Fluorspar is a key ingredient in aluminium smelting, which uses AlF3 as a flux; this accounts for about 20% of the fluorspar market.

China supply shortages hit consumers as new sources emerge

By **Mike O'Driscoll***

Despite a decline in world fluorspar demand in 2016, the outlook remains strong for fluorine in the aluminium, steel, and fluoropolymer markets as prices firm during 2017.

Acid grade fluorspar, or acidspar as it is termed commercially, is the primary raw material used to manufacture aluminium fluoride (AlF_3), which is essential as a flux used in aluminium smelting.

The aluminium market accounts for some 20% of global fluorspar consumption, and as such all aluminium producers do well to track fluorspar supply sources, availability, and price trends since it is a major cost factor in the metal's production.

In spite of continued sluggish world growth, fluorspar demand and prices have increased in 2017 owing to lower overhanging stocks and production and supply in better balance. Although all-important Chinese supply is tightening, new sources offer potential alternatives to consumers.

There remain some environmental concerns for fluorine products derived from acidspar in the chemical sector, through the restricted use of certain fluorine compounds (hydrofluorocarbons, HFCs) owing to their global warming potential. Certain fluorine-based alternatives are being evaluated.

This does not affect the aluminium or steel consumers, other than if certain chemical markets close to acidspar suppliers, it may enhance availability of raw material for AlF_3 production.

Fluorspar basics

Fluorspar (CaF_2) is the dominant source of fluorine, which is a key ingredient in the manufacturing of a wide range of industrial and domestic products from steel, aluminium, cement, and glass to Teflon™ coatings, toothpaste, solar cells, and Li-ion batteries.

Found in a range of geological environments from hydrothermal to sedimentary, most fluorspar requires upgrading through beneficiation suited to the source and end markets.

Mined by open pit and underground methods, the mineral is prepared by sorting, crushing, grinding and sieving, while acidspar also requires separation from impurities by flotation.

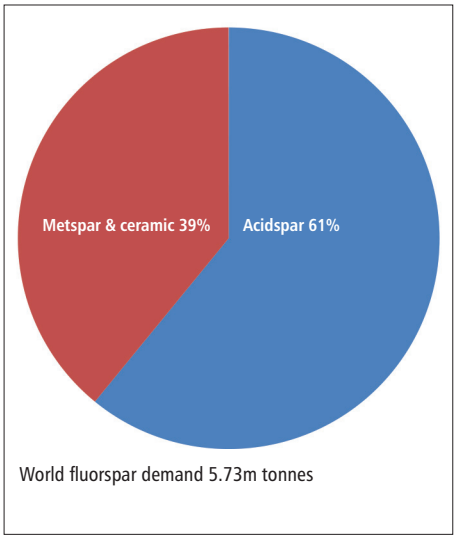
There are three main grades based on CaF_2 content:

- Acid grade (acidspar), min.97% CaF_2; used to make hydrofluoric acid, the important precursor to a wide range of fluorochemicals, including AlF_3 essential to aluminium production, and fluoropolymers
- Metallurgical grade (metspar), 60-82% CaF_2; used as a flux in steel and cement manufacture
- Ceramic grade, 94–96% CaF_2; used in various glasses, enamels, welding rods

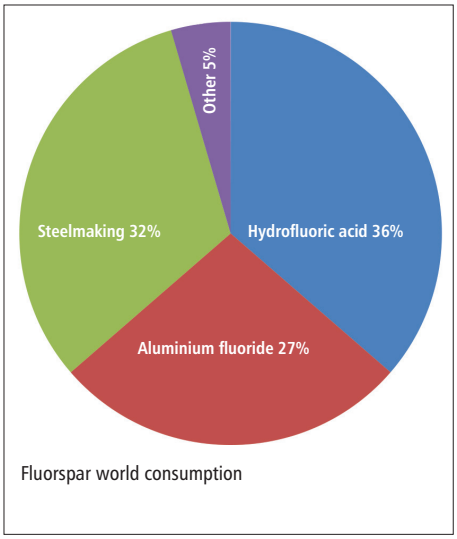
The primary markets for fluorspar are for the production of hydrofluoric acid (HF; 40%), aluminium fluoride (AlF_3) and synthetic cryolite, both used as a flux in aluminium smelting (20%); and in steelmaking (35%).

