

Mineral Industry Surveys

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FLUORSPAR IN THE FOURTH QUARTER 2022

Fluorspar imports in the fourth quarter of 2022 were 121,000 metric tons (t), 92,400 t of which were acid grade and 28,800 t of which were metallurgical grade (fig. 1, table 1). In terms of quantity, acid-grade imports increased by 37% compared with imports in the fourth quarter of 2021 and decreased by 40% compared with the previous quarter. The leading sources of acid-grade imports were, in descending order of quantity, Mexico (55%), China (23%), and Vietnam (22%) (table 2). Imports of metallurgical-grade fluorspar increased by 87% compared with the fourth quarter of 2021 and by 90% compared with the previous quarter. The leading sources of metallurgical-grade imports were Mexico (54%), China (28%), Pakistan (13%), and South Africa (5%).

Fluorspar imports for the full year 2022 were 512,000 t, of which 425,000 t were acid-grade and 87,800 t were metallurgical grade. Acid- and metallurgical-grade imports each increased compared with those in 2021, by 8% and 48%, respectively (table 1).

Fluorspar production disruptions in North America likely

contributed to unusual patterns in domestic trade in 2022.

Mexico continued to be the leading source of acid-grade and metallurgical-grade imports, but its share dropped from 66% and 98%, respectively, in 2021 to 53% and 76% in 2022 (table 2). Conversely, China reemerged as a leading source of domestic fluorspar imports, accounting for 22% of acid-grade imports and 15% of metallurgical-grade imports in 2022. Imports of metallurgical-grade fluorspar from China, which had never exceeded 1,000 t in the past 20 years, were 12,900 t in 2022. Imports of acid-grade fluorspar from China were 92,500 t in 2022, the highest level since 2011. Also noteworthy were metallurgical-grade imports from Pakistan and South Africa, which were 3,930 t and 4,070 t, respectively in 2022 (table 2). There were no reported imports of fluorspar of any grade from Pakistan in the past 20 years. Although South Africa has been a consistent source of acid-grade imports, imports of metallurgical-grade fluorspar in 2022 were the highest since 2004.

