

FLUORSPAR

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World fluorspar production in 2003 is estimated at 4.46 Mt, an increase on recent years and against a revised output of 4.18 Mt in 2002. Output of acid-grade fluorspar (acidspars) was 2.83 Mt (2.62 Mt) and was destined mainly for the fluorochemical and aluminium industries; metallurgical-grade fluorspar (metspars) output was 1.63 Mt (1.56 Mt) and the predominant use was in the steel and cement industry. World fluorspar production reached a record high of 5.48 Mt in 1989, ahead of the adverse impact on demand of the Montreal Protocol restricting the use of chlorofluorocarbons (CFCs); the low point in production, of 3.74 Mt, was reached in 1994 following the subsequent phase-out of CFC manufacture. Since 1995 the norm has generally been in the range of 4.2-4.4 Mt.

The market last year continued to be dominated by China, with an output estimated at 2.3 Mt (52% of the world total) of which 0.95 Mt was reportedly exported. The other major producers with outputs in excess of 100,000 t and accounting for a further 35% of the total were: Mexico (756,300 t, 17%), South Africa (205,000 t, 4.6%), Mongolia (4.4%), Russia (3.8%), Spain (3.0%) and Iran (2.3%). The production increases, particularly in China, Mexico and Iran, were in response to higher demand.

Supply and demand during 2003 were essentially in balance (Table 1), and production and consumption have both been trending higher over recent years. However, the market is becoming increasingly tight and this intensified in the first half of 2004. The principle consumers, taking some 88% of world output, remained China (1.25 Mt), Western Europe (1.05 Mt), the US and Canada (750,000 t), Japan (500,000 t) and the CIS (350,000 t).

Acidspars prices increased sharply, particularly in the second half of 2003, as reflected by the increase in both the average import price cif US of US\$137/t (against US\$127/t in 2002) and the spot price ranges for filtercake cif port, as quoted by *Industrial Minerals* magazine. This was a reflection of the reduced export quotas from China and a doubling of freight rates due to shortages of vessels and the high demand for imports of raw materials to China to satisfy the much higher level of overall activity there. This trend has continued into 2004, with shortages of Chinese material, a further reduction in the export quota to 750,000 t, continued higher freight rates and a decrease in VAT rebates to domestic producers from the previous 17% to 5% for fluorspar exports from China. *Industrial Minerals* quoted spot prices had risen as high as US\$195-205/t cif by March 2004 and the average US import price for the first quarter of 2004 was US\$172/t.

No new mine operations were announced during 2003 but three proposed ventures continued to be reported in the technical press. Mineral Securities Ltd (MSL) of Perth, Western Australia, has plans to open its 150,000 t/y Speewah mine 110 km southwest of Kununurra in the east Kimberley region of WA. A pre-feasibility study is expected in the third quarter of 2004. Tiberon Minerals Ltd from Toronto, Canada, has a 77.5% stake in the Nui Phao tungsten-fluorite deposit in Vietnam, 80 km north of Hanoi. This open-pit mine could potentially produce 200,000 t/y of by-product acidspar, albeit from a very low 8-11% CaF_2 head feed. The operation, with two local partners, would produce tungsten oxide as the main product as well as copper, gold and bismuth. Tiberon is looking for a start-up date before the end of 2006 and full production by the third quarter of 2007. Burin Minerals Ltd has launched several attempts to re-finance and re-open its St Lawrence, Newfoundland, Canada operation, which closed in 1990. In December 2003, it was seeking a strategic partner to market by-product aggregate. Burin also staked additional claims peripheral to its main property in November.

Meanwhile, residual use of fluorspar from previously sold US stockpile material provided some 50,000-70,000 t/y to the market but this is unlikely to continue beyond late 2005.

