

MICA

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The mica group represents 37 phyllosilicate minerals that have a layered or platy texture (Rieder and others, 1998). Phyllo is derived from the Greek word “phyllo,” which means leaf. The commercially important micas are muscovite and phlogopite, which are used in a variety of applications.

In 2003, about 78,600 metric tons (t) of scrap and flake mica was produced in the United States; this was 3.0% less than that of 2002 (tables 1, 3). Ground mica sales totaled 94,100 t valued at \$28.6 million, a decrease in quantity and overall value compared with 2002, but a \$2 per metric ton increase in unit value (tables 1, 4). Essentially all sheet mica used in the United States was imported; India was the major supplier (table 10). Consumption of muscovite block mica decreased to 1.84 t valued at \$120,000 in 2003 from 2.08 t valued at \$134,000 in 2002 (tables 1, 5). Consumption of mica splittings increased to 669 t in 2003 from 573 t in 2002. Worked and unworked sheet mica exports increased to 855 t in 2003 from 723 t in 2002, and the value decreased to \$12.4 million in 2003 from \$12.5 million in 2002 (table 13). U.S. imports of worked and unworked sheet mica decreased to 1,130 t in 2003 from 1,580 t in 2002, and the value increased to \$11.5 million in 2003 from \$10.2 million in 2002.

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

The mica group minerals, which comprise tetrahedral-octahedral-tetrahedral layers, are 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 calcium, magnesium, potassium, and sodium. Layering in the univalent (potassium and sodium), or true, micas imparts perfect basal cleavage, which allows crystals to be split into very thin sheets that are tough and flexible. Layering in the divalent, or brittle, micas also results in perfect basal cleavage; the greater bond strengths, however, make them more brittle and less flexible.

Legislation and Government Programs

The Bob Stump National Defense Authorization Act for Fiscal Year 2003 (Public Law 107-314) was enacted on December 2, 2002. The revised Annual Material Plan for Fiscal Year

2003 authorized the disposal of 22,880 kilograms (kg) (50,441 pounds) of mica (all types) from the National Defense Stockpile (NDS) classified as excess to goal. Stocks of mica classified as excess to goal at the end of fiscal year (FY) 2002 were all subject to no disposal limits. Excess FY 2002 NDS mica stocks were 10,144 kg (22,363 pounds) of muscovite block (stained and better), 506 kg (1,115 pounds) of muscovite film (first and second qualities), and 12,230 kg (26,963 pounds) of phlogopite splittings (table 2).

The National Defense Authorization Act for Fiscal Year 2004 (Public Law 108-136) was enacted on November 24, 2003. The revised Annual Material Plan for Fiscal Year 2004 authorized the disposal of the remaining inventory of mica (all types) from the NDS classified as excess to goal. Stocks of mica classified as excess to goal at the end of FY 2003 were all subject to no disposal limits. Excess FY 2004 NDS mica stocks authorized for disposal were 7,113 kg (15,681 pounds) of muscovite block (stained and better), 506 kg (1,115 pounds) of muscovite film (first and second qualities), 1,290,776 kg (2,845,673 pounds) of muscovite splittings that have all been sold (committed inventory), and 12,226 kg (26,954 pounds) of phlogopite splittings. All remaining NDS stocks of phlogopite block were shipped in FY 2003 (table 2).

Production

Domestic mine production data for mica are developed by the U.S. Geological Survey from four separate voluntary surveys. Of the 17 operations to which the “Crude Scrap and Flake Mica Production” form (including sericite production) was sent, 12 operations responded. Of the 14 operations to which the “Ground Mica” form was sent, 9 operations responded (excludes low-grade ground sericite production). Of the six surveyed operations to which the “Mica Block and Film Consumption” form was sent, four operations responded. Of the nine surveyed operations to which the “Mica Splittings Consumption” form was sent, four operations responded. Consumption for the nonrespondents was estimated by using prior-year production data. Individual company production and consumption data are withheld to avoid disclosing company proprietary data.

Georgia Industrial Minerals, Inc. announced reserves of greater than 500,000 short tons (454,000 t) from its sedimentary deposit in the coastal plain of Georgia. The micaceous deposits are located in sands and clays of late Cretaceous age and contain 2% to 25% mica. Leaching by groundwater allowed the placer deposits to form a high-quality, high-brightness mica that is easily delaminated (Georgia Industrial Minerals, Inc., undated¹).

¹References that include a section mark (§) are found in the Internet References Cited section.

AZCO Mining Inc. announced that it began trading on the Over-The-Counter BB after it voluntarily delisted from the American Stock Exchange. In June, the company completed the first commercial sale of its engineered mica-filled plastic pellets to the automotive industry. Since acquiring the Black Canyon mica deposit in 1999, AZCO has installed mining and beneficiation facilities at Black Canyon, AZ, and processing and storage facilities at Glendale, AZ. AZCO last mined in 2002, producing both mica and feldspathic sand. AZCO sold all its feldspathic sand in 2002 and has been selling mica products during the past 2 years (AZCO Mining Inc., 2003).

Delphi Corporation was awarded the “2003 Most Innovative Use of Plastic” award for automotive interiors by the Society of Plastics Engineers. The material is an innovative fiberglass and mica-reinforced polypropylene that may replace conventional fiberglass-reinforced styrene maleic anhydride. Benefits of the material are its cost savings, improved recyclability, no change required for tooling, low-noise emission, and sound absorption. The mica-containing material is implemented in General Motors Corp. dashboards in full-sized pickups and sport utility vehicles (Delphi Corporation, 2003).

