

Mica

By Benjamin Petkof ¹

Scrap and flake mica production reached the highest output ever recorded in the United States during 1972. Only a minor quantity of low-quality sheet mica was produced during the year in only one State. Ground mica production increased in both quantity and value. All exports of mica

declined in quantity but increased in value. Imports of unprocessed and processed sheet increased, and scrap imports declined. The domestic consumption of all forms of sheet mica varied little from that of the previous year.

Table 1.—Salient mica statistics

	1968	1969	1970	1971	1972
United States:					
Sold or used by producers:					
Sheet mica.....thousand pounds..	15	W	--	17	14
Value.....thousands..	W	\$3	--	\$7	\$7
Scrap and flake mica.thousand short tons..	125	133	119	127	160
Value.....thousands..	\$3,014	\$2,893	\$2,527	\$2,917	\$4,353
Ground mica.....thousand short tons..	111	125	115	120	128
Value.....thousands..	\$7,072	\$8,058	\$7,350	\$8,280	\$8,844
Consumption, block and film					
Value.....thousand pounds..	1,628	1,498	1,299	1,901	1,207
Value.....thousands..	\$2,591	\$2,595	\$2,058	\$2,259	\$2,026
Consumption, splittings.....thousand pounds..	4,785	5,077	5,214	4,177	4,324
Value.....thousands..	\$2,010	\$2,196	\$2,254	\$1,818	\$1,771
Exports.....thousand short tons..	14	6	9	8	7
Imports for consumption.....do.....	5	5	6	7	5
World: Production.....thousand pounds..	346,513	367,635	360,768	375,554	440,016

W Withheld to avoid disclosing individual company confidential data.

DOMESTIC PRODUCTION

Sheet Mica.—Slightly over 7 short tons of sheet mica, valued at \$7,000, was produced in Colorado during 1972. The production consisted of low-value punch and circle mica. The outlook for any large future production of any quality of sheet mica remained small.

Scrap and Flake Mica.—The production of scrap and flake mica reached an alltime high of 159,536 short tons valued at \$4,353,313. This was an increase of 26% in quantity and 49% in value. North Carolina was the major scrap and flake producing State with almost 57% of total production. The remaining output came from Alabama, Arizona, Connecticut, Georgia, New Mexico, Pennsylvania, South Dakota,

and South Carolina. Flake mica was obtained primarily by the beneficiation of material from pegmatite and kaolin deposits. The domestic output of scrap and flake was processed to small particle size mica for various industrial end uses.

Ground Mica.—Sales of ground mica increased 7% in both quantity and value over those of 1971. Dry-ground mica accounted for 80% of total sales. Sixteen companies, operating a total of 20 plants, processed scrap and flake to a small particle size; of these plants, 14 produced dry-ground mica; 3, wet-ground; and 3, both wet- and dry-ground.

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Table 2.—Mica sold or used by producers in the United States

Year and State	Sheet mica						Scrap and flake mica ¹	
	Uncut punch and circle mica		Uncut mica larger than punch and circle		Total sheet mica		Short tons	Value
	Pounds	Value	Pounds	Value	Pounds	Value		
1968.....	--	--	15,000	W	15,000	W	125,323	\$3,013,855
1969.....	W	\$3,244	--	--	W	\$3,244	133,058	2,893,133
1970.....	--	--	--	--	--	--	118,843	2,527,450
1971.....	17,005	6,652	--	--	17,005	6,652	127,084	2,916,379
1972:								
Colorado.....	14,280	7,140	--	--	14,280	7,140	--	--
Connecticut.....	--	--	--	--	--	--	2,446	W
New Mexico.....	--	--	--	--	--	--	14,000	W
North Carolina.....	--	--	--	--	--	--	90,743	2,941,809
Other ²	--	--	--	--	--	--	52,347	1,411,504
Total.....	14,280	7,140	--	--	14,280	7,140	159,536	4,353,313

W Withheld to avoid disclosing individual company confidential data, included with "Other."

¹ Includes finely divided mica recovered from mica and sericite schist, and mica that is a byproduct of feldspar and kaolin beneficiation.

² Includes Alabama, Arizona, Georgia, Pennsylvania, South Carolina, South Dakota, and states indicated by symbol W.