In the fourth quarter of 2022, imports of other fluorine-

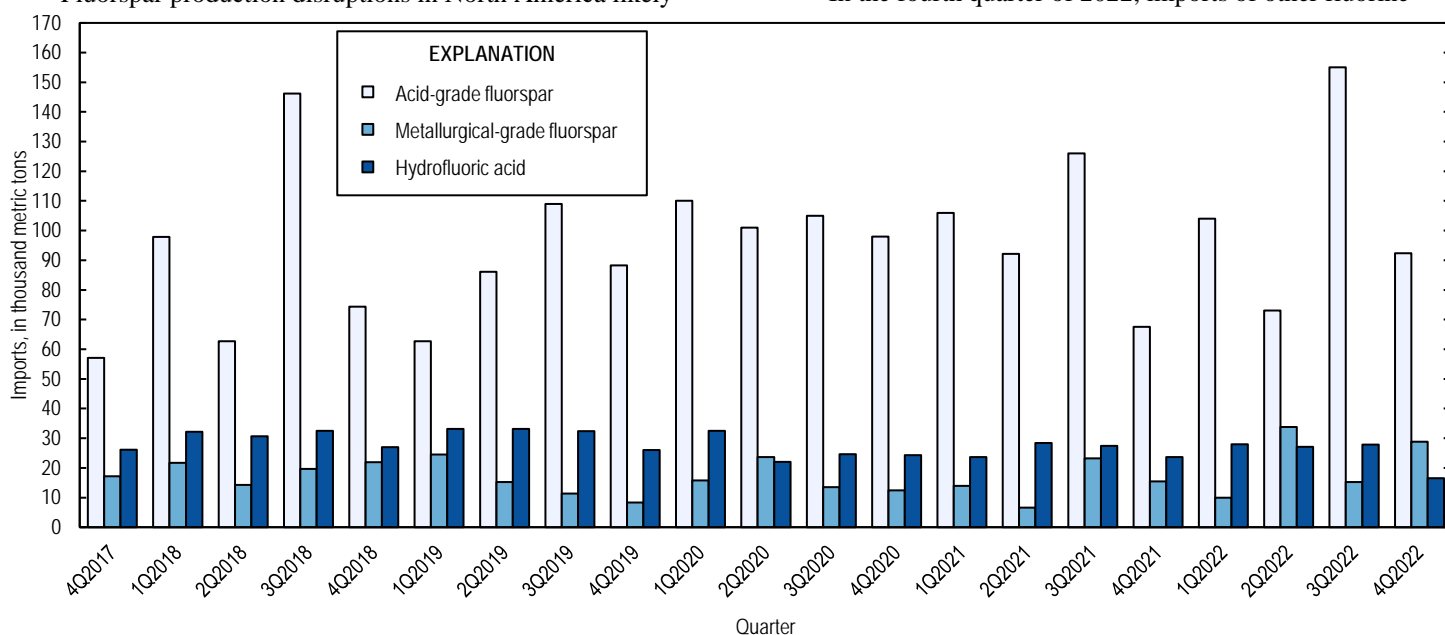


Figure 1. Acid-grade fluorspar, metallurgical-grade fluorspar, and hydrofluoric acid imports from the fourth quarter of 2017 through the fourth quarter of 2022. Source: U.S. Census Bureau and U.S. Geological Survey.

containing materials produced directly from fluor spar were 16,500 t for hydrofluoric acid, 6,470 t for cryolite, and 5,010 t for aluminum fluoride (table 1). For the full year 2022, imports of these materials were 99,400 t for hydrofluoric acid, 27,800 t for cryolite, and 21,200 t for aluminum fluoride. Mexico was the leading supplier of hydrofluoric acid accounting for 83% of imports in the fourth quarter of 2022, and for 88% for the full year (table 3). Exports of acid- and metallurgical-grade fluor spar, aluminum fluoride, and cryolite were likely re-exports as there is no domestic production (table 1).

In 2022, the annual average unit value of acid-grade imports was \$384 per metric ton, an increase of 19% compared with the 2021 annual average unit value of \$322 per metric ton. The 2022 annual average unit value of acid-grade imports from China was \$511 per metric ton, which could not be compared to 2021 because there were no imports of acid-grade fluor spar. The annual average unit value of acid-grade imports from Mexico was \$362, a 9% increase compared with the \$331 in 2021; and the annual average unit value of acid-grade imports from South Africa was \$347 per metric ton, a 13% decrease compared with \$400 per metric ton in 2021. The estimated value of acid-grade imports from Vietnam was \$307 per metric ton, a 19% increase compared with \$257 in 2021.

The 2022 annual average unit value of metallurgical-grade imports was \$223 per metric ton, a 48% increase compared with the 2021 annual average unit value of \$151 per metric ton (table 2). Although the annual average unit value from Mexico, the leading supplier, decreased by 23% to \$109 per metric ton, this was more than offset by increased imports from China, Pakistan, and South Africa. The annual average unit value of metallurgical-grade imports from those countries ranged from \$536 per metric ton to \$652 per metric ton.

Mining and Exploration News

In the fourth quarter of 2022, the mine and processing operations of Canada Fluorspar (NL), Inc. remained idle and under the control of a court-appointed receiver. In October, the monitor cancelled the sale of the mining and processing assets after the selected bidder failed to deliver the agreed upon deposit. The monitor subsequently invited all previous bidders, including the previous successful bidder, to submit revised letters of intent by January 16, 2023. The monitor also took action to move the facility from care-and-maintenance status to 'cold idle'. These actions included reducing the number of total employees to 11, allowing the open pits to flood in accordance with the mine closure and rehabilitation plan, shutting off power and water to almost all facilities except for those being used by remaining staff, terminating payments on leasing and financing agreements, and arranging to return leased equipment (Grant Thornton Ltd., 2023, p. 5, 9, 12–13, 18, 21, and 26–27).

Mexichem Fluor, S.A. de C.V.'s (known commercially as Koura) force majeure for fluor spar supply contracts remained in effect for most of 2022 owing to ongoing safety issues at the company's Las Cuevas Mine in San Luis Potosi, Mexico. However, Mexico's fluor spar mine production in 2022 was 990,079 t, only a slight decrease compared with 1,007,118 t in 2021 (National Institute of Statistics and Geography, 2023).

Fluorochemical News

In October, the U.S. Department of Energy awarded \$2.8 billion funding from the Bipartisan Infrastructure Law to stimulate domestic development of raw materials used in the production of electric-vehicle batteries. Nearly \$280 million in funding was awarded to Koura for the construction of a new facility in Louisiana to produce lithium hexafluorophosphate (LiPF₆) and to Solvay Specialty Polymers USA, LLC, a research and innovation center owned by Solvay S.A. (Belgium), for the construction of a new polyvinylidene difluoride (PVDF) facility in Georgia. LiPF₆ is the main salt used in lithium-ion battery electrolytes; PVDF is used as a binder and separator coating. Additionally, more than \$500 million was allocated to facilities that were likely to consume fluorochemicals in the processing of spherical graphite and the production of separator materials (U.S. Department of Energy, 2022, p. 6, 11, 14, 20, 21). In a related development, Orbia Advance Corp., S.A.B. de C.V., the parent company of Koura, announced a joint venture with Solvay S.A. to supply raw materials, including chlorine, hydrofluoric acid, and vinyl chloride monomer, to support Solvay's production of PVDF in North America (Orbia Advance Corp., S.A.B. de C.V. and Solvay S.A., 2022).