Zemex Corporation of Canada was acquired by Cementos Pacasmayo S.A.A. of Peru in March. Zemex announced the sale of its assets, including the mica holdings of Zemex Industrial Minerals, Inc. (ZIM) and the Suzorite Mica Products phlogopite mine and plant in Canada. Pacasmayo purchased Zemex for \$8.80 per share; the deal included the assumption of Zemex’s current debt. The total purchase cost, including the debt, was about \$100 million. The purchase was expected to be completed in 2003 (Zemex Corporation, 2003).

In September, Oglebay Norton Specialty Minerals, Inc. (a subsidiary of Oglebay Norton Company) announced that it planned to sell its lime and mica operations to reduce long-term debt. Oglebay Norton is the leading mica producer in the United States with mica operations at Kings Mountain, NC, and Velarde, NM. The mica operations have reportedly contributed \$15 million in sales annually during the past several years and have provided \$2.3 million in earnings before interest, taxes, depreciation, and amortization (Oglebay Norton Company, 2003§).

The mica paper operations of US Samica Corp. in Rutland, VT, were purchased by the Isovolta Group (a subsidiary of Isovolta AG of Austria) in September. The company will be marketing products as Isovolta Inc./US Samica Corp. and will continue to produce reconstituted mica paper and high dielectric mica tapes and wrappers. The company also custom designs and manufactures mica specialty products (Isovolta Inc./US Samica Corp., undated§).

Scrap and Flake Mica.—In 2003, seven domestic companies with eight mines in five States produced scrap and flake mica, which excluded low-grade sericite. The United States was one of the world’s primary producers with production of 78,600 t (tables 1, 3, 14). North Carolina remained the major producing State with 50% of domestic production, and the remainder was produced in Georgia, New Mexico, South Carolina, and South Dakota. Mica was recovered from mica schist, high-quality sericite schist, weathered pegmatites, a gemstone pegmatite, and as a coproduct of feldspar and kaolin mining and processing operations. Mining, which was suspended at Velarde, NM, throughout 2002, resumed in 2003.

The scrap and flake mica producers in 2003 were Engelhard Corp., Hartwell, GA; The Feldspar Corporation (a ZIM company) (two mines), Spruce Pine, NC; Georgia Industrial Minerals, Deep Step, GA; K-T Feldspar Corp., Spruce Pine, NC; The Mineral Mining Co. Inc., Kershaw, SC; Oglebay Norton, Kings Mountain, NC; Pacer Corp., Custer, SD; and Unimin Corp., Spruce Pine, NC.

Ground Mica.—In 2003, 8 companies operated 12 grinding plants in 5 States; 9 plants produced dry-ground mica, and 3, wet-ground mica. The four leading ground-mica companies, which included one company with four plants, accounted for 67% of the total of 94,100 t of ground mica produced in the United States (table 4).

Dry-ground mica producers were Asheville Mica Co., Asheville, NC; Georgia Industrial Minerals, Deepstep, GA; K-T Feldspar, Spruce Pine, NC; The Mineral Mining Co., Kershaw, SC; Oglebay Norton (two plants), Kings Mountain, NC, and Velarde, NM; Pacer, Custer, SD; Piedmont Minerals Corp., Hillsborough, NC; and United States Gypsum Co. (a subsidiary of USG Corp.), Spruce Pine, NC.

Wet-ground mica producers, in alphabetical order, were Engelhard, Hartwell, GA; Georgia Industrial Minerals, Sandersville, GA; and Oglebay Norton Specialty Minerals, Kings Mountain, NC.

Sheet Mica.—Small quantities of muscovite sheet and scrap mica were produced as a byproduct by Morefield Gem Mine, Inc. in Amelia County, VA. The pegmatite was mined primarily for gemstones and mineral specimens using underground methods. The mine also produced biotite and zinnwaldite mica.

Consumption

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

Only high-quality muscovite film mica, which is variously called India ruby mica or ruby muscovite mica, is used as a dielectric in capacitors. The highest quality film is used to manufacture capacitors for calibration standards. The next lower grade is used in transmitting capacitors. Receiving capacitors use a slightly lower grade of high-quality muscovite.

In 2003, consumption of ruby and nonruby muscovite block totaled 1.84 t, a decrease from the 2.08 t consumed in 2002 (table 5). Stained and lower-than-stained quality remained in greatest demand and accounted for about 73% of consumption

of ruby and nonruby mica block. Consumption of nonruby mica block was 61% for stained and lower-than-stained quality and 39% for good quality.

In 2003, five companies consumed muscovite block and film in five plants in four States—two in North Carolina and one each in New Jersey, Ohio, and Virginia.

In 2003, mica splittings represented the largest part of the sheet mica industry in the United States. Consumption of muscovite and phlogopite splittings increased by almost 17% to 669 t in 2003 from 573 t in 2002 (table 6). Muscovite splittings from India accounted for essentially all domestic consumption. The remainder of consumption was primarily phlogopite splittings imported from Madagascar. Muscovite and phlogopite splittings were fabricated into various built-up mica products by nine companies that operated nine plants in seven States.

Built-Up Mica.—Produced by mechanized 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 bonding materials; flexible, heater, molding, and segment plates; mica paper; and tape (table 7).

