



Refractory mineral supply

Alternative solutions driven by China supply squeeze

This time last year I wrote an article entitled “2018: Year of the Dog likely to live up to its name for Chinese mineral consumers” (*American Ceramic Society Bulletin*, Vol. 97, No. 2, p.20). Well, it certainly did!

Already well into 2019, China’s mineral supply squeeze continues to challenge world refractory (and other) producers, and from most indications, 2019 Chinese Year of the Pig is also likely to live up to its name.

A range of factors arising in 2017 and spilling into 2018 significantly compounded the shortage of key refractory (and other) mineral exports from China vital to the world’s refractory manufacturing sector.

The situation created real problems for refractory manufacturers requiring dead burned magnesia (DBM), fused magnesia (FM), calcined bauxite, graphite, and fused alumina for making refractory shapes and monolithics.

China is well known as the world’s primary source of most refractory minerals; there are perhaps >40 types of refractory raw materials (natural and synthetic) produced with a total production capacity of some >30m. tpa, of which 2–3m. tpa are exported.

What is fundamental to understand is that despite past supply bottlenecks occurring over the last two decades, these bottlenecks were short-lived. This time it is serious; it is not a cyclical phase. The fall-out is unlikely to be temporary for many Chinese mineral and refractory operations.

Unfortunately for the global refractories industry, where certain regions, such as India, have relied almost entirely



Quality control at CMP’s new calcined bauxite plant, Xiuwen.

Credit: Mike O'Driscoll, IMFORMED, UK

on raw material supply from China, the crisis continues apace into 2019 and the world market must react and adapt to the new world of Chinese refractory mineral supply.

China’s minerals woe wears on

Although refractory mineral prices stabilised into early 2018, albeit remaining at high levels, 2017’s “perfect storm” of robust pollution controls and environmental inspections (mine and plant closures), restricted and banned explosives provision (lack of primary ore availability), and closure of illegal businesses (reducing capacity) continued through 2018 to tighten refractory raw material supply and increase prices, thus living up to 2018’s Chinese zodiac animal—Year of the Dog!

Uncertainty over physical supply availability and future pricing continues to challenge traders and refractory raw material buyers desperate to secure supply for 2019.

China’s war on pollution, zealously driven by President Xi Jinping, accelerated in 2018 with the passing of a new Environmental Protection Tax Law and the old Ministry of Environmental Protection becoming the Ministry of Ecology and Environment (MEE).

November 2018 saw a new month-long round of environmental inspections in Jilin, Liaoning, Shandong, and Shanxi provinces—all key mineral production centers.

This crusade and its ramifications on Chinese industry is not going away anytime soon, particularly when 2020 has been officially designated a milestone year for China to be a “Moderately Prosperous Society.”

Impact on magnesia, bauxite, and brown fused alumina

By Q3 2018, almost all production of high purity magnesia in Liaoning remained closed; all magnesite mining had closed, and had not yet restarted in the Anshan and Dashiqiao area, with some 90 percent of plants closed failing to meet new environmental standards.

Indeed, new emission standards for the magnesia refractory industry in Liaoning were enacted on Jan. 1, 2019, and have challenged both magnesia and refractory operating production capacity in the province.

Reports suggest there are plans to restart magnesite mining and exploration in the Haicheng area from mid-September 2019 at the earliest. The provincial government announced that in “the first half” of 2019, it will issue long awaited explosives to all “qualified mining enterprises,” thus alleviating primary ore shortage.

Regarding bauxite supply, the primary producing provinces of Henan, Guizhou, and Shanxi have suffered serious interruptions of bauxite mining and calcined bauxite and fused alumina production, which will continue into 2019.

The government’s drive to switch all plants from coal- to natural gas-fired kilns comes with technical and financial challenges to most producers, for example, adding some US\$40–70/t to calcined bauxite prices.

In the key bauxite mining area of Xiaoyi, Shanxi province, raw bauxite production, which stood at about 10–20m tpa up to 2017, dramatically declined to just 3m tpa in 2018—this is raw feed-



CMP's new gas-fired rotary kiln for calcined bauxite started up in 2018 at Xiuwen, Guizhou.

Credit: Mike O'Driscoll, INFORMED, UK



The new DBM flotation plant in construction at Pailou, Liaoning, for Refratechnik's joint venture with Haicheng Guofan Mining and Yingkou Jinlong Refractories.

Credit: Refratechnik

stock for both smelter grade alumina (majority of consumption) and non-metallurgical calcined bauxite grades.

By late November 2018, things had gotten worse. Reports from China stated that owing to high levels of pollution in Hebei, Shanxi, and Henan provinces, every plant was closed until further notice, regardless of whether they had secured environmental permits or had switched to natural gas.

At the time of writing, late January 2019, reports from China indicated that although some magnesite and bauxite operations had come back on stream, others had done so only to be shut down again, for example, Dazhong No.7 Grinding Wheel (fused alumina) on January 8, and Haicheng Magnesite Refractory General Factory on January 23.

Combined with the looming 3-4 week of "normal" disruption of supply chains by the Chinese New Year holidays from Feb. 5, 2019, prospects for a continuing squeeze on supply remain high.

Industry response: in China

There have been some positive moves forced upon the industry inside and outside China.

Within China, there is a drive to develop alternative and upgrade existing mineral processing methods to better utilize lower-grade refractory mineral deposits.

For example, a three-step fused magnesite production process using magnesite "rejects" via flotation has been developed at Liaoning Donghe Refractory Materials Group, and at least five flotation plant projects are in development and aiming to be on stream in 2019-20.

Meanwhile, there is also work on development of more remote magnesite sources, for example in Gansu province, and in Tibet.

Of significance has been the first move (in recent years) of a major western refractory producer to invest in China. In October 2018, Refratechnik GmbH, Germany, announced a major joint venture to develop a 100,000 tpa DBM flotation plant at Pailou, Haicheng, partnering with Haicheng Guofan Mining and Yingkou Jinlong Refractories. This may well light the fuse for more of such partnerships in 2019-20.

In Guizhou, where there is no mining ban in place (as yet) and pollution controls appear less stringent at present, there is a sense of opportunity by new players emerging to supply the large gap in the market from the closures in Henan and