



SepFluor's Nokeng Fluorspar mine project, South Africa, under construction in January 2019. The project is now complete and ramping up to full production. Pic courtesy of SepFluor

Fluorspar flux supply – is relief in sight?

With relatively few commercially developed fluorspar sources worldwide, will steel producers be able to secure adequate supplies in the future?

Fluxes are extremely important in the steelmaking process to produce clean steel efficiently. They primarily function to help improve the removal of impurities, protect the refractory lining of the vessel, and enhance the liquidity of the slag.

The mineral fluorspar is one of the key fluxing agents used in steelmaking, and is the second largest consuming market for fluorspar accounting for about 30% of world fluorspar demand or around 1.8 million tonnes (Mt).

World crude steel production increased in the first six months of 2019, to 925.1Mt, up by 4.9% compared to the same period in 2018, mainly driven by China and India. Thus demand for fluorspar by steel producers is relatively healthy, at least in Asia and the USA, for Europe performance is flat to declining at present.

However, there are relatively few commercially developed fluorspar sources worldwide, and the largest producing country is now facing cutbacks, while new suppliers have been facing delays in start-up. Will steel producers be able to secure adequate supplies of fluorspar in the future?

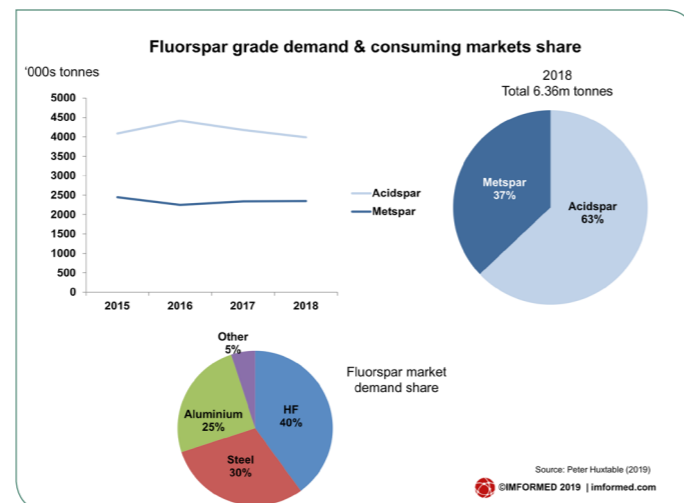
Fluorspar input to steelmaking

Fluorspar is a mineral composed primarily of calcium fluoride (CaF₂). Commercial grades are generally categorised by CaF₂ content: metallurgical grade, 'metspar' (60-87% CaF₂) is mainly used as a fluxing agent in steelmaking, but is also used in cement clinker manufacture; ceramic grade (85-96%) used to make certain glasses and ceramics; and acid grade, 'acidspar' (>97%), accounting for 60-

65% of total fluorspar production, is used to make hydrofluoric acid (HF) the precursor to a wide range of fluorochemicals (fluorocarbons, fluoropolymers).

The fluorspar demand market in 2018 was estimated at 6.36Mt, of which acidspar accounted for 63% and metspar 37%.

Fluorspar is a neutral flux often used as an additive in steelmaking



slags to improve fluidity, but it has also been used in combination with lime (CaO) as a primary slag.

The addition of fluorspar to some slags will increase the solubility of CaO and thus give the slags greater desulphurisation potential. It is this increased CaO solubility (assuming that the lime is added) that increases the sulphide capacity of the slag, which results in improved desulphurisation.

A typical metallurgical grade fluorspar is composed of mainly 65-87% CaF₂ that usually melts at 1418°C, and the remainder is mostly 10-20% SiO₂ (melts at 1713°C) and 5-20% CaCO₃ (melts at 1339°C).

Fluorspar is considered to be an important fluxing component in ladle refining. It has a much higher fluxing potential than Al₂O₃ (with a melting point of 2072°C) and SiO₂ (with a melting point of 1713°C) to increase the solubility of basic components like CaO and MgO in the slag.

HF, derived from acidspar, also finds application in steelmaking. The removal of the iron scale layer and the chromium-depleted layer from steel surfaces is achieved by pickling in acids. A mixture of nitric acid and HF acid is mainly used for the pickling of highly alloyed steels.

In stainless and acid-proof steels pickling is a double-step procedure. Metal oxides and the thin chromium-depleted layer of the basic metal are dissolved under the effect of a strongly oxidising nitric acid. In addition to divalent and trivalent metal oxides, nitrogen oxides and water are generated. The completeness of the pickling procedure requires the separation of these metals. HF acid serves for such purpose, as it transforms these metal ions into stable fluoride complexes.

Where in the world is fluorspar from?