Flexible plate (cold) is used in electric motor and generator armatures, field coil insulation, and magnet and commutator core insulation. Mica consumption in flexible plate in 2003 was essentially unchanged from 2002 at 73 t (table 7).

Heater plate is used where high-temperature insulation is required. Consumption of mica in heater plate is withheld to avoid disclosing company proprietary information. Consumption of heater plate mica increased in 2003 compared with that of 2002.

Molding plate is sheet mica 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 also is fabricated into tubes and rings for insulation in transformers, armatures, and motor starters. Consumption of molding plate decreased to 185 t in 2003 compared with 194 t in 2002.

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. Although muscovite has a greater resistance to wear, it causes uneven ridges that may interfere with the operation of a motor or generator. Consumption of segment plate was 220 t in 2003.

Some types of built-up mica have the bonded splittings reinforced with cloth, glass, linen, muslin, plastic, silk, or special paper. 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 also are corrugated or reinforced by multiple layering.

The total amount of built-up mica that was consumed or shipped was 559 t; this was an increase of 58% compared with the 354 t in 2002. In 2003, molding plate and segment plate were the major end products and accounted for 33% and 39% of the total, respectively.

Mica Paper (Reconstituted Mica).—Primary uses for mica paper are the same as those for built-up mica. Three companies consumed scrap mica to produce mica paper for electrical applications. The principal source of the scrap was India. In

2003, the manufacturing companies were Asheville-Schoonmaker Mica Co., Newport News, VA; Corona Films Inc., West Townsend, MA; and Isovolta Inc./US Samica Corp., Rutland, VT.

Ground Mica.—The leading domestic use of dry-ground mica was in joint compound for filling and finishing seams and blemishes in gypsum wallboard (drywall) (table 4). The mica acts as a filler and extender, provides a smooth consistency, improves the workability of the compound, and provides resistance to cracking. In 2003, joint compound accounted for 65% 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 aqueous and oleoresinous formulations. Consumption of dry-ground mica in paint, the second leading use, accounted for 14% of the dry-ground mica used in 2003.

Ground mica is used in the well-drilling industry as an additive to drilling muds. The coarsely ground mica flakes help prevent the loss of circulation by sealing porous sections of the drill hole. Well drilling muds accounted for less than 1% of dry-ground mica use.

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 and 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. In 2003, consumption of dry-ground mica in plastic applications accounted for 5.2% of the market.

The rubber industry uses ground mica as an inert filler and 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 about 1% of the dry-ground mica used in 2003.

Dry-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.

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

Dry-ground phlogopite mica is used in automotive brake linings and clutch plates to reduce noise and vibrations (asbestos substitute); as sound-absorbing insulation for coatings and polymer systems; reinforcing additives for polymers to increase strength and stiffness and to improve stability to heat, chemicals, and ultraviolet (UV) radiation; heat shields and temperature-insulation, industrial coating additive to decrease the permeability of moisture and hydrocarbons; and in polar

polymer formulations to increase the strength of epoxies, nylons, and polyesters.

Wet-ground mica, which retains the brilliancy of its cleavage faces, was used primarily in pearlescent paints by the automotive industry. In the cosmetics industry, its reflective and refractive properties made mica an important ingredient in blushes, eyeliner, eyeshadow, foundation, hair and body glitter, lipstick, lip gloss, mascara, moisturizing lotions, and nail polish.

Stocks

Government stocks of mica in the NDS comprised stockpile-grade muscovite block (stained and better), first and second qualities muscovite film, 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 2003 stocks of various types of mica in the NDS are listed in table 2.

Reported yearend industry stocks of muscovite mica block (ruby and nonruby) decreased to 17.6 t in 2003 from 18.6 t in 2002. Industry stocks of muscovite and phlogopite mica splittings decreased to 404 t at yearend 2003 from 417 t at yearend 2002 (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 2003 compared with the previous year were as follows: muscovite block (ruby and nonruby) increased to \$66 per kilogram in 2003 from \$64 per kilogram in 2002, muscovite and phlogopite splittings decreased to \$1.74 per kilogram from \$1.82 per kilogram in 2002, and muscovite and phlogopite block (ruby and nonruby) was unchanged from the previous year at \$67 per kilogram in 2003 (tables 1, 6).

The average value of phlogopite block decreased to \$77 per kilogram in 2003 from \$87 per kilogram in 2002. The average value of phlogopite splittings decreased slightly to \$4.89 per kilogram in 2003 from \$4.91 per kilogram in 2002.

In 2003, the average U.S. value of scrap and flake mica, which included high-quality sericite, increased to \$213 per ton (table 3). The average value for North Carolina flake mica increased to \$244 per ton in 2003. The value of dry-ground mica increased by 14% to average \$205 per ton, and wet-ground mica decreased by 2.3% to \$938 per ton in 2003 (table 1).

Foreign Trade

The value of U.S. exports of mica increased by 6.5% to \$18.4 million, and the quantity increased by the same amount, 6.5% to 11,200 t (tables 1, 13). U.S. exports of mica, excluding unworked mica scrap, increased by 6.6% in value from 2002 to \$18.3 million, while the quantity increased by 6.6% to 11,200 t (table 13).

Domestic ground mica (powder) exports increased to 8,020 t, up by 260 t from that of 2002 (tables 8, 13). Exports of crude

and rifted mica increased to 924 t; this was up from the 745 t exported in 2002. In 2003, exports of worked mica increased by 20% to 821 t from 685 t in 2002. The value of U.S. exports of worked mica, however, was essentially unchanged from that of 2002 at \$12.3 million (table 13).

