrick

Mica is a group of phyllosilicate minerals that have a layered or platy texture. Phyllo is derived from the Greek word, phyllon, meaning leaf. The commercially important micas are muscovite and phlogopite. Composed of tetrahedral-octahedral-tetrahedral layers, the mica group is characterized by partial substitution of aluminum for silicon in the silicate tetrahedron. This substitution in the laminar structure provides charges to bind interlayer univalent and divalent cations, typically potassium, magnesium, calcium, and sodium. Layering in the univalent (potassium, sodium) or "true" micas imparts perfect basal cleavage, allowing crystals to be split into very thin sheets that are tough and flexible. Layering in the divalent or "brittle" micas also imparts perfect basal cleavage; however, the greater bond strengths make them more brittle and less flexible.

The value of mica is in its unique physical properties. The crystalline structure of mica forms minerals that can be split or delaminated into thin sheets that are platy, flexible, elastic, transparent to opaque, resilient, reflective, refractive, dielectric, chemically inert, insulating, lightweight, and hydrophilic. Mica is also stable when exposed to extreme temperature, electricity, light, and moisture. Muscovite is the principal mica used based on its greater abundance and superior electrical properties. Phlogopite remains stable at higher temperatures and is used in applications where a combination of high heat stability and electrical properties is required. Muscovite and phlogopite are used in both sheet and ground forms.

In 1997, about 114,000 metric tons of scrap and flake mica was produced in the United States, 17.5% more than that in 1996. (*See table 1*.) Ground mica sales were 110,000 tons valued at $37.0 million, an increase in tonnage of 6.8%. Essentially all of the sheet mica used in the United States was imported, primarily from India. Consumption of muscovite block mica increased 23% to 6 tons, valued at $249,000. Consumption of mica splittings decreased from 859 tons in 1996 to 736 tons in 1997. Worked and unworked sheet mica exports increased 28% to 1,070 tons while the value gained 19% to $13.3 million. The value of 5,760 tons of imports of worked and unworked sheet mica increased 11% to $14.6 million.

Legislation and Government Programs

The calendar year 1997 included parts of the U.S. Government fiscal years (October 1 to September 30) 1997 and 1998. Public Law 104-201, the National Defense Authorization Act for Fiscal Year 1997, was enacted on September 23, 1996. It did not change the previous authorizations for disposal of specific mica stocks. The National Defense Authorization Act for Fiscal Year 1998, Public Law 105-85, also known as the "Strategic and Critical Stock Piling Act," was enacted on November 18, 1997. It also did not change the previous authorizations for disposal of specific mica stocks.

Stocks of mica classified as excess to goal at the end of fiscal year 1997 (September 30, 1997) included 929,524 kilograms of muscovite block (stained and better), 15,950 kilograms of muscovite film (1st and 2d qualities), 5,643,135 kilograms of muscovite splittings, and 265,185 kilograms of phlogopite splittings. Phlogopite block in the stockpile is 84,265 kilograms below the goal of 143,570 kilograms. No phlogopite block was purchased during fiscal year 1997. *(See table 2.)*

Production

Domestic mine production data for mica are developed by the U.S. Geological Survey from four separate voluntary surveys. Of the 16 operations to which the *Crude Scrap and Flake Mica* production form was sent (including sericite production), 12 operations responded. Of the 14 operations to which the *Ground Mica* form was sent, 8 operations responded, representing 65% of the domestic ground mica production noted in table 1 (excludes low-grade ground sericite production). Of the five surveyed operations to which the *Mica Block and Film* consumption form was sent, four operations responded. Of the eight surveyed operations to which the *Mica Splittings* consumption form was sent, seven operations responded. Consumption for the nonrespondents was estimated using prior-year production data. Individual company production and consumption data are withheld to avoid disclosing company proprietary data.

The Georgia Industrial Minerals (GIM) company began operation of a placer mica operation in late 1996 in Deep Step, GA, near Sandersville. The mine is the first placer mica operation to operate in the United States. GIM produces dry ground and wet ground mica and byproduct sand and gravel. (Georgia Department of Transportation, accessed March 24, 1998, at URL http://www.dot.state.ga.us/homeoffs/fpmr.www/qpl01.htm).

The mine and plant facilities of Aspect Minerals, Inc., in North Carolina were purchased by Zemex Industrial Minerals, Inc. (ZIM), a wholly owned subsidiary of the Canadian company, Zemex Corp. The sale was completed in January 1998. The acquired properties will be operated under the new ZIM subsidiary, Zemex Mica Corp. (Zemex Corporation, accessed February 17, 1998, at URL http://www.zemex.com/zemex/newsmica.htm).