Table 3.—Ground mica sold by producers in the United States by method of grinding¹

Year	Dry-ground		Wet-ground		Total	
	Short tons	Value (thousands)	Short tons	Value (thousands)	Short tons	Value (thousands)
1968.....	96,410	\$4,862	14,979	\$2,210	111,389	\$7,072
1969.....	109,152	5,486	15,704	2,572	124,856	8,053
1970.....	101,188	5,070	13,905	2,280	115,093	7,350
1971.....	103,428	5,463	16,176	2,817	119,604	8,280
1972.....	102,625	5,500	25,649	3,343	128,274	* 8,844

¹ Domestic and some imported scrap.

² Data may not add to total shown because of independent rounding.

CONSUMPTION AND USES

Sheet Mica.—The consumption of all forms of sheet mica, consisting of block, film, and splittings varied only slightly from that of the previous year. Splittings were the major form of sheet mica consumed.

About 1.1 million pounds of block mica was consumed for the fabrication of vacuum tubes, capacitors, and various other electrical and nonelectrical items. Of the total consumption, vacuum tubes required 70% and capacitors accounted for 1%. Lower than Stained quality was in greatest demand and accounted for 64% of total consumption; Stained, 35%; and Good Stained or better, the remainder. Only a small quantity of mica film was consumed primarily for the fabrication of capacitors.

Muscovite block and film was consumed by 14 companies in Seven States. New Jersey with four consuming plants, New York with three, North Carolina with two, and

Pennsylvania with one, consumed 77% of the domestically fabricated block and film mica. The consumption of phlogopite block increased 11% to 74,199 pounds.

Total consumption of splittings increased almost 4% from that of 1971. India and the Malagasy Republic continued to supply the bulk of the splittings consumed domestically. Splittings were fabricated into various built-up mica products by 10 companies with 11 plants in seven States. Four companies, with five plants located in New Hampshire, New York, Ohio, and Pennsylvania, consumed almost 3.6 million pounds of splittings or 83% of total consumption.

Built-up Mica.—This mica-based alternate material was produced in various forms, primarily for use as an electrical insulating material. The production of built-up mica products in 1972 declined 5% in quantity and 10% in value from

Table 4.—Fabrication of muscovite ruby and nonruby block and film mica and phlogopite block mica, by quality and end-product use in the United States in 1972
(Pounds)

Variety, form, and quality	Electronic uses				Nonelectronic uses			Grand total
	Capacitors	Tubes	Other	Total	Gage glass and diaphragms	Other	Total	
Muscovite:								
Block:								
Good Stained or better.....	972	2,313	3,179	6,464	3,631	15	3,646	10,110
Stained.....	3,632	342,891	43,345	389,868	3,202	95	3,297	393,165
Lower than Stained ¹	7,425	436,786	135,213	579,424	20,250	118,168	138,418	717,842
Total.....	12,029	781,990	181,737	975,756	27,083	118,278	145,361	1,121,117
Film:								
First quality.....	2,133	420	260	2,813	307	--	307	3,120
Second quality.....	5,915	--	25	5,940	--	--	--	5,940
Other quality.....	2,450	--	--	2,450	--	--	--	2,450
Total.....	10,498	420	285	11,203	307	--	307	11,510
Block and film:								
Good Stained or better ²	9,020	2,733	3,464	15,217	3,938	15	3,953	19,170
Stained ³	6,082	342,891	43,345	392,318	3,202	95	3,297	395,615
Lower than Stained.....	7,425	436,786	135,213	579,424	20,250	118,168	138,418	717,842
Total.....	22,527	782,410	182,022	986,959	27,390	118,278	145,668	1,132,627
Phlogopite: Block								
(all qualities).....	--	--	68	68	--	74,131	74,131	74,199

¹ Includes punch mica.

² Includes first- and second-quality film.

³ Includes other-quality film.

Table 5.—Fabrication of muscovite ruby and nonruby block and film mica in the United States in 1972, by quality and grade
(Pounds)