The value of U.S. imports of all mica increased by 13.9% to \$25.4 million, while the quantity decreased by 1.2% to 36,000 t. U.S. imports of mica, excluding unworked mica scrap (less than \$1.00 per kilogram), increased by 13% in value from 2002 to \$22.5 million, while the quantity declined 2.9% from 2002 at 22,600 t.

India continued to supply the United States with essentially all its supply of sheet and paper-quality scrap micas. Total imports for consumption of unworked split block, film, splittings, and mica sheet categorized as "Other" totaled about 13,500 t in 2003 (table 10). Imports of unworked low-value scrap mica (less than \$1.00 per kilogram), increased to 13,400 t in 2003 (table 10) compared with 13,200 t in 2002. Demand continued strong for the low-value mica for use as a dry-ground additive for drywall compound, fillers, and paints.

In 2003, about 20,600 t of powder mica was imported, mostly from Canada, about 200 t less than in 2002 (table 11). Worked mica imports were 1,000 t; this was 9.6% higher than those of 2002 (table 12).

Outlook

The outlook for ground mica is for production growth of 1% to 3% per year. The major markets for ground mica—joint compounds and paints—are mature and relatively stable with growth tied to new housing starts and interest rates. To a lesser extent, widespread natural disasters also affect the market by creating immediate demand for residential building materials. Demand also is responsive to automobile production because interior and exterior parts typically contain dry-ground mica or engineered mica composites and exterior surfaces are painted with wet-ground pearlescent pigments and mica-containing coatings.

In 2004 and 2005, domestic demand for crude and ground mica is expected to grow slowly. Demand for wet-ground mica used in pearlescent automotive coatings and dry-ground mica used in automotive fillers and plastics also is expected to increase slowly. Demand for the smaller specialty markets for ground mica in cosmetics, nylon and polyester resins, coated micas, and polypropylene composites are expected to increase at a rate slightly higher than the 1% to 3% production rate. Markets for dry-ground mica are forecast to grow by as much as 2% to 3% per year through 2006 unless higher interest rates and significantly higher home prices slow demand for new housing and automobiles. Wet-ground mica is expected to show a moderate 2% to 3% growth through 2020 as demand from the automotive industry increases in response to population growth and increased use of pearlescent paints and engineered mica-bearing plastics and composites.

Demand for block mica is expected to grow slowly at about 1% during the next several years with demand increasing in a few specialty markets such as electronics. 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, mostly pegmatites.

Consumption of mica splittings, which is the principal type of sheet mica consumed in the United States, decreased sharply throughout the 1960s and 1970s, and leveled off in the 1980s and 1990s in the range of 700 to 1,000 t/yr. With no potential new uses apparent and many substitute materials being used, no substantial growth is expected. Consumption of mica splittings is expected to remain in the range of from 500 to 900 t/yr in the near future.

References Cited

- AZCO Mining Inc., 2003, AZCO provides update of its activities: Glendale, AZ, AZCO Mining Inc. news release, August 5, 2 p.
- Delphi Corporation, 2003, Delphi honored by Society of Plastics Engineers for material conversion innovation: Troy, MI, Delphi Corporation news release, November 18, 1 p.
- Rieder, Milan, and others, 1998, Nomenclature of the micas: American Mineralogist IMA Mica Report, November-December, p. 1366-1371.
- Zemex Corporation, 2003, Zemex Corporation agrees to be acquired for US\$8.80 per share: Toronto, Ontario, Canada, Zemex Corporation news release, March 3, 2 p.

Internet References Cited

- Georgia Industrial Minerals, Inc., [undated], Geology and reserves, accessed March 10, 2004, at URL <http://gim-inc.com/geology.htm>.

- Isovolta Inc./US Samica Corp., [undated], New high-performance mica tapes—New processing technique improves mica papers—Electrical grade mica holds close tolerances, accessed May 25, 2004, at URL <http://216.239.39.104/search?q=cache:pna7KeypoM0J:www.ussamica.com/+isovolta+and+US+Samica&hl=en>.
- Oglebay Norton Company, 2003 (September 22), Oglebay Norton announces intent to sell lime and mica operations, accessed January 16, 2004, at URL <http://ir.thomsonfn.com/InvestorRelations/PubNewsStory.aspx?partner=9942&storyId=94579>.

GENERAL SOURCES OF INFORMATION

U.S. Geological Survey Publications

- Mica (Natural), Scrap and Flake. Ch. in Mineral Commodity Summaries, annual.
- Mica (Natural), Sheet. Ch. in Mineral Commodity Summaries, annual.
- Mica. Ch. in United States Mineral Resources, Professional Paper 820, 1973.

Other

- Economics of Mica, The (7th ed.). Roskill Information Services Ltd., 1991.
- Mica. Ch. in Mineral Facts and Problems, U.S. Bureau of Mines Bulletin 675, 1985.