FMC Corp. planned to close its lithium-feldspar-mica operations at Bessemer City, NC, in 1998. Lower cost foreign lithium deposits were the primary reason for the planned closure. Byproduct mica produced during the processing of the spodumene ore was dry ground at FMC's mica and feldspathic sand plant in Pacolet, SC.

Scrap and Flake Mica.—Ten domestic companies with 13

mines in 5 States produced scrap and flake mica (excluding low-grade sericite) in 1997. The United States was the world's largest producer with 114,000 tons. North Carolina remained the major producing State, with 58% of domestic production. The remainder was produced in Georgia, New Mexico, South Carolina, and South Dakota. Most mica was recovered from mica schist, high-quality sericite schist, weathered pegmatites, and as a coproduct of feldspar, kaolin, and lithium. *(See table 3.)*

The scrap and flake mica producers, in alphabetical order, were Engelhard Corp., Hartwell, GA; The Feldspar Corp., a Zemex Industrial Minerals Company, Spruce Pine, NC; FMC Corp. Lithium Division, Bessemer City, NC; Georgia Industrial Minerals, Deep Step, GA; Franklin Industrial Minerals, a division of Franklin Industries Inc., Kings Mountain, NC and Velarde, NM; K-T Feldspar Corp., Spruce Pine, NC; The Mineral Mining Co., Kershaw, SC; Pacer Corp., Custer, SD; Tinton Enterprises, Spearfish, SD; Unimin Corp., Spruce Pine, NC; and Zemex Mica Corp., a Zemex Industrial Minerals Company, Micaville, NC.

Ground Mica.—Nine companies operated 15 grinding plants in 5 States. Eleven plants produced dry-ground mica and four plants produced wet-ground mica. The four largest ground mica companies, including one company with four plants, accounted for 69% of the total of 110,000 tons. *(See table 4.)*

Dry-ground mica producers, in alphabetical order, were: Asheville Mica Co., Asheville, NC; Georgia Industrial Minerals, Deep Step, GA; Franklin Industrial Minerals, a division of Franklin Industries Inc., Kings Mountain, NC, and Velarde, NM; Mineral Mining Co. Inc., Kershaw, SC; Pacer Corp., Custer, SD; Piedmont Minerals, Hillsborough, NC; Spartan Minerals Corp., a subsidiary of FMC Corp. Lithium Division, Pacolet, SC; USG Corp., Spruce Pine, NC, and Zemex Mica Corp., a Zemex Industrial Minerals Company, Spruce Pine, NC. Wet-ground mica producers, in alphabetical order, were: Engelhard Corp., Hartwell, GA; Georgia Industrial Minerals, Deep Step, GA; KMG Minerals Division of Franklin Industries Inc., Kings Mountain, NC, and Zemex Mica Corp., a Zemex Industrial Minerals Company, Bakersville, NC.

Consumption

Statistics on domestic mica consumption are developed by surveying various processors and manufacturers, evaluating import-export data, and analyzing Government stockpile shipments.

Sheet Mica.—Sheet mica is used principally in the electronic and electrical industries. Its usefulness in these applications is derived from its unique electrical and thermal insulating properties and its mechanical properties, which allow it to be cut, punched, stamped, and machined to close tolerances.

The largest use of block mica is as an electrical insulator in electronic equipment. High-quality mica is also used to line the gauge glasses of high-pressure steam boilers because of its transparency, flexibility, and resistance to heat and chemical attack. Other uses include diaphragms for oxygen-breathing equipment, marker dials for navigation compasses, optical filters, retardation plates in helium-neon lasers, pyrometers, thermal regulators, and stove and kerosene heater windows. Specialized applications for sheet mica are found in ground and air-launched missile systems, optical instrumentation, laser devices, medical electronics for radiation treatment, radar systems, and aerospace components.

Muscovite film mica is used as a dielectric in capacitors. Only high-quality mica is used in this application. The highest grade film is used in capacitors that are manufactured as calibration standards. The next grade down is used in transmitting capacitors. Receiving capacitors use a slightly lower grade of high-quality muscovite.

Consumption of muscovite block (ruby and nonruby) totaled 8,180 kilograms, a 46% increase from that of 1996. Stained and lower-than-stained quality remained in greatest demand, accounting for 94.3% of ruby mica block. Consumption of nonruby mica block was spilt 13% for good quality and 87% for stained quality. The use of block mica in 1997 was higher as demand increased in both electronic and nonelectronic applications.