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TABLE 1
SALIENT FLUORSPAR STATISTICS¹

(Metric tons)

	2021		2022				
	4th quarter	1st quarter– 4th quarter	1st quarter	2d quarter	3d quarter	4th quarter	1st quarter– 4th quarter
Production, fluorspar	--	--	--	--	--	--	--
Imports for consumption: ²							
Fluorspar:							
Acid grade, more than 97% calcium fluoride	67,600	391,000	104,000	73,100	155,000	92,400	425,000
Metallurgical grade, less than 97% calcium fluoride	15,400	59,200	9,940	33,800	15,200	28,800	87,800
Total	83,000	451,000	114,000	107,000	170,000	121,000	512,000
Hydrofluoric acid	23,700	103,000	28,000	27,100	27,800	16,500	99,400
Aluminum fluoride	7,220	27,600	4,600	6,450	5,120	5,010	21,200
Cryolite	9,670	41,600	6,010	8,640	6,640	6,470	27,800
Exports: ²							
Fluorspar:							
Acid grade, more than 97% calcium fluoride	1,070	3,860	2,250	5,650	3,800	3,260	15,000
Metallurgical grade, less than 97% calcium fluoride	2,380	10,900	2,420	2,920	2,050	1,610	9,000
Total	3,450	14,800	4,670	8,570	5,850	4,880	24,000
Hydrofluoric acid	2,480	16,600	2,310	2,000	2,530	2,950	9,790
Aluminum fluoride	28	196	1 ^r	10 ^r	1 ^r	20	31
Cryolite	4,360	10,700	2,980	2,560	4,230	1,280	11,000
Apparent consumption, fluorspar: ³							
Acid grade, more than 97% calcium fluoride	66,500	388,000	102,000	67,500	151,000	89,100	410,000
Metallurgical grade, less than 97% calcium fluoride	13,100	48,300	7,520	30,900	13,200	27,200	78,800
Total	79,600	436,000	109,000	98,400	164,000	116,000	488,000

¹Revised. -- Zero.

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

²Source: U.S. Census Bureau; may be adjusted by U.S. Geological Survey.

³Imports minus exports.

TABLE 2
U.S. IMPORTS FOR CONSUMPTION OF FLUORSPAR, BY COUNTRY AND VALUE^{1,2}

	2021									
	4th quarter		1st quarter–4th quarter							
	Quantity	Value ³	Quantity	Value ³						
	(metric tons)	(thousands)	(metric tons)	(thousands)						
Acid grade, more than 97% calcium fluoride:										
Canada	18,400	\$5,350	39,400	\$11,300						
Germany	82	47	512	288						
Japan	824	446	2,380	1,380						
Mexico	47,700	16,000	260,000	86,100						
Mongolia	532	350	1,190	750						
South Africa	--	--	24,800	9,940						
Spain	--	--	7	5						
United Kingdom	3	8	10	32						
Vietnam	--	--	63,000	16,200 ^e						
Total	67,600	22,200	391,000	126,000 ^e						
Metallurgical grade, less than 97% calcium fluoride:										
Canada	6	4	6	4						
China	300	169	455	263						
Mexico	14,600	2,220	57,900	8,160						
Mongolia	498	295	743	439						
Netherlands	1	4	37	28						
South Africa	--	--	29	15						
United Kingdom	6	18	10	31						
Total	15,400	2,710	59,200	8,940						
Grand total	83,000	24,900	451,000	135,000 ^e						
	2022									
	1st quarter		2d quarter		3d quarter		4th quarter		1st quarter–4th quarter	
	Quantity	Value ³	Quantity	Value ³	Quantity	Value ³	Quantity	Value ³	Quantity	Value ³
	(metric tons)	(thousands)	(metric tons)	(thousands)	(metric tons)	(thousands)	(metric tons)	(thousands)	(metric tons)	(thousands)
Acid grade, more than 97% calcium fluoride:										
Canada	1	\$3	--	--	11	\$3	--	--	12	\$6
China	--	--	27,600	\$16,300	43,600 ^r	21,600 ^r	21,200	\$9,340	92,500	47,300
Germany	--	--	--	--	1	3	64	50	65	53
Hong Kong	134	71	--	--	142	88	--	--	276	160
Japan	629	361	3,580	580	249	131	--	--	4,460	1,070
Mexico	62,300	19,200	42,000	15,200	72,100	27,300	50,800	20,400	227,000	82,100

See footnotes at end of table.