The major end use for HF is in the manufacture of fluorocarbons used

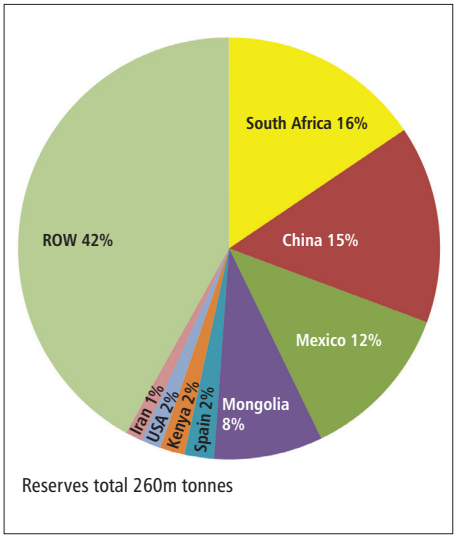
*Director and co-founder of IMFORMED Industrial Mineral Forums & Research Ltd and has 30 years experience in the industrial minerals business; mike@imformed.com; www.imformed.com



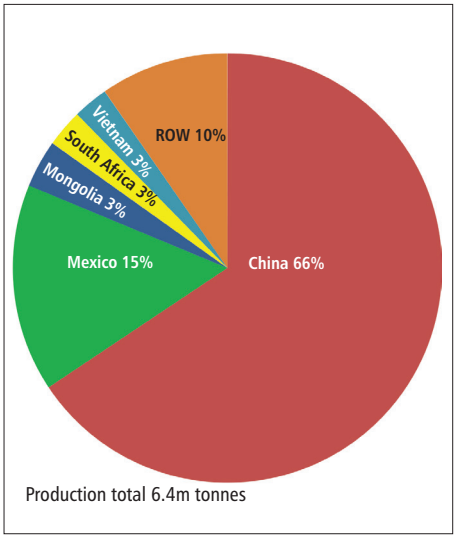
World fluorspar demand 5.73m tonnes



Fluorspar world consumption



Reserves total 260m tonnes



Production total 6.4m tonnes

World fluorspar reserves & production and consumption

predominantly as refrigerants and as foam-blowing agents, in the production of fluoropolymers and fluoroelastomers, chemical derivatives, stainless steel pickling, and in other diverse uses.

HF overall demand remained relatively flat in 2016 despite increased higher consumption by Japan since 2014. Production continued to increase as a result of the new Gulf Fluor facility in the UAE.

China accounted for some 40% of world HF output, with an increasing domestic market and important export trade.

Worldwide demand for AlF_3, which follows the performance of aluminium production, was unchanged in 2016 at 1.2m tonnes. AlF_3 consumption increased again in China, and also in India, Europe and Malaysia but reduced in the USA.

Supply trends

Despite its widespread requirement in key industries, there are relatively few commercially developed fluorspar sources worldwide.

China dominates production and consumption; recent newcomers include Vietnam and Thailand; while potential new sources are in Canada, Norway, South Africa, Sweden, and the USA.

Fluorspar is classified as a "Critical Raw Material" in the EU, and as a "Strategic Mineral" in USA.

During 2016, fluorspar prices fell owing to overcapacity exacerbated by the new acidspar output since late 2014 from Vietnam (2016 year-end Chinese fluorspar was at US$260-270/tonne, which has since risen sharply, and, according to some reports by 30-40%).

Elsewhere, last year saw mine closures in Bulgaria and Kenya, while others reduced output, notably Mexico and Mongolia down to around 50% of more recent output rates this year.