Five companies continued to consume muscovite block and film in five plants in four States: two in North Carolina and one each in New Jersey, Ohio, and Virginia.

Mica splittings represents the largest part of the sheet mica industry in the United States. Muscovite and phlogopite splittings are used to make built-up mica. Consumption of muscovite and phlogopite splittings decreased 14.3% in 1997 to 736 tons. *(See table 6.)* Muscovite splittings from India accounted for essentially all of the domestic consumption. The remainder of consumption was primarily phlogopite splittings imported from Madagascar. The splittings were fabricated into various built-up mica products by eight companies operating eight plants in seven States.

Built-Up Mica.—Produced by mechanical or hand setting of overlapping splittings and alternate layers of binders and splittings, built-up mica is primarily used as an electrical insulation material. Major products are molding plate, segment plate, flexible plate, tape, heater plate, mica paper, and bonding materials. *(See table 7.)*

Segment plate acts as insulation between the copper commutator segments of direct-current universal motors and generators. Phlogopite built-up mica is preferred because it will wear at the same rate as the copper segments. Muscovite has a greater resistance to wear, causing uneven ridges that may interfere with the operation of a motor or generator. Consumption of segment plate was 133 tons in 1997, 23% lower than in 1996.

Molding plate is sheet from which V-rings are cut and stamped for use in insulating the copper segments from the steel shaft ends at the end of a commutator. Molding plate is also fabricated into tubes and rings for insulation in transformers, armatures, and motor starters. Consumption of molding plate decreased 2% from 179 tons in 1996 to 176 tons in 1997.

Flexible plate is used in electric motor and generator armatures, field coil insulation, and magnet and commutator core insulation. Mica consumption in flexible plate decreased from 123 tons in 1996 to 110 tons in 1997.

Heater plate is used where high-temperature insulation is required. Consumption of mica in heater plate decreased in 1997.

Some types of built-up mica have the bonded splittings reinforced with special paper, silk, linen, muslin, glass, cloth, or plastic. These products are very flexible and are produced in

wide, continuous sheets that are either shipped rolled or cut into ribbons, tapes, or trimmed to specified dimensions. Built-up mica products are also corrugated or reinforced by multiple layering.

The total amount of built-up mica that was consumed or shipped was 567 tons, a decrease of 10% from the 1996 level. Segment plate and molding plate were the major end products and accounted for 23% and 31% of the total, respectively.

Reconstituted Mica (Mica Paper).—Primary uses for mica paper are the same as those for built-up mica. Three companies consumed scrap mica to produce mica paper. The principal source of the scrap was India. Manufacturing companies in 1997 were: Corona Films Inc., West Townsend, MA; General Electric Co., Coshocton, OH; and U.S. Samica Corp., Rutland, VT.

Ground Mica.—The largest domestic use of dry ground mica was in joint compound for filling and finishing seams and blemishes in gypsum wall board (drywall). The mica acts as a filler and extender, provides a smooth consistency, improves the workability of the compound, and imparts resistance to cracking. Joint compound accounted for 51.3% of dry-ground mica consumption.

In the paint industry, ground mica is used as a pigment extender that also facilitates suspension, reduces chalking, prevents shrinking and shearing of the paint film, increases resistance of the paint film to water penetration and weathering, and brightens the tone of colored pigments. Mica also promotes paint adhesion in both aqueous and oleoresinous formulations. Consumption of dry-ground mica in paint, its second largest use, accounted for 24.3% of the 1997 total.

Ground mica is used in the well-drilling industry as an additive to drilling muds. The coarsely ground mica flakes help prevent loss of circulation by sealing porous sections of the drill hole.

The rubber industry uses ground mica as an inert filler and as a mold release compound in the manufacture of molded rubber products such as tires and roofing. The platy texture acts as an antiblocking, antisticking agent. Rubber mold lubricant accounted for 3.3% of dry-ground mica use in 1997.

The plastics industry uses dry-ground mica as an extender and filler, especially in parts for automobiles for lightweight insulation to suppress sound and vibration. Mica is used in plastic automobile fascia and fenders as a reinforcing material, providing improved mechanical properties, increased strength, stiffness, and dimensional stability. Mica-reinforced plastics also have high-heat dimensional stability, reduced warpage, and the best surface properties of any filled plastic composite. Consumption of dry-ground mica in plastic applications accounted for 3.1% of the market in 1997, slightly lower than the 3.5% in 1996.