In the downstream market, Solvay SA's merged fluoropolymers business was relaunched as Solvay Solexis in January 2003, with production sites in Brazil, France, Italy, Japan and the US. The use of the foam-blowing agent HCFC 141b in the US and Europe was phased out from January. (The remaining HCFCs 142b and 22 will continue until phase-out in 2020). To meet the changed market requirement, several new fluorine derivative plants commenced operations, including Solvay's 15,000 t/y HFC365mfc plant in Tavaux, France (March), Honeywell's HFC245fa plant in Geismar, Louisiana (August 2002) and Atofina's HCFC32 plants in Zaramillo, Spain and Calvert City, US. In China, Itochu Corp of Japan, which is in joint venture with Yingpeng, Zhejiang, will triple its hydrofluoric acid (HF) production to 35,000 t/y by 2005, and Dupont is investing in a JV with Zhonghao New Materials Co to manufacture HFCs in Changshu, Jiangsu, with product available from mid-2004. In the UK, Ineos is increasing production of HFC125 at Runcorn from 2,000 t/y to 14,000 t/y, with the first phase due for completion in the second quarter of 2005; HFC134a production will cease and the shortfall made up by capacity increases in the US and Japan.

HF capacity in China continues to grow and is now reported at some 392,000 t/y, matching the 393,000 t/y in North America and 371,000 t/y in Europe. However, capacity utilisation was lower, at 284,000 t in 2003, and some 239,000 t of the production was consumed domestically. Of the total installed capacity, 37% is in Zhejiang, 24% in Fujian, 22% in Jiangsu and 17% in Shandong.

World fluorocarbon use is growing by some 0.9 to 1.7% annually but the environmental pressure to phase out HCFCs and also HFCs because of their global warming potential is reducing production in Europe (-0.5%) and Japan (-0.7%). By contrast, there have been increases in the US (+1.6%) and China

(+2-4%). Meanwhile, annual growth in the use of fluoropolymers continues in the range 3-6% worldwide, and current world demand is some 114,000 t/y.

Aluminium production capacity will continue to increase and in China production is expected to more than double by 2010. There are also reported plans to build aluminium fluoride capacity in Mongolia through Mongolia Minerals a US-Mongolia joint venture utilising domestic fluorspar.

Anti-dumping measures against Chinese acidspar continue in Europe, Mexico and Russia. The EU rejected recommended increases of the minimum price mechanism for acidspar following a review, and this remains at €113/t as a result of lobbying by both producers and consumers of fluorspar in Europe.

North America

Mexico remained the only fluorspar producer in the region. Output increased to 756,300 t (622,500 t), with a significantly increased production of acidspar, to 366,300 t (343,300 t) from all producers in the country. Some 74% of the output was from Las Cuevas, the world's largest fluorspar mine, with a significant acidspar output also from Fluorita de Mexico, and smaller quantities from Minera Muzquiz in Coahuila, Minerales y Productos Metalurgicos (MPM) in Durango and Minera Ramos amongst others. Minerales Atlas considered and later declined an option to reopen La Barra mine in Sonora, last operated in 1974.

Much of the acidspar was converted domestically to hydrofluoric acid and aluminium fluoride. Las Cuevas' parent group Camesa purchased the Mexican HF producer Quimica Fluor in May 2004. Exports of metspar and acidspar included 79,000 t (68,400 t) to Canada, 90,100 t (58,100 t) to the US, 29,800 t (25,900 t) to Italy and a much increased – and more typical – 149,900 t reportedly exported (23,100 t) to Japan. There was also significant export of mainly metspar to Europe, South America and Asia; and an increasing tonnage for use in cement clinker manufacture both domestically and in South America.