TABLE 1
SALIENT MICA STATISTICS¹

| | | 1999 | 2000 | 2001 | 2002 | 2003 |
|--|------------------------|----------|----------------------|----------|----------------------|----------------------|
| United States: | | | | | | |
| Production, sold or used by producers: | | | | | | |
| Scrap and flake mica: | | | | | | |
| Quantity | thousand metric tons | 95 | 101 | 98 | 81 | 79 |
| Value | thousands | \$14,700 | \$14,800 | \$7,990 | \$7,370 | \$16,700 |
| Ground mica: | | | | | | |
| Quantity | thousand metric tons | 111 | 112 | 89 | 99 ^r | 94 |
| Value | thousands | \$36,700 | \$37,500 | \$28,100 | \$29,600 | \$28,600 |
| Prices: | | | | | | |
| Scrap and flake mica | dollars per metric ton | \$148 | \$136 | \$82 | \$90 ^r | \$213 |
| Ground: | | | | | | |
| Wet | do. | \$849 | \$751 | \$771 | \$960 | \$938 |
| Dry | do. | \$192 | \$169 | \$147 | \$180 | \$205 |
| Sheets, muscovite and phlogopite: | | | | | | |
| Block | dollars per kilogram | \$20 | \$23 | \$55 | \$67 | \$67 |
| Splittings | do. | \$1.67 | \$1.81 | \$1.67 | \$1.82 | \$1.74 |
| Consumption: | | | | | | |
| Block, muscovite: | | | | | | |
| Quantity | metric tons | 7 | 6 | 3 | 2 | 2 |
| Value | thousands | \$139 | \$132 | \$129 | \$134 | \$120 |
| Splittings, all types | | | | | | |
| Quantity | metric tons | 786 | 583 | 742 | 573 | 669 |
| Value | thousands | \$1,310 | \$1,060 | \$1,240 | \$1,040 | \$1,160 |
| Exports | metric tons | 12,600 | 11,500 | 10,500 | 10,500 | 11,200 |
| Imports | do. | 30,200 | 34,000 | 36,600 | 36,400 | 36,000 |
| World, production | do. | 278,000 | 329,000 ^r | 369,000 | 270,000 ^r | 275,000 ^e |

^eEstimated. ^rRevised.

¹Data are rounded to no more than three significant digits.

TABLE 2
STOCKPILE STATUS AND GOVERNMENT INVENTORIES FOR MICA, DECEMBER 31, 2003

(Metric tons)

| Material | Inventory, uncommitted | | Available for disposal | Fiscal year 2003 sales |
|--|------------------------|--------------------|------------------------|------------------------|
| | Stockpile grade | Nonstockpile grade | | |
| Block: | | | | |
| Muscovite, stained and better | 7.29 | 0.09 | (1) | 2.89 |
| Muscovite, stained and lower | 34.67 | 0.93 | (1) | -- |
| Phlogopite | -- | -- | (1) | (2) |
| Film, muscovite (first and second qualities) | 0.51 | -- | (1) | (2) |
| Splittings: | | | | |
| Muscovite | -- | -- | (1) | -- |
| Phlogopite | 12.23 | -- | (1) | 119 |

-- Zero.

¹The total disposal plan for all categories of mica in the national stockpile is undifferentiated at 3,856 metric tons (8.5 million pounds).

²Less than 1/2 unit.

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)

| State | 2002 | | 2003 | |
|--------------------|----------|-------|----------|--------|
| | Quantity | Value | Quantity | Value |
| North Carolina | 40 | 3,130 | 39 | 9,580 |
| Other ³ | 41 | 4,240 | 39 | 7,130 |
| Total | 81 | 7,370 | 79 | 16,700 |

¹Data are rounded to no more than three significant digits; may not add to total shown.

²Includes finely divided mica recovered from mica schist and high-quality sericite schist, and mica that is a byproduct of feldspar and kaolin beneficiation.

³Includes Arizona (2002), 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}

| | 2002 | | | 2003 | | |
|----------------------------|---------------------------------|---------------------|------------|---------------------------------|-------------------|------------|
| | Quantity (thousand metric tons) | Value (thousands) | Unit value | Quantity (thousand metric tons) | Value (thousands) | Unit value |
| End use: | | | | | | |
| Joint cement | 58 | \$10,600 | \$183 | 61 | \$12,100 | \$200 |
| Paint | 15 | 3,880 | 266 | 13 | 3,060 | 233 |
| Plastics | 5 | 2,270 | 465 | 5 | 2,570 | 522 |
| Well-drilling mud | (3) | (3) | 209 | (3) | (3) | 146 |
| Other ⁴ | 21 | 12,900 | 627 | 15 | 10,800 | 708 |
| Total | 99 ^r | 29,600 ^r | 302 | 94 | 28,600 | 304 |
| Method of grinding: | | | | | | |
| Dry | W | W | 180 | W | W | 186 |
| Wet | W | W | 960 | W | W | 851 |

^rRevised. W Withheld to avoid disclosing company proprietary data.

¹Data are rounded to no more than three significant digits; may not add to totals shown.

²Domestic and some imported scrap. Low-quality sericite is not included.

³Withheld to avoid disclosing company proprietary data; included in "Other."

⁴Includes 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 QUALITY¹

(Metric tons)

| | 2002 | 2003 |
|-------------------------------|------|------|
| Good stained or better | 0.42 | 0.50 |
| Stained or lower ² | 1.66 | 1.34 |
| Total | 2.08 | 1.84 |

¹Data are rounded to no more than three significant digits; may not add to totals shown.

²Includes punch mica.

TABLE 6
CONSUMPTION AND STOCKS OF MICA SPLITTINGS
IN THE UNITED STATES¹

| Year | Consumption | | Stocks on December 31 (metric tons) |
|------|---------------------------|----------------------|---|
| | Quantity (metric tons) | Value (thousands) | |
| 2002 | 573 | 1,040 | 417 |
| 2003 | 669 | 1,160 | 404 |

¹Data are rounded to no more than three significant digits.