Ground mica is used in the production of rolled roofing and asphalt shingles, where it serves as a surface coating to prevent sticking of adjacent surfaces. The coating is not absorbed by freshly manufactured roofing because mica's platy structure is unaffected by the acid in asphalt or by weathering conditions. As a rubber additive, mica reduces gas permeation and improves resiliency.

Other uses include decorative coatings on wallpaper, concrete, stucco, and tile surfaces. It is also used as an ingredient in some special greases, as a flux coating on welding rods, and in foundry applications as coatings for core and mold release compounds, mold washes, and facing agents.

Stocks

Government stocks of mica in the National Defense Stockpile (NDS) are comprised of stockpile-grade muscovite block, stained and better; muscovite film, first and second quality; muscovite splittings; phlogopite block; and phlogopite splittings. NDS stocks of muscovite block, muscovite film, and muscovite and phlogopite splittings were available for sale from the Defense National Stockpile Center, Fort Belvoir, VA. Yearend 1997 stocks of various types of mica in the NDS are shown in table 2.

Reported yearend industry stocks of muscovite mica block (ruby and nonruby) decreased slightly from 21.5 tons in 1996 to 21.2 tons in 1997. Industry stocks of muscovite and phlogopite mica splittings increased from 416 tons at yearend 1996 to 445 tons at yearend 1997. *(See table 6.)*

Prices

Sheet mica prices vary with grade and can range from less than $1 per kilogram for low-quality mica to more than $2,000 per kilogram for the highest quality. The average values of muscovite sheet mica consumed in the United States in 1997 compared with 1996 were as follows: block (ruby and nonruby) decreased 47% to $41 per kilogram and muscovite splittings decreased 7% to $1.51 per kilogram. *(See table 2.)*

The average value of phlogopite block decreased from $19.84 per kilogram in 1996 to $18.51 per kilogram in 1997. The average value of phlogopite splittings increased from $4.40 per kilogram in 1996 to $4.96 per kilogram in 1997.

The average U.S. value of crude flake mica, including high-quality sericite, increased to $83 per ton. The average value for North Carolina flake mica increased to $79 per ton in 1997. In 1997, the value of dry-ground mica decreased slightly to average $176 per ton while wet-ground mica increased to average $1,080 per ton.

World Review

Demand increased for mica in the United States and in foreign markets in 1997. Foreign trade increased with the value of U.S. exports of mica increasing 20.3% to $17.8 million as the quantity increased 10% to 9,210 tons. Imports of mica also increased with the value of U.S. imports of mica, increasing 10.4% in value to $24.9 million and the quantity increasing 16.9% to 29,000 tons. *(See table 13.)*

Domestic ground mica imports increased to 6,310 tons, up 480 tons from the 1996 level. Exports of crude and rifted mica increased, up 9.8% to 1,532 tons. *(See table 8.)* Exports of worked mica sheet in 1997 declined 6.8% to 564 tons. *(See table 9.)* The value of U.S. exports of worked mica sheet increased to $11.7 million, 9.8% higher than that in 1996.

The United States continued to rely on imports, primarily from India, for essentially all of its supply of sheet mica and paper-quality scrap mica. Imports for consumption of unmanufactured split block, film, splitting, and mica sheet catagorized as other, were about 4,080 tons, 19.9% less than that in 1996. *(See table*

10.)

About 13,000 tons of ground mica was imported in 1997, mostly from Canada. *(See table 11.)* Worked mica imports were 41% higher than those in 1996, at 1,541 tons. *(See table 12.)*

Canada.—Zemex Corp. (Toronto) acquired the mica operations of Aspect Minerals, Inc., in North Carolina, for around $2.2 million plus the assumption of current debt. Zemex Corp.'s wholly owned subsidiary, ZIM announced on January 28, 1998, it would operate the mine and processing plants under the name Zemex Mica Corp. ZIM already operated three other companies including The Feldspar Corp., Suzorite Minerals Products Inc., and Suzorite Mica Products Inc. (Zemex Corp., accessed February 17, 1998, at URL http://www.zemex.com/ zemex/newsmica.htm).

Finland.—Kemira Pigments Oy announced it would sell its pearlescent pigments (mica based) operations to German corporation Eckart-Werke GmbH & Co. Eckart-Werke established the Finnish company, Eckart Pigments Oy, to operate the plant at Pori. All Kemira employees at the plant were to be transferred to the new company. (News, Kemira Today, accessed May 5, 1998, at URL http://www.kemira.com/news/news43.htm).