Form, variety, and quality	Grade					Total
	No. 4 and larger	No. 5	No. 5½	No. 6	Other ¹	
Block:						
Ruby:						
Good Stained or better.....	3,200	1,123	336	877	--	5,536
Stained.....	11,218	50,812	80,016	224,916	11,830	378,792
Lower than Stained.....	7,543	88,340	115,897	277,912	168,012	657,704
Total.....	21,961	140,275	196,249	503,705	179,842	1,042,032
Nonruby:						
Good Stained or better.....	2,196	318	50	2,010	--	4,574
Stained.....	918	6,027	2,319	5,109	--	14,373
Lower than Stained.....	14,300	12,538	800	2,500	30,000	60,138
Total.....	17,414	18,883	3,169	9,619	30,000	79,085
Film:						
Ruby:						
First quality.....	690	475	350	380	--	1,895
Second quality.....	498	2,817	1,375	150	--	4,840
Other quality.....	--	--	--	--	2,450	2,450
Total.....	1,188	3,292	1,725	530	2,450	9,185
Nonruby:						
First quality.....	--	75	520	630	--	1,225
Second quality.....	--	--	1,100	--	--	1,100
Other quality.....	--	--	--	--	--	--
Total.....	--	75	1,620	630	--	2,325

¹ Figures for block mica include all smaller than No. 6 grade and "punch" mica.

Table 6.—Consumption and stocks of mica splittings in the United States, by source
(Thousand pounds and thousand dollars)

	India		Malagasy		Total	
	Quantity	Value	Quantity	Value	Quantity	Value
Consumption:						
1968.....	4,579	1,874	206	136	4,785	2,010
1969.....	4,799	2,005	273	191	5,077	2,196
1970.....	5,013	2,109	202	144	¹ 5,214	¹ 2,254
1971.....	4,084	1,750	93	68	4,177	1,813
1972.....	4,245	1,653	79	113	4,324	1,771
Stocks Dec. 31:						
1968.....	2,469	NA	149	NA	2,618	NA
1969.....	2,415	NA	145	NA	2,560	NA
1970.....	W	NA	W	NA	2,013	NA
1971.....	1,317	NA	98	NA	1,415	NA
1972.....	1,723	NA	86	NA	1,809	NA

NA Not available. W Withheld to avoid disclosing individual company confidential data.

¹ Data may not add to total shown because of independent rounding.

Table 7.—Built-up mica¹ sold or used in the United States, by product
(Thousand pounds and thousand dollars)

Product	1971		1972	
	Quantity	Value	Quantity	Value
Molding plate.....	698	2,102	851	2,369
Segment plate.....	993	2,072	1,125	2,394
Heater plate.....	W	W	W	W
Flexible (cold).....	520	1,031	468	971
Tape.....	1,165	4,253	957	3,239
Other.....	596	1,499	357	934
Total.....	23,971	10,957	23,757	9,907

W Withheld to avoid disclosing individual company confidential data, included with "Other."

¹ Consists of alternate layers of binder and irregularly arranged and partly overlapped splittings.

² Data may not add to total shown because of independent rounding.

Table 8.—Ground mica sold by producers in the United States, by use

Use	1971		1972	
	Short tons	Value (thousands)	Short tons	Value (thousands)
Roofing.....	17,835	\$669	18,798	\$650
Wallpaper.....	W	W	492	79
Rubber.....	5,234	376	5,589	W
Paint.....	26,807	2,710	27,115	2,816
Plastics.....	479	93	497	96
Welding rods.....	W	W	W	W
Joint cement.....	45,230	2,977	52,111	3,308
Other ¹	23,969	956	23,672	1,894
Total.....	119,604	23,280	123,274	28,844

W Withheld to avoid disclosing individual company confidential data, included with "Other."

¹ Includes mica used for molded electric insulation, annealing, well drilling, textile and decorative coating, texture paint, and uses indicated by symbol W.

² Data may not add to totals shown because of independent rounding.

that of the previous year. The forms of built-up mica in greatest demand was segment plate (30%), tape (25%), and molding plate (23%).

Reconstituted Mica.—Three companies continued to manufacture this mica-based alternate material from good-quality de-

laminated scrap mica. The manufacturing companies were the General Electric Co. at Schenectady, N.Y., the Samica Corp. at Rutland, Vt., and the Acim Paper Corp. at New Hyde Park, N.Y. There were no data available relating to the quantity and value of the reconstituted mica produced during the year.

STOCKS

At yearend there was about 2.5 million pounds of sheet mica in fabricators' stocks. Of this quantity, 73% was splittings, and the remainder was almost entirely of block. Only a minor quantity consisted of film. This information was obtained by direct

canvass of fabricators of sheet mica. Similar information is not available for scrap and flake mica, but it is thought that producers maintain stock inventories equal to 5% or 10% of domestic production.