2016 saw world production output drop to 5.68m tonnes in total. The new by-product output from the Masan Nui Phao tungsten operation in Vietnam remained close to the design output of 200,000 tpa.

Reduced output from Mexico and Mongolia amounted to more than 500,000 tonnes, and from China around 300,000 tonnes. There were some increases from South Africa, and also some smaller output from new producers in Germany and Spain.

Mongolia's output remained low at 300,000 tonnes much of which was exported to Russia where UC Rusal's 120,000 tpa Yaroslavsk operation remained closed.

Fluorsid Spa, Italy, purchased Boliden's 40,000 tpa Noralf AlF_3 plant in Odda, Norway in December 2016. This adds to the company's portfolio of 60,000 tpa AlF_3 and 10,000 tpa HF plants in Italy, and the 60,000 tpa British Fluorspar mine in the UK.

The USA remained reliant on fluorspar imports mainly from Mexico and China, as Hastie Mining and Trucking Co. continued limited fluorspar production from its mine in Kentucky, although intends to eventually produce both acidspar and metspar grades.

Regarding potential new supply sources, Canada Fluorspar Inc., which received government approval and funding mid-2016 to develop its new 200,000 tpa acidspar mine and plant project in St. Lawrence, Newfoundland, was officially opened in early August 2017 and aims to be in production by year-end.

Meanwhile, somewhat of a fluorspar renaissance is rallying in South Africa with SepFluor Ltd subsidiary Nokeng Fluorspar Mine (RF) (Pty) Ltd commencing construction of its new fluorspar mine and plant, expected on stream by 2019 (180,000 tpa acidspar, 30,000 tpa metspar). SepFluor is also planning another mine, and HF and AlF_3 plants.

Hard on the heels of SepFluor is SA Fluorite (Pty) Ltd with its development of the Doornhoek fluorspar deposit in North West province, expecting to secure mining rights by the end of 2018.

At present, while hosting the largest reserves of fluorspar in the world, South Africa has just one mine active and two others closed.

In early 2017, the Chinese government imposed and enforced on its mining sector strict anti-pollution control measures , as well as a restriction on the provision of dynamite.

The upshot has been widespread mine and plant closures (until they meet government environmental standards), and reduced mining, prompting a shortage of raw materials including fluorspar, and a consequent sharp rise in prices. This is significant, since China is the main world source of fluorspar.

Extracting fluorspar ore at the the largest source in the world, the underground Las Cuevas mine of Mexichem in San Luis Potosi; also hosting a visit for Fluorine Forum 2017.

The reduction in acidspar supply was compounded by a rise in domestic demand for refrigerant and hydrofluoric acid ahead of summer impacting acidspar availability.

Recovery in production by the Chinese steel industry also pushed up demand for metallurgical grades.

The effect has been that Chinese prices for both grades have risen to levels not seen since 2014. Outside China, prices have not risen to the same extent since producers are locked into annual contract terms negotiated in late 2016. Acidspar 97% CaF_2 prices were reported stable at US$250-270/t CIF US or European ports. New 2018 contracts are due to be renegotiated in September/October 2017.

At best, it is thought that the mineral supply situation in China may ease following the mid-October 19th National Congress, but at worst, it may stretch on to March 2018.

The problem here is that even the best case scenario translates to maybe only a maximum two-month period of mine drilling and blasting before the seasonal closure of mining operations during the winter period of December to March.

This is just as much a headache for Chinese mineral traders and consumers as it is a golden opportunity for mineral producers and developers, outside China, such as in Canada and South Africa.

These latest supply developments and their significance in the context of the evolving global fluorine market will be addressed at IMFORMED's Fluorine Forum 2017, 30 Oct-2 Nov., Hilton San Luis Potosi where the leading players in supply and demand will gather for two days of networking and discussion. Also included is an exclusive visit to the world's largest fluorspar mine of Mexichem. All details at www.imformed.com/get-imformed/forums/fluorine-forum-2017/ ■