Outlook

The outlook for mica is for average production growth of 3% to 5% annually based on various economic factors. The major markets for ground mica, joint compounds and paints, are mature and relatively stable, and growth is tied to new housing starts and interest rates. To a lesser extent, widespread natural disasters also affect the market, creating immediate demand for residential building materials. Demand is also responsive to automobile production because interior and exterior parts typically contain dry-ground mica, while exterior surfaces are painted with wet-ground pearlescent pigments and mica-containing coatings.

In 1998 and 1999, domestic demand for crude and ground mica is expected to remain stable. Demand for dry- and wet-ground micas is expected to improve in the short term to meet increasing demand for pearlescent paints and cosmetics. Markets for dry-ground mica are forecast to grow 5% per year through the year 2000, unless interest rates and prices rise sufficiently to slow demand for new housing and automobiles. Wet-ground mica is also expected to show moderate growth as demand from the cyclical automotive industry utilizes increasing amounts of pearlescent paint pigments.

Demand for block mica is expected to grow slowly through the end of the century as demand increases in a few specialty markets. A shortage of high-quality block mica is expected to continue because of the generally low percentage of high-quality mica in currently mined deposits (pegmatites).

Consumption of mica splittings, the major type of sheet mica consumed in the United States, decreased sharply throughout the 1960's and 1970's and leveled off in the 1980's and 1990's in the range of 800 to 1,000 tons per year. With no new uses and many substitute materials, no substantial growth is expected. Consumption of mica splittings is expected to remain in the range of 600 to 900 tons.

SOURCES OF INFORMATION

U.S. Geological Survey Publications

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Mica (natural), scrap and flake. Ch. in Mineral Commodity Summaries, annual.[1]

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Other

Mica. Ch. in Mineral facts and problems, U.S. Bureau of Mines Bulletin 675, 1985.

Roskill Information Service Ltd. (London). The Economics of Mica, 7th edition, 1991.

[1]Prior to January 1996, published by the U.S. Bureau of Mines.

TABLE 1
SALIENT MICA STATISTICS 1/

		1993	1994	1995	1996	1997
United States:						
Production (sold or used by producers):						
Scrap and flake mica	thousand metric tons	88	109	108	97	114
Value	thousands	$4,450	$5,780	$5,630	$7,820	$9,400
Ground mica	thousand metric tons	92	95	98	103	110
Value	thousands	$27,000	$28,700	$24,800	$33,600	$37,000
Prices, dollars per metric ton:						
Scrap and flake mica		$51	$53	$52	$81	$83
Ground:						
Wet		$838	$1,010	$974 r/	$1,030 r/	$1,080
Dry		$152	$151	$174 r/	$182	$176
Sheets, dollars per kilogram:						
Block		$95	$66 r/	$73 r/	$77	$41
Splittings		$1.55	$1.72 r/	$1.86 r/	$1.75	$1.69
Consumption:						
Block, muscovite	metric tons	5	6	6 r/	6 r/	8
Value	thousands	$509	$432	$407	$383	$249
Splittings	metric tons	826	857	713	859	736
Value	thousands	$1,390	$1,470	$1,320	$1,510	$1,240
Exports	metric tons	5,860	7,520	8,160	8,380	9,210
Imports	do.	22,200	25,200	26,200	24,700	28,900
World: Production	do.	301,000 r/	318,000 r/	327,000 r/	302,000 r/	315,000 e/

e/ Estimated. r/ Revised.
1/ Data are rounded to three significant digits.

TABLE 2
STOCKPILE STATUS AND GOVERNMENT INVENTORIES FOR MICA, DECEMBER 31, 1997 1/

(Metric tons)

	Inventory (uncommitted)			Fiscal year 1996 sales
Material	Stockpile grade	Nonstockpile grade	Available for disposal	
Block:				
Muscovite, stained and better	989	12	930	270
Phlogopite	8	52	--	--
Film: Muscovite, 1st and 2d qualities	15	--	15	32
Splittings:				
Muscovite	5,640	--	5,640	41
Phlogopite	265	--	265	46

1/ Data are rounded to three significant digits.