PRICES

The average value of the domestically produced uncut punch ad circle mica in 1972 was \$0.50 per pound, an increase of \$0.11 per pound over that of the previous year. The average value of muscovite sheet mica in 1972, based on consumption data, was as follows: block, \$1.62 per pound; film \$6.70 per pound; and splittings, \$0.41 per pound. The average value of phlogopite sheet mica, also based on consumption data, was as follows: phlogopite block, \$1.84 per pound and phlogopite splittings, \$1.43 per pound.

The average value of scrap and flake mica produced during the year was \$27.29 per ton. Prices for ground mica, prepared from scrap and flake, quoted in the Chemical Marketing Reporter were essentially un-

changed from the previous year. Yearend prices are shown in table 9.

Table 9.—Price of dry-or wet-ground mica in the United States in 1972¹

	Cents per pound
Dry-ground:	
Joint cement, 100 mesh.....	3¾-5
Plastic, 100 mesh.....	3¾-5
Roofing, 20 to 80 mesh.....	2-3
Wet-ground: ²	
Paint or lacquer, 325 mesh.....	9
Rubber.....	9
Wall paper.....	10

¹ In bags at works, carlots, unless otherwise noted.

² Freight allowed east of the Mississippi River, ½ cent higher west of the Mississippi River, 1 cent higher west of the Rockies.

Source: Chemical Marketing Reporter. V. 203, No. 1, Jan. 1, 1973.

FOREIGN TRADE

All classes of mica exports declined 1% in quantity but increased 26% in value from that of the previous year. Almost 70% of the sheet, scrap and flake, and ground mica exported, was shipped to Canada, France, Japan, and Venezuela. Reported export data do not provide information on the grade or type of mica exported but it is

assumed that the major portion of the material exported is ground mica.

Imports of scrap and waste mica declined 64% in both quantity and value. Imports of sheet mica increased slightly in quantity but declined slightly in value. Processed mica imports increased 26% in quantity and 29% in value.

Table 10.—U.S. exports of mica and manufactures of mica, by country

Destination	Mica, including block, film and splittings, waste and scrap, and ground mica		Manufactured	
	Pounds	Value (thousands)	Pounds	Value (thousands)
Argentina	77,600	\$11	18,465	\$42
Australia	54,541	5	10,373	42
Belgium-Luxembourg	63,000	5	4,060	21
Bolivia	84,000	8		
Brazil			58,857	123
Canada	6,293,821	523	357,849	1,014
Chile	13,838	2	982	4
Colombia	95,682	13	1,067	6
Denmark			8,434	23
Dominican Republic	44,000	5	1,332	5
France	1,126,200	72	13,267	74
Germany, West	588,922	98	4,945	14
Hong Kong	154,041	64		
Iran	101,100	10	616	2
Italy	418,539	58	50,977	172
Jamaica	38,000	2	51,034	400
Japan	1,188,843	564	19,474	54
Mexico	95,337	10	294,769	641
Netherlands	854,562	49	1,955	9
Norway	110,000	6		
Peru	20,500	5	1,030	3
Philippines	51,300	8	121	1
Singapore	169,600	14	580	2
South Africa, Republic of	20,000	1	4,295	10
Spain	177,570	20	7,834	40
Sweden	48,375	13	24,872	32
Switzerland	141,347	17	189	1
Taiwan	4,863	17	2,334	24
Trinidad and Tobago			5,154	11
United Arab Emirates	278,150	31		
United Kingdom	411,594	122	45,421	91
Venezuela	1,093,200	74	1,334	8
Other	138,788	15	15,469	41
Total	13,957,313	1,842	1,001,639	2,910

Table 11.—U.S. exports and imports of mica
(Thousand pounds and thousand dollars)

Year	Exports		Imports for consumption					
	All classes		Uncut sheet and punch		Scrap		Manufactured	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
1970	18,721	4,732	875	966	6,048	136	4,530	2,549
1971	15,182	3,768	1,355	1,171	7,284	171	4,464	2,476
1972	14,959	4,752	1,494	1,162	2,641	62	5,644	3,183

WORLD REVIEW

World mica production remained strong during the year with major producing countries continuing to maintain their output. India and the Malagasy Republic remained the major producers of sheet muscovite and phlogopite respectively. The United States dominated the area of scrap and flake production.