China remains the world's top fluorspar producer, accounting for around 60% of total world output of 5.8Mt in 2018, followed by Mexico, South Africa, Mongolia, Vietnam, and Spain (see accompanying charts). There has been some recent production emerging from Pakistan, Thailand and Myanmar.

Fluorspar supply for 2018 was reasonably tight, mainly owing to mine closures from environmental controls in China, and limited and delayed production from new and emerging producers in Canada, South Africa and Asia. This looks set to continue throughout 2019 and even 2020 unless new capacity comes on stream soon.

Fluorspar supply for 2018 was reasonably tight, mainly owing to mine closures in China, and delayed production from new and emerging producers in Canada, South Africa and Asia

China's hold on global export markets for fluorspar has declined significantly in recent years from the peaks of 2010-11. For the first time, in 2017 and 2018, China became a net importer of fluorspar. Over 500,000 tonnes imported against just over 400,000 exported in 2018 – a reflection of the squeeze on domestic supply by environmental controls, as well as increased domestic demand from a growing fluorochemicals market. The trend is expected to continue in 2019.

China's sharp increase in metspar imports was sourced mainly from Mongolia and also Myanmar. Acidspar was imported from Mexico and South Africa. The leading world acidspar exporters are Mexico, Vietnam, South Africa and China. For metspar it is Mongolia, Mexico and China.

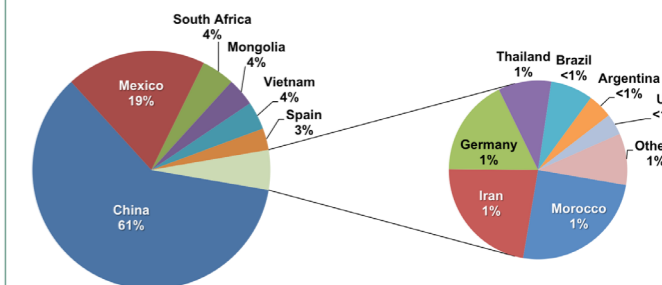
The main regional markets for acidspar are the USA, Italy, India and Germany, reflecting the main centres of fluorochemical manufacturing. The next ranked is the UAE with its significant and relatively recent aluminium production.

The main regional markets for metspar are China, Russia, Turkey, USA, Japan and South Korea, reflecting the world's leading steelmakers.

The tightness in global supply in 2018 resulted in sharp price increases

World fluorspar production 2018

Primary source countries; total 5.8m. tonnes



There has been some recent production emerging from Pakistan, Thailand, and Myanmar; new production is expected from Canada and South Africa.

for acidspar which peaked at over \$500/t, this has carried over into 2019, with reports that metspar prices were also rising and even overtaking acidspar levels at up to \$550/t.

US net import reliance on Chinese fluorspar has declined from a dominant 52% in 2009 to a mere 6% in 2018, being eclipsed by increasing imports from Mexico (at 69%), and most recently, although on a smaller scale, from Vietnam.

Although the US raised tariffs from 10% to 25% on US\$200bn of Chinese products on 'List 3' in May 2019 which includes many minerals, fluorspar (acidspar and metspar) was excluded, while aluminium fluoride and hydrofluoric acid remain on the list.

In contrast, there was certainly more of a risk from US President Trump's recent threats to impose 5% punitive tariffs on all goods imported from Mexico beginning 10 June 2019.

As it turned out, Trump backed off his plan, announcing on 7 June that the USA had reached an agreement with Mexico, and there will be a renegotiated United States-Mexico-Canada Agreement (USMCA). So US fluorspar consumers will feel somewhat relieved....for now.

New sources finally emerging

Depleting high quality fluorspar reserves, high cost of acidspar production, and likely continued pressure and perhaps further capacity reductions in China, combined with continuing demand for fluorspar in chemical, steel and aluminium markets mean that there is a case for alternative and new fluorspar sources to come on line.

The two players ahead of the pack are SepFluor Ltd and Canada Fluorspar Inc. However, each has experienced start-up delays. But prospects for progress are good.

SepFluor's Nokeng Fluorspar open pit mine and concentrator was finally commissioned in South Africa, ramping up to commercial production (180,000tpa acidspar capacity; 30,000 tpa metspar) by end of July 2019. A 60,000tpa AIF₃ plant is also planned.

Canada Fluorspar (CFI) is ramping up production at its St Lawrence, Newfoundland, facility with a nominal target of full production capacity of 200,000tpa acidspar. CFI is planning a new location for development of a vital marine terminal near its mining property.

By the end of 2019 we shall know if these new sources are fully on stream, if they are not, 2020 may see continued tight supply and upwards pressure on prices for fluorspar.

Author

Mike O'Driscoll
Director & co-founder of IMFORMED
www.imformed.com