TABLE 3
SCRAP AND FLAKE MICA SOLD OR USED BY PRODUCERS IN THE UNITED STATES, BY STATE 1/ 2/

(Thousand metric tons and thousand dollars)

	1996		1997	
State	Quantity	Value	Quantity	Value
North Carolina	62	4,900	66	5,210
Other States 3/	35	2,920	48	4,190
Total	97	7,820	114	9,400

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes finely divided mica recovered from mica schist and high-quality sericite schist, and mica that is a byproduct of feldspar, kaolin, and lithium beneficiation.
3/ Includes Georgia, New Mexico, South Carolina, and South Dakota.

TABLE 4
GROUND MICA SOLD OR USED BY PRODUCERS IN THE UNITED STATES,
BY END USE AND METHOD OF GRINDING 1/ 2/

	1996			1997		
	Quantity (thousand metric tons)	Value (thousand dollars)	Unit value	Quantity (thousand metric tons)	Value (thousand dollars)	Unit value
End use:						
Joint cement	52	8,610	$165	47	7,880	$168
Paint	21	8,850	421	38	21,900	576
Plastics	3	1,970	656	4	1,820	455
Well-drilling mud	4	815	203	3	757	252
Other 3/	23	13,400	581	19	4,690	247
Total	103	33,600	326	110	37,000	337
Method of grinding:						
Dry	W	W	165	W	W	160
Wet	W	W	936	W	W	980

W Withheld to avoid disclosing company proprietary data.
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Domestic and some imported scrap. Low-quality sericite is not included.
3/ Includes mica used for molded electrical insulation, roofing, rubber, textile and decorative coatings, welding rods, and miscellaneous.

TABLE 5
FABRICATION OF MUSCOVITE BLOCK MICA
IN THE UNITED STATES, BY QUALITY 1/

(Metric tons)

Quantity	1996	1997
Good stained or better	0.590	0.540
Stained or lower 2/	4.490	6.890
Total	5.070	7.420

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Includes punch mica.

TABLE 6
CONSUMPTION AND STOCKS OF MICA SPLITTINGS IN
THE UNITED STATES 1/

	Consumption		Stocks on Dec. 31
Year	Quantity (metric tons)	Value (thousands)	(metric tons)
1996	859	$1,510	416
1997	736	1,240	445

1/ Data are rounded to three significant digits.

TABLE 7
BUILT-UP MICA SOLD OR USED IN THE UNITED STATES, BY PRODUCT 1/ 2/

	1996		1997	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
Flexible (cold)	123	$1,020	110	$646
Heater plate	W	W	W	W
Molding plate	179	1,710	176	1,490
Segment plate	172	1,990	133	1,270
Tape	W	W	W	W
Other	126	972	130	1,940
Total	633	6,110	567	5,540

W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Consists of alternating layers of binder and irregularly arranged and partly overlapped splittings.

TABLE 8
U.S. EXPORTS OF CRUDE AND RIFTED MICA, MICA POWDER, AND WASTE IN 1997, BY COUNTRY 1/

Country	Crude and rifted: Less than $0.55 per kilogram		Crude and rifted: More than $0.55 per kilogram		Powder		Waste	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
Argentina	--	--	--	--	6	$3	--	--
Australia	24	$8	1	$17	196	141	--	--
Bahrain	--	--	--	--	2	9	--	--
Belgium	22	11	--	--	60	75	--	--
Brazil	14	4	--	--	--	--	--	--
Bristish Virgin Islands	--	--	--	--	--	--	4	$3
Canada	--	--	--	--	3,050	1,080	681	158
Chile	--	--	--	--	96	59	--	--
China	--	--	11	7	--	--	--	--
Colombia	--	--	--	--	62	37	(2/)	4
Cote d'Ivoire	--	--	--	--	40	31	--	--
Ecuador	--	--	--	--	16	9	--	--
France	--	--	--	3	(2/)	4	--	--
Germany	212	28	--	--	129	89	2	4
Hong Kong	36	13	1	13	185	120	--	--
India	--	--	150	212	8	5	99	45
Indonesia	56	22	1	25	26	19	--	--
Ireland	--	--	--	--	16	4	--	--
Italy	18	6	--	--	144	30	--	--
Japan	21	7	88	465	423	282	--	--
Kenya	--	--	--	--	5	4	--	--
Korea, Republic of	108	22	20	11	176	206	--	--
Malaysia	--	--	--	--	92	27	--	--
Mexico	62	16	3	25	617	313	--	--
Netherlands	89	47	23	58	79	182	21	6
New Zealand	--	--	--	--	437	104	--	--
Parkistan	--	--	--	--	23	21	--	--
Peru	--	--	--	--	14	12	--	--
Philippines	280	45	5	97	5	11	--	--
Poland	20	5	--	--	--	--	--	--
Saudi Arabia	--	--	--	--	17	9	--	--
Singapore	--	--	--	--	2	13	--	--
Spain	30	11	--	5	--	--	--	--
Sweden	--	--	--	--	21	13	--	--
Taiwan	9	3	5	99	67	42	--	--
Thailand	--	--	--	--	39	28	--	--
United Arab Emirates	--	--	--	--	17	11	--	--
United Kingdom	14	5	205	612	97	105	(2/)	3
Uruguay	--	--	--	--	5	6	--	--
Venezuela	--	--	--	--	147	913	--	--
Total	1,020	254	512	1,650	6,310	4,010	808	217