India.—On January 25, 1972, the Indian Government announced that all mica exports were to be channelled through the Minerals and Metals Trading Corp. of India (MMTC). The MMTC was expected to purchase mica from small mine owners for export. The corporation does not control exports of manufactured, fabricated, built-up, reconstituted, or ground mica. In April 1972, MMTC agreed to consider requests from private mica exporters to ne-

gotiate sales directly. Exporters with current contracts or agreements with foreign buyers were permitted to function as previously, but on behalf of MMTC and at current minimum prices. An additional proviso stipulated that all letters of credit were to be made to the favor of MMTC.

During 1972, 422 privately owned mines reported production. About 100 of these mines claimed that their production was in excess of 50 short tons per year. The output of the remaining mines, which were essentially cottage industry-type operations, varied from 5 to 30 tons per year, each. Hand-mining methods were used in open pits throughout the industry where operations rarely exceeded depths of 50 feet.

Table 13.—Mica: World production by country
(Thousand pounds)

Country ¹	1970	1971	1972 ^p
Argentina:			
Sheet.....	r 198	340	* 330
Waste, scrap, etc.....	r 2,897	6,400	r 6,600
Bolivia.....	13	—	—
Brazil ².....	4,451	5,298	* 5,300
Ceylon.....	1,032	694	428
Colombia.....	57	71	84
France.....	r 6,830	* 6,800	* 6,800
India:			
Exports:			
Block ³	3,616	2,915	3,309
Splittings ⁴	14,756	13,832	14,235
Scrap ⁵	41,026	35,891	38,354
Domestic consumption, all classes ⁶	13,200	17,600	13,700
Total ^e	72,598	70,238	74,598
Malagasy Republic (phlogopite):			
Block.....	86	74	127
Splittings.....	1,935	973	751
Scrap.....	42	244	413
Mexico.....	1,235	1,561	* 1,565
Mozambique (including scrap).....	557	2,094	* 2,100
Norway (including scrap) ².....	9,586	7,668	* 6,600
Portugal.....	4,266	1,786	3,651
South Africa, Republic of:			
Sheet.....	24	7	4
Scrap.....	16,647	15,785	9,359
Tanzania:			
Sheet.....	99	81	50
Scrap.....	28	* 29	* 29
United States:			
Sheet.....	—	17	14
Scrap and flake.....	237,686	254,168	320,000
Yugoslavia.....	501	1,221	* 1,213
Total.....	r 360,768	375,554	440,016

^e Estimate. ^p Preliminary. ^r Revised.

¹ In addition to the countries listed, the People's Republic of China, Romania, Southern Rhodesia, South-West Africa, Sweden and the U.S.S.R. are known to produce mica, but available information is inadequate to make reliable estimates of output levels.

² Exports.

³ Includes micanite and other built-up.

⁴ Includes condenser film, washer, and discs.

⁵ Includes sheets, strips, and powder.

Crude mica production, based on exports plus consumption, increased slightly from 35,119 tons in 1971 to 37,299 tons in 1972. Exports also increased from 26,319 tons valued at \$21.7 million in 1971 to 27,949

tons valued at \$25.3 million in 1972. Thirty-two percent of exports in both 1971 and 1972 consisted of sheet mica. The remainder consisted of other forms of processed and scrap mica.

TECHNOLOGY

The work of the Bureau of Mines in the area of recovery of mica concentrates by flotation from weathered mica pegmatites and micaceous schist ores has been reviewed. The acid cationic and alkaline anionic-cationic method for the recovery of coarse and fine mica, respectively, are discussed and flowsheets for their use were provided. In addition, mining, recovery, and grinding of mica were discussed.²

Batch laboratory scale tests were run on several industrial minerals that included mica to determine the optimum grinding constants. The test used an attrition grinding process developed previously by the Bureau of Mines.³

A method has been developed to break apart natural, synthetic, or mixtures of mica by initially heating the material to drive off the water of hydration. The heated material is then broken apart in oriented streams of an inert gas such as argon to produce thin, smooth-surfaced particles, or flakes with a high specific surface area and a high ratio of length to thickness.⁴

² Browning, James S. Mica Beneficiation. BuMines Bull. 662, 1973, 21 pp.

³ Stanczyk, Martin H., and I. L. Feld. Ultrafine Grinding of Several Industrial Minerals by the Attrition Grinding Process. BuMines RI 7641, 1972, 25 pp.

⁴ Ruzick, J. Ultradisintegration of Natural or Synthetic Mica. U.S. Pat. 3,719,329, Mar. 6, 1973.