US imports were significantly higher at 566,600 t (494,500 t) of which 532,800 t (466,000 t) were acidspar for hydrofluoric acid and aluminium fluoride production. There were reports of a continuing growth in HF consumption of around 1% a year and this is predicted to continue. Although there have been no fluorspar sales from the National Defense Stockpile since 2000, re-processing of previously sold materials continues to feed the market – around 50,000-70,000 t in 2003. Exports accounted for some 50-60% of this - 31,000 t (24,300 t) mainly to Canada but some 5,700 t went to Taiwan. There was, as of May 2004, a stock of 4,400 t acidspar (6,800 t Dec 2002), 68,200 t (77,100 t) metspar and 18,400 t (12,600 t) sub-metspar. There was also a further reported 63,200 t (94,500 t) of acidspar and no (21,800 t) metspar “sold pending shipment”. It is unlikely that this will continue beyond mid to late 2005. Some synthetic fluorspar continued to supplement domestic consumption of the order of 5,000 t–8,000 t/y, predominantly as a by-product from uranium processing.

Canadian demand for fluorspar continued to be met entirely by imports. In 2003, these increased to 186,600 t (153,700 t) of which 161,100 t was acidspar (132,200 t). Imports came principally from Mexico (42%), China (28%), the US stockpile (13%), Morocco (11%) and a further 6% from Spain.

South America

The only reported output from the region was 48,000 t (47,900 t) from Brazil and 5,500 t (5,200 t from Argentina. All South American production was consumed domestically, supplemented by imports, mainly from Mexico and also from Europe estimated at around 100,000 t.

Western Europe

Production remained slightly lower than recent years at 373,000 t (382,000 t), due mainly to lower output from Sogerem's mines in Albi, France (now owned by Alcan), with output from other individual producers remaining essentially unchanged. Societe Industrielle du Centre (SIC), which ceased production from its Rossignol mine, France in 1997, made its last fluorspar shipment in January 2004.

Most production was consumed within Europe apart from 5,800 t (24,100 t) of the continuing shipments from France to the Tunisian aluminium industry, and smaller quantities of acidspar for speciality applications to all continents.

Imports continued to supplement the increased (estimated) 1.05 Mt (0.95 Mt) consumption requirement, with some 262,800 t (252,500 t) from China, an estimated further increase to 296,900 t (271,000 t) from Africa, and a significant tonnage from Mexico. German imports were strong at 244,300 t (272,900 t), and also Italy, at 237,300 t (162,500 t). The other main importer continued to be Norway, with an estimated requirement of some 43,000 t for Norsk Hydro's aluminium fluoride operation.

CIS and Mongolia

Output appears to have increased slightly to 379,000 t (366,000 t). Some 83% of this production is attributed to the Yaroslavsky Mining Complex near Vladivostok in Russia, and to the Mongolian-Russian joint enterprise Mongolrostsvetmet in Bor-Undur, Mongolia. JSC Yaroslavsky GOK in Primorsky in Far East Russia produces some 70% of Russia's output, primarily for the local aluminium industry. Output is low grade of 90-94% CaF_2 . There are plans in 2004 to increase output and decrease the dependence on imports from Mongolia, which supplies 50% of Russia's domestic needs. Other producers in Russia are JSC Zabaikasky GOK in Buryatia (byproduct from tantalum, niobium and lithium), JSC Kalanguisky PShK and Suran Cooperative Quartz in Baskortostan in the Urals. The only other CIS production to be reported was in Tajikistan and Kyrgyzstan. Mongolrostsvetmet has been placed on the market for sale in 2004, and some of its production is already marketed and re-processed by Mongolia Minerals – the US-Mongolia JV that is also looking to build an aluminium fluoride facility.

The region is essentially self-sufficient. Production is almost entirely for domestic consumption, with only a 12,800 t export sale from Mongolia to South Korea. Mongolia is attempting to expand its markets and firms have been appointed in Europe and North America to act as exclusive marketing agents.

Asia and Australasia

Total production rose sharply, to 2.44 Mt (2.27 Mt). Overall output was 94% from China. Iran output increased sharply to 102,000 t (82,000 t), South Korea estimated at 25,000 t, India 10,500 t (10,500 t) and Thailand at 2,400 t (2,300 t).