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

| | 2002 | | 2003 | |
|-----------------------|---------------------------|----------------------|---------------------------|----------------------|
| | Quantity (metric tons) | Value (thousands) | Quantity (metric tons) | Value (thousands) |
| Flexible plate (cold) | 73 | \$363 | 73 | \$363 |
| Heater plate | W | W | W | W |
| Molding plate | 194 | 1,510 | 185 | 1,330 |
| Segment plate | 7 | 1,000 | 220 | 1,140 |
| Tape | W | W | W | W |
| Other | 66 | 398 | 65 | 391 |
| Total | 354 | 3,420 | 559 | 3,370 |

W Withheld to avoid disclosing company proprietary data; included in "Total."

¹Data are rounded to no more than three significant digits; may not add to totals shown.

²Consists 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 2003, BY COUNTRY¹

| Country | Crude and rifted | | | | | | | |
|----------------------|----------------------------|----------------------|----------------------------|----------------------|---------------------------|----------------------|---------------------------|----------------------|
| | Less than \$1 per kilogram | | More than \$1 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 | -- | -- | -- | -- | 5 | \$4 | -- | -- |
| Australia | -- | -- | -- | -- | 74 | 69 | -- | -- |
| Barbados | -- | -- | -- | -- | 35 | 28 | -- | -- |
| Belgium | -- | -- | -- | -- | 173 | 142 | -- | -- |
| Brazil | -- | -- | -- | -- | 1 | 4 | -- | -- |
| Canada | -- | -- | -- | -- | 3,990 | 1,350 | 1,380 | \$318 |
| Chile | -- | -- | -- | -- | 503 | 411 | -- | -- |
| China | -- | -- | 4 | \$13 | 44 | 23 | -- | -- |
| Colombia | -- | -- | -- | -- | 47 | 87 | -- | -- |
| Dominica | -- | -- | -- | -- | 24 | 21 | -- | -- |
| Dominican Republic | -- | -- | -- | -- | 7 | 8 | -- | -- |
| Ecuador | -- | -- | -- | -- | 146 | 17 | -- | -- |
| El Salvador | -- | -- | -- | -- | 12 | 4 | -- | -- |
| France | -- | -- | -- | -- | 8 | 28 | 62 | 13 |
| Germany | 201 | \$70 | 20 | 50 | 332 | 206 | -- | -- |
| Guatemala | -- | -- | (2) | 3 | -- | -- | -- | -- |
| Hong Kong | -- | -- | -- | -- | 28 | 120 | -- | -- |
| India | 439 | 150 | -- | -- | 34 | 14 | -- | -- |
| Indonesia | -- | -- | -- | -- | 25 | 42 | -- | -- |
| Ireland | -- | -- | -- | -- | 16 | 4 | -- | -- |
| Italy | -- | -- | -- | -- | 20 | 11 | -- | -- |
| Japan | -- | -- | -- | -- | 434 | 444 | -- | -- |
| Korea, Republic of | -- | -- | -- | -- | 243 | 155 | -- | -- |
| Mexico | 25 | 79 | -- | -- | 848 | 373 | 21 | 9 |
| Netherlands | 133 | 65 | -- | -- | 131 | 390 | 2 | 29 |
| Pakistan | -- | -- | -- | -- | 7 | 8 | -- | -- |
| Panama | 34 | 24 | 7 | 7 | 7 | 4 | -- | -- |
| Peru | -- | -- | -- | -- | 3 | 17 | -- | -- |
| Philippines | -- | -- | -- | -- | 4 | 3 | -- | -- |
| Poland | -- | -- | -- | -- | 20 | 3 | -- | -- |
| Saudi Arabia | -- | -- | -- | -- | 52 | 24 | -- | -- |
| Singapore | -- | -- | 2 | 15 | -- | -- | -- | -- |
| South Africa | -- | -- | 1 | 7 | 33 | 11 | -- | -- |
| Taiwan | -- | -- | -- | -- | 67 | 75 | -- | -- |
| Thailand | 58 | 36 | -- | -- | 1 | 13 | -- | -- |
| Trinidad and Tobago | -- | -- | (2) | 4 | (2) | 3 | -- | -- |
| United Arab Emirates | -- | -- | -- | -- | 6 | 8 | -- | -- |
| United Kingdom | -- | -- | -- | -- | 166 | 121 | -- | -- |
| Venezuela | -- | -- | -- | -- | 470 | 938 | -- | -- |
| Total | 890 | 424 | 34 | 99 | 8,020 | 5,190 | 1,460 | 370 |

-- Zero.

¹Data are rounded to no more than three significant digits; may not add to totals shown.

²Less than 1/2 unit.

Source: U.S. Census Bureau.