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Less than 1/2 unit.

Source: Bureau of the Census.

TABLE 9
U.S. EXPORTS OF WORKED MICA IN 1997, BY COUNTRY 1/

Country	Plates, sheets		Other	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
Argentina	16	$57	--	--
Aruba	--	--	1	$4
Australia	9	214	(2/)	25
Bahamas, The	4	22	2	24
Barbados	3	36	(2/)	6
Belgium	20	417	1	25
Brazil	29	365	2	76
Canada	150	3,780	75	1,710
Chile	(2/)	3	(2/)	9
China	1	15	1	31
Colombia	3	35	--	--
Costa Rica	25	98	(2/)	4
Czech Republic	6	18	--	--
Denmark	--	--	(2/)	3
Dominican Republic	(2/)	3	--	--
France	6	101	2	39
Germany	12	141	(2/)	24
Greece	3	10	--	--
Guadeloupe	--	--	2	6
Guatemala	13	68	(2/)	4
Honduras	2	17	2	37
Hong Kong	--	--	2	112
India	(2/)	10	2	143
Israel	2	25	2	22
Italy	14	348	1	17
Japan	(2/)	4	5	69
Korea, Republic of	(2/)	5	8	110
Kuwait	--	--	(2/)	7
Malaysia	1	3	(2/)	12
Mexico	48	1,100	31	1,490
Netherlands	--	--	(2/)	17
Netherlands Antilles	--	--	3	15
New Zealand	--	--	(2/)	3
Norway	--	--	(2/)	5
Panama	--	--	(2/)	9
Peru	2	14	--	--
Philippines	--	--	2	9
Poland	--	--	(2/)	12
Qatar	--	--	(2/)	12
Saudi Arabia	9	61	--	--
Singapore	8	27	(2/)	28
South Africa	1	23	(2/)	9
Spain	(2/)	5	(2/)	32
St. Lucia	--	--	(2/)	4
Suriname	2	6	--	--
Switzerland	8	218	4	96
Taiwan	2	45	1	28
Thailand	2	12	(2/)	3
Trinidad and Tobago	4	12	--	--
United Kingdom	1	20	6	88
Vietnam	--	--	(2/)	3
Total 2/	406	7,330	159	4,380

1/ Data are rounded to three significant digits; may add to totals shown.
2/ Less than 1/2 unit.

Source: Bureau of the Census.

TABLE 10
U.S. IMPORTS FOR CONSUMPTION OF CRUDE AND RIFTED MICA IN 1997, BY COUNTRY 1/

Country	Split block		Splittings		Other			
					Less than $0.55 per kilogram		More than $0.55 per kilogram	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
China	--	--	--	--	20	$2	125	$284
Czech Republic	--	--	--	--	--	--	2	23
Finland	--	--	--	--	1,190	276	--	--
France	--	--	9	$42	--	--	--	--
Germany	--	--	1,080	267	--	--	2	20
Hong Kong	--	--	18	12	--	--	--	--
India	47	$70	2,910	1,460	8,140	1,570	2	24
Japan	--	--	--	--	--	--	2	23
Madagascar	--	--	23	85	--	--	--	--
Turkey	--	--	--	--	--	--	(2/)	3
United Kingdom	--	--	--	--	--	--	(2/)	2
Total	47	70	4,040	1,870	9,350	1,850	134	378

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Less than 1/2 unit.

Source: Bureau of the Census.

TABLE 11
U.S. IMPORTS FOR CONSUMPTION OF MICA POWDER AND WASTE IN 1997, BY COUNTRY 1/

Country	Powder		Waste	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
Australia	20	$6	--	--
Austria	1	2	--	--
Canada	12,400	5,060	33	$7
China	34	11	--	--
Finland	(2/)	10	--	--
Germany	48	211	--	--
India	28	14	792	405
Italy	(2/)	1	--	--
Japan	272	2,350	--	--
Malaysia	107	359	--	--
United Kingdom	14	48	--	--
Total	13,000	8,080	825	412

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Less than 1/2 unit.