TABLE 2—Continued
U.S. IMPORTS FOR CONSUMPTION OF FLUORSPAR, BY COUNTRY AND VALUE^{1,2}

	2022									
	1st quarter		2d quarter		3d quarter		4th quarter		1st quarter–4th quarter	
	Quantity (metric tons)	Value ³ (thousands)	Quantity (metric tons)	Value ³ (thousands)	Quantity (metric tons)	Value ³ (thousands)	Quantity (metric tons)	Value ³ (thousands)	Quantity (metric tons)	Value ³ (thousands)
Acid grade, more than 97% calcium fluoride—Continued:										
South Africa	18,200	6,090	--	--	16,000	5,770	--	--	34,200	11,900
Spain	--	--	--	--	43	42	--	--	43	42
United Kingdom	3	9	4	14	29	16	21	12	57	51
Vietnam	23,000	6,310 ^e	--	--	22,700 ^r	7,620 ^{r,e}	20,200	6,270 ^e	65,900	20,200 ^e
Total	104,000	32,100 ^e	73,100	32,100	155,000	62,600 ^{r,e}	92,400	36,100 ^e	425,000	163,000 ^e
Metallurgical grade, less than 97% calcium fluoride:										
Canada	--	--	--	--	8	5	--	--	8	5
China	270	150	1,500	878	3,020	1,870	8,120	4,480	12,900	7,370
Mexico	9,580	1,110	32,100	3,160	9,440	1,090	15,500	1,890	66,600	7,260
Mongolia	--	--	249	147	--	--	--	--	249	147
Pakistan	83	57	--	--	--	--	3,850	2,050	3,930	2,110
South Africa	--	--	--	--	2,730	1,820	1,330	838	4,070	2,650
United Kingdom	5	4	1	5	2	6	1	4	9	18
Total	9,940	1,320	33,800	4,190	15,200	4,790	28,800	9,260	87,800	19,600
Grand total	114,000	33,400 ^e	107,000	36,300	170,000	67,400 ^{r,e}	121,000	45,400 ^e	512,000	182,000

^eEstimated. ^rRevised. -- Zero.

¹Imports for consumption include imports of immediate entry and warehouse withdrawals.

²Data are rounded to no more than three significant digits; may not add to totals shown.

³Cost, insurance, and freight at U.S. ports.

Source: U.S. Census Bureau; may be adjusted by U.S. Geological Survey.

TABLE 3
U.S. IMPORTS FOR CONSUMPTION OF HYDROFLUORIC ACID¹

	2021				2022									
	4th quarter		1st quarter–4th quarter		1st quarter		2d quarter		3d quarter		4th quarter		1st quarter–4th quarter	
	Quantity	Value ²	Quantity	Value ²	Quantity	Value ²	Quantity	Value ²	Quantity	Value ²	Quantity	Value ²	Quantity	Value ²
	(metric tons)	(thousands)	(metric tons)	(thousands)	(metric tons)	(thousands)	(metric tons)	(thousands)	(metric tons)	(thousands)	(metric tons)	(thousands)	(metric tons)	(thousands)
Canada	90	\$183	325	\$679	121	\$230	104	\$220	86	\$184	19	\$60	329	\$693
China	17	48	329	464	56	96	--	--	165	273	535	715	757	1,080
Germany	250	619	884	1,810	111	282	238	590	14	22	265	898	628	1,790
India	53	93	430	656	--	--	18	40	79	231	--	--	98	271
Japan	536	1,190	2,280	5,040	393	854	724	1,460	524	1,300	422	1,210	2,060	4,820
Korea, Republic of	293	953	1,020	3,190	200	614	552	966	898	1,450	493	1,300	2,140	4,330
Mexico	21,300	35,500	93,800	150,000	26,100	47,900	24,100	45,000	24,100	50,000	13,700	34,000	87,900	177,000
Mongolia	--	--	17	39	--	--	--	--	--	--	--	--	--	--
Singapore	97	365	417	1,430	80	295	118	456	128	516	97	426	422	1,690
Spain	510	795	1,830	2,660	331	649	386	976	724	1,780	425	820	1,870	4,220
Taiwan	559	1,260	1,940	4,870	610	2,100	860	2,780	934	2,720	423	1,250	2,830	8,850
United Kingdom	--	--	(3)	3	--	--	--	--	229	313	151	237	380	549
Total	23,700	41,000	103,000	171,000	28,000	53,100	27,100	52,500	27,800	58,800	16,500	40,900	99,400	205,000

-- Zero.

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

²Cost, insurance, and freight at U.S. ports.

³Less than ½ unit.

Source: U.S. Census Bureau.