Of the assessed Chinese total production of 2.3 Mt (2.15 Mt), published exports were reported down again at 0.95 Mt (1.0 Mt in 2002, 1.1 Mt in 2001 and 1.2 Mt in 1999 and 2000). Domestic consumption is estimated up again and very strongly at 1.35 Mt (1.14 Mt) comprising – 613,000 t of acidspar, 335,000 t of metspar and 400,000 t as sub-metallurgical grade for the construction industry. This reflects an annual increase of 5-10% in acidspar use in the past three years. Current installed HF capacity has risen dramatically in recent years, from 80,000 t in 1998 to 392,000 t in 2003, of which some 60% was utilised to produce 245,000 t of HF. China has also been developing a small but growing export market in HF during the past eight years. This increased to 45,000 t (11,400 t) mainly to Japan, South Korea and Taiwan. There is now also evidence of the export of fluorochemicals manufactured in China and surplus to the domestic market.

Further rapid domestic production growth in China is considered potentially restricted by the availability of mine reserves – several mines have exhausted resource or been shut for safety reasons. There is also an increase in the manufacture of inorganic fluorides using waste fluorosilicic acid.

The licence fee for exports from China remained similar to 2002 at around US\$53/t for the official 850,000 t quota. The quota for 2004 is down further to 750,000 t. The first round of bidding in 2004 was for some 375,000 t and the average export licence fee worked out at US\$55/t. Reported Chinese shipments in the first four months of 2004, at 210,000 t, were 23% down on the same period of 2003, and the average fob price was US\$132/t (US\$108/t). This has all contributed to material shortages and, coupled with a shortage of ships, freight price increases and the reduction in VAT rebates, has led to sharp increases in quoted spot prices in *Industrial Minerals* to the range US\$195-205/t cif US Gulf port by mid-2004. This is against a typical fob China price of US\$140-145/t.

Information on individual operations in China is sparse and often conflicting but has been improving. Production is dominated by Zhejiang Province (around 50%), with significant output from Fujian and Jiangxi. In recent years closures and consolidations have seen the number of flotation mills reduce from some 125 in 1997 to nearer 78 in 2002. Half of these operations have only come on stream since 1997. Some 10% of the total remains state-owned, compared with 100% in 1990. Some 56% of production in 2003 came

from just 11 operations. Environmental issues and the conditions to be met in the transition to WTO membership are increasing domestic production costs, along with increased power and transport costs, with particularly adverse impact on the smaller mines. There has been increased level of vertical integration with adjacent HF and fluorochemical or AlF₃ plants.

Export destinations and reported tonnages were primarily Japan, 252,800 t (297,200 t), the US, 362,700 t (344,000 t), Western Europe 203,400 t (252,500 t) and elsewhere in Asia 59,600 t (67,600 t), with smaller shipments to Canada, Tunisia and Australia.

Japan's reported imports recovered to 523,700 t (397,000 t) of which 284,700t was acidspar (238,800 t). Of the total, 70% (90%) came from China (98% of the acidspar and 37% of the metspar). Mexico supplied the balance of metspar.

Africa

Total production showed a further decrease to 446,300 t from 480,800 t in 2002 and 575,800 t in 2001. This was primarily a result of the closure of the recently re-opened Buffalo retreatment operation in South Africa in September 2002 due to ownership disputes. There were also production problems at Witkop, which should be finally resolved following the current flotation-plant upgrade, anticipated to be complete by end-July 2004

South Africa continued as the dominant player, with an output of 205,000 t (227,000 t) followed by Kenya with output around 100,000 t, and Morocco and Namibia each with 70,000 – 80,000 t. A very small metspar output was reported from Egypt. Solvay's Okorusu mine in Namibia maintained its output level – and following metallurgical breakthroughs in November anticipates increased production in 2004 up possibly 20%. All sales were exported to the parent European fluorochemical business in Bad Wimpfen, Germany and Porto Marghera, Italy.