Source: Bureau of the Census.

TABLE 12
U.S. IMPORTS FOR CONSUMPTION OF WORKED MICA IN 1997
BY COUNTRY 1/

Country	Plates, sheets		Other	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
Australia	(2/)	$3	9	$213
Belgium	695	5,950	--	--
Brazil	72	542	160	440
Canada	13	94	(2/)	13
China	138	348	16	94
Czech Republic	--	--	6	50
France	18	139	1	25
Germany	(2/)	9	3	122
Hong Kong	2	8	9	46
India	101	905	151	1,110
Italy	2	10		3
Japan	13	200	22	358
Korea, Republic of	10	57	15	28
Philippines	--	--	(2/)	2
Russia	--	--	(2/)	2
Singapore	--	--	1	2
Sweden	--	--	16	18
Switzerland	57	1,270	1	30
Taiwan	1	14	--	--
United Kingdom	5	149	(2/)	6
Total	1,130	9,700	411	2,560

1/ Data are rounded to three significant digits; may not add to totals shown.
2/ Less than 1/2 unit.

Source: Bureau of the Census.

TABLE 13
SUMMATION OF U.S. MICA TRADE DATA 1/

	Scrap and flake mica				Sheet mica			
	Powder		Waste		Unworked		Worked	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
Exports:								
1996	5,830	$3,070	1,710	$495	225	$542	606	$10,700
1997	6,310	4,010	1,820	471	512	1,650	565	11,700
Imports for consumption:								
1996	13,600	8,250	4,840	1,230	5,240	2,310	1,090	10,800
1997	13,000	8,080	10,200	2,260	4,220	2,310	1,540	12,300

1/ Data are rounded to three significant digits.

Source: Bureau of the Census.

TABLE 14
MICA: WORLD PRODUCTION, BY COUNTRY 1/ 2/

(Metric tons)

Country 3/	1993	1994	1995	1996	1997 e/
Argentina:					
Sheet	720	720 e/	700 e/	297 r/	300
Waste, scrap, etc.	1,226	1,104	4,341	1,840 r/	1,900
Brazil	7,000	6,700 r/	5,200 r/	7,000	7,000
Canada e/	17,500	17,500	17,500	17,500	17,500
Finland	4,488	5,591	--	--	--
France e/	8,000	8,000	10,000	8,000	8,000
India:					
Crude	2,082	2,055	1,728 r/	1,894 r/	2,000
Scrap and waste	1,187	719	1,013 r/	1,413 r/	1,400
Total	3,269	2,774	2,741 r/	3,307 r/	3,400
Iran e/ 5/	8,000	8,000	8,000	8,000	8,000
Korea, Republic of (all grades)	7,500 e/	37,470	43,709 r/	35,923	34,489 4/
Madagascar (phlogopite) e/	774	774	432 4/	450	450
Malaysia	4,659	4,993	5,848	5,501	5,708 4/
Mexico (all grades)	6,440	5,753	5,028	4,273 r/	975 p/
Morocco e/	1,500	1,500	1,500	1,500	1,500
Peru e/	100	100	100	100	100
Russia e/	129,000 r/ 4/	100,000 r/	100,000 r/	100,000 r/	100,000
Serbia and Montenegro	68	158	199	200 e/	200
South Africa (scrap)	1,991	1,973	2,137	1,429	1,482 4/
Spain e/	250	200	200	200	200
Sri Lanka (scrap) e/	200	200	200	200	200
Taiwan	9,751	5,220	9,792	8,510 r/	8,600
United States (scrap and flake) 6/	87,900	109,000	108,000	96,600	114,000 4/
Zimbabwe	510 r/	213 e/	1,040	1,500 r/ e/	1,000
Grand total	301,000 r/	318,000 r/	327,000 r/	302,000 r/	315,000

e/ Estimated. p/ Preliminary. r/ Revised.

1/ World data, U.S. data, and estimated data are rounded to three significant digits; may not add to totals shown.

2/ Table includes data available through July 22, 1998.

3/ In addition to the countries listed, China, Norway, Pakistan, Romania, and Sweden are known to produce mica, but available information is inadequate to make reliable estimates of output levels.

4/ Reported figure.

5/ Year beginning March 21 of that stated.

6/ Excludes U.S. production of low-quality sericite and sheet mica, if any.