TABLE 9
U.S. EXPORTS OF WORKED MICA IN 2003, BY COUNTRY¹

| Country | Plates, sheets | | Other | |
|----------------------|---------------------------|----------------------|---------------------------|----------------------|
| | Quantity (metric tons) | Value (thousands) | Quantity (metric tons) | Value (thousands) |
| Argentina | 6 | \$34 | -- | -- |
| Australia | 52 | 293 | 1 | \$8 |
| Austria | 1 | 8 | (2) | 12 |
| Bahamas, The | -- | -- | (2) | 7 |
| Barbados | 2 | 5 | -- | -- |
| Bermuda | 1 | 8 | -- | -- |
| Brazil | 49 | 900 | 2 | 49 |
| Canada | 114 | 3,400 | 105 | 2,210 |
| Cayman Islands | -- | -- | (2) | 7 |
| Chile | 1 | 12 | -- | -- |
| China | 5 | 11 | 6 | 152 |
| Colombia | (2) | 7 | 1 | 18 |
| Costa Rica | 2 | 6 | (2) | 3 |
| Dominican Republic | (2) | 4 | -- | -- |
| Egypt | -- | -- | (2) | 3 |
| El Salvador | 2 | 11 | (2) | 11 |
| Finland | (2) | 15 | -- | -- |
| France | 5 | 80 | -- | -- |
| Germany | 14 | 185 | 1 | 38 |
| Guatemala | 2 | 25 | 1 | 18 |
| Honduras | (2) | 3 | -- | -- |
| Hong Kong | -- | -- | 5 | 143 |
| India | 11 | 262 | 2 | 58 |
| Israel | 6 | 22 | (2) | 8 |
| Italy | 24 | 410 | 4 | 115 |
| Jamaica | 47 | 188 | -- | -- |
| Japan | 4 | 61 | 43 | 311 |
| Korea, Republic of | 11 | 140 | -- | -- |
| Malaysia | (2) | 3 | -- | -- |
| Mexico | 25 | 393 | 10 | 92 |
| Netherlands | 14 | 104 | 3 | 75 |
| New Zealand | (2) | 8 | -- | -- |
| Pakistan | 1 | 8 | -- | -- |
| Philippines | (2) | 3 | -- | -- |
| Poland | -- | -- | (2) | 8 |
| Russia | 13 | 340 | -- | -- |
| Singapore | 13 | 143 | (2) | 4 |
| South Africa | 3 | 37 | (2) | 3 |
| Switzerland | 2 | 31 | -- | -- |
| Taiwan | 61 | 485 | 22 | 380 |
| Trinidad and Tobago | 114 | 838 | -- | -- |
| United Arab Emirates | 1 | 6 | -- | -- |
| United Kingdom | 4 | 64 | 1 | 27 |
| Venezuela | -- | -- | (2) | 4 |
| Zimbabwe | 2 | 17 | -- | -- |
| Total | 612 | 8,570 | 209 | 3,760 |

-- Zero.

¹Data are rounded to no more than three significant digits; may not add to totals shown.

²Less than 1/2 unit.

Source: U.S. Census Bureau.

TABLE 10
U.S. IMPORTS FOR CONSUMPTION OF CRUDE AND RIFTED MICA IN 2003, BY COUNTRY¹

| Country | Split block | | Splittings | | Other | | | |
|----------------|---------------------------|----------------------|---------------------------|----------------------|----------------------------|----------------------|----------------------------|----------------------|
| | Quantity (metric tons) | Value (thousands) | Quantity (metric tons) | Value (thousands) | Less than \$1 per kilogram | | More than \$1 per kilogram | |
| | | | | | Quantity (metric tons) | Value (thousands) | Quantity (metric tons) | Value (thousands) |
| Canada | (2) | \$2 | -- | -- | 167 | \$22 | -- | -- |
| China | -- | -- | -- | -- | 3,810 | 585 | 7 | \$59 |
| Finland | -- | -- | -- | -- | 3,400 | 1,010 | -- | -- |
| Hong Kong | -- | -- | -- | -- | -- | -- | 5 | 67 |
| India | 21 | 59 | 77 | \$100 | 5,660 | 1,230 | 5 | 19 |
| Indonesia | -- | -- | -- | -- | 252 | 64 | -- | -- |
| Japan | -- | -- | -- | -- | -- | -- | 19 | 44 |
| Pakistan | -- | -- | -- | -- | 126 | 32 | -- | -- |
| United Kingdom | -- | -- | -- | -- | 26 | 8 | -- | -- |
| Total | 21 | 61 | 77 | 100 | 13,400 | 2,950 | 36 | 189 |

-- Zero.

¹Data are rounded to no more than three significant digits; may not add to totals shown.

²Less than 1/2 unit.

Source: U.S. Census Bureau.

TABLE 11
U.S. IMPORTS FOR CONSUMPTION OF MICA POWDER AND WASTE
IN 2003, BY COUNTRY¹

| Country | Powder | | Waste | |
|----------------|---------------------------|----------------------|---------------------------|----------------------|
| | Quantity (metric tons) | Value (thousands) | Quantity (metric tons) | Value (thousands) |
| Argentina | 564 | \$471 | -- | -- |
| Brazil | -- | -- | 139 | \$62 |
| Canada | 16,800 | 6,210 | 89 | 66 |
| China | 2,320 | 834 | 89 | 65 |
| Finland | 60 | 18 | -- | -- |
| France | 1 | 14 | -- | -- |
| Germany | 20 | 75 | -- | -- |
| India | 26 | 15 | 532 | 215 |
| Japan | 470 | 2,680 | (2) | 3 |
| Malaysia | 17 | 33 | -- | -- |
| Netherlands | 1 | 3 | -- | -- |
| Norway | 160 | 101 | -- | -- |
| United Kingdom | 6 | 21 | -- | -- |
| Uruguay | 109 | 97 | -- | -- |
| Total | 20,600 | 10,600 | 850 | 411 |

-- Zero.

¹Data are rounded to no more than three significant digits; may not add to totals shown.

²Less than 1/2 unit.

Source: U.S. Census Bureau.

TABLE 12
U.S. IMPORTS FOR CONSUMPTION OF WORKED MICA IN 2003, BY COUNTRY¹

| Country | Plates, sheets | | Other | |
|--------------------|---------------------------|----------------------|---------------------------|----------------------|
| | Quantity (metric tons) | Value (thousands) | Quantity (metric tons) | Value (thousands) |
| Austria | 61 | \$1,300 | 29 | \$654 |
| Belgium | 287 | 3,710 | -- | -- |
| Brazil | 12 | 32 | (2) | 9 |
| Canada | 3 | 59 | (2) | 4 |
| China | 108 | 526 | 53 | 282 |
| Denmark | (2) | 3 | (2) | 3 |
| France | 23 | 145 | 3 | 100 |
| Germany | 1 | 35 | 5 | 126 |
| Hong Kong | -- | -- | 12 | 91 |
| India | 39 | 597 | 209 | 1,510 |
| Japan | 13 | 248 | 10 | 188 |
| Korea, Republic of | 2 | 18 | 30 | 40 |
| Singapore | (2) | 4 | -- | -- |
| Slovakia | (2) | 2 | -- | -- |
| Spain | -- | -- | (2) | 5 |
| Switzerland | 44 | 712 | (2) | 14 |
| United Kingdom | 20 | 299 | 15 | 386 |
| Vietnam | -- | -- | 21 | 46 |
| Total | 613 | 7,690 | 388 | 3,460 |

-- Zero.

¹Data are rounded to no more than three significant digits; may not add to totals shown.

²Less than 1/2 unit.

Source: U.S. Census Bureau.

TABLE 13
SUMMATION OF U.S. MICA TRADE DATA¹

| | 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: | | | | | | | | |
| 2002 | 7,760 | \$4,060 | 2,050 | \$686 | 38 | \$108 | 685 | \$12,400 |
| 2003 | 8,020 | 5,190 | 2,350 | 794 | 34 | 99 | 821 | 12,300 |
| Imports for consumption: | | | | | | | | |
| 2002 | 20,800 | 9,310 | 14,100 | 2,860 | 670 ² | 439 ² | 913 | 9,750 |
| 2003 | 20,600 | 10,600 | 14,300 | 3,390 | 134 ² | 350 ² | 1,000 | 11,100 |

¹Data are rounded to no more than three significant digits.

²Excludes unworked sheet mica valued at less than \$1 per kilogram.

Source: U.S. Census Bureau.

TABLE 14
MICA: WORLD PRODUCTION, BY COUNTRY^{1,2}

(Metric tons)

| Country ³ | 1999 | 2000 | 2001 | 2002 | 2003 ^e |
|---|--------------------|----------------------|--------------------|----------------------|---------------------|
| Argentina, all grades | 3,097 | 4,665 ^r | 2,120 ^r | 1,770 ^r | 1,894 ^p |
| Brazil | 3,000 | 5,000 | 5,000 | 5,000 ^e | 500 |
| Canada ^e | 17,500 | 17,500 | 17,500 | 17,500 | 17,500 |
| France ^e | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 |
| India: | | | | | |
| Crude | 1,500 ^e | 1,500 ^e | 1,300 | 1,500 | 1,600 |
| Scrap and waste | 1,000 ^e | 950 ^e | 1,100 | 2,000 | 2,000 |
| Total | 2,500 ^e | 2,450 ^e | 2,400 | 3,500 | 3,600 |
| Iran ⁴ | 1,425 | 2,000 ^e | 3,255 ^r | 2,845 ^r | 3,000 |
| Korea, Republic of, all grades | 24,733 | 65,249 | 109,339 | 29,870 ^r | 40,000 |
| Madagascar, phlogopite | 54 | 66 | 90 | 60 ^r | 70 |
| Malaysia | 3,675 | 3,835 | 4,107 | 3,669 ^r | 4,100 |
| Mexico, all grades | 971 | 1,658 | 648 | 456 ^r | 500 |
| Morocco | 210 | 1,897 | -- ^e | -- | -- |
| Norway, flake ^e | 2,500 | 2,500 | 2,500 | 2,600 | 2,600 |
| Russia ^e | 100,000 | 100,000 | 100,000 | 100,000 | 100,000 |
| Serbia and Montenegro ^e | 50 | 100 | 100 | 100 | 100 |
| South Africa, ground and scrap | 1,010 | 708 ^r | 937 ^r | 821 ^r | 1,003 ⁵ |
| Spain ^e | 2,500 | 2,500 | 2,500 | 2,500 | 2,500 |
| Sri Lanka, scrap | 1,425 | 1,491 | 1,161 | 1,161 ^r | 1,200 |
| Taiwan | 6,966 | 6,862 | 9,733 | 6,595 | 3,237 ⁵ |
| United States, scrap and flake ⁶ | 95,400 | 101,000 | 97,800 | 81,100 | 78,600 ⁵ |
| Zimbabwe | 1,300 ^e | -- | -- | -- | -- |
| Grand total | 278,000 | 329,000 ^r | 369,000 | 270,000 ^r | 275,000 |

^eEstimated. ^pPreliminary. ^rRevised. -- Zero.

¹World totals, U.S. data, and estimated data are rounded to no more than three significant digits; may not add to totals shown.

²Table includes data available through May 30, 2004.

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

⁴Year beginning March 21 of that stated.

⁵Reported figure.

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