In addition to Namibia, both Witkop and Kenya are scheduling higher output levels following plant de-bottlenecking. Witkop is also installing additional milling and flotation capacity to counteract the lower head feeds, with a reported potential for an additional 30-40% output.

Apart from servicing a small level of domestic sales in South Africa of around 45,000 t, all African fluorspar output was exported to world markets. South African exports were primarily to the US (54%) and Europe; Moroccan exports to Norway (60%), Canada (29%), and Italy; Namibian exports to Germany and Italy (100%); and Kenyan exports to Europe (60%), and India (25%). The 30,000 t/y aluminium fluoride operation in Tunisia continued to import all its requirements from France and China.

Outlook

There has been a marked change in the fluorspar market, most particularly for acidspar where a tight market has developed. Demand levels have risen

worldwide but there has been a reduction in availability of material from China and this, coupled with freight rate increases (particularly from China where they have doubled) and reduced VAT rebates in China, has resulted in a very sharp increase in the US dollar quoted product prices which continues into the second half of 2004.

Whereas the dollar price has risen sharply, this has not been reflected to the same extent outside the US dollar zone owing to the strengthening of the euro and to a greater degree the strengthening of the South African rand and the Australian dollar. World consumption of fluorspar has stabilised but this masks the steady increase in acidspar use, offset by continued reduction in the use of metspar for steelmaking owing to technical innovations and more efficient furnaces in both Western countries and the developing countries. The small use of metspar in the ceramic and fibreglass industry remains steady and there is growth in its use in the cement industry, with a reported future potential 200,000 t/y market in North America, and also indications for greater use in South Africa

The markets for fluorochemicals continue to increase but the overall level is showing signs of decreasing to around an annual rate of between 0.9% and 1.7% due to the environmental pressures on the HCFC and HFC product range in Europe and Japan. This has been exacerbated by the perceived global warming potential of HFCs, and the EU is currently set to ban HFC134a in new car air-conditioning units from 2014.

The fluoropolymer industry continues to boom and worldwide growth rates of 3-6% are seen through to 2010. Consumption of fluorspar will also benefit from the continuing overall worldwide growth in the aluminium industry.

Acidspar output is running at just over 90% of current installed capacity. Any future supply shortfall in the market of 100,000 – 200,000 t could continue to be met by increased output from current operations. This could be offset from some of the reported new operations (in Australia, Canada or Vietnam) that might possibly contribute, in total, up to some 300,000 t/y of acidspar to the market by 2005-2006.

In the longer term over the next five to ten years there is likely to be a continued expansion to added-value products in China and to a lesser extent in other parts of Asia, only constrained by the availability of local raw material fluorspar.

The immediate outlook for 2004 and 2005 is for a continued tight market supply and modest increases in consumption over 2003 at the higher price levels due to a continuing shortage of both material from China and ships.

Tables following pages.

Table 1: Fluorspar supply and demand (t)

	Production			Consumption		
	2001	2002	2003 ^p	2001	2002	2003
Asia – China	2,200	2,150	2,300	1,100	1,150	1,250
- Other	90 ^r	121 ^r	141	650	550	700
N America & Mexico	619	623 ^r	756	950	900	1,000
S America	53	53	54	100	150	50
Western Europe	381	382 ^r	373	1,000	950	1,050
CIS and Mongolia	409 ^r	366 ^r	379	350	300	350
Africa	576 ^r	481 ^r	454	100	100	50
Total	4328	4176	4457	4250	4100	4450

^r revised ^p provisional**Table 2: Fluorspar Prices (US\$/t)**

	2001	2002	2003
US imports - acid grade	136	127	137
cif – metspar	82	92	85

**Industrial Minerals'
quotation**

Chinese acidspars filtercake cif US gulf port, December	136-141	128-135	165-170	195-205 Jun 2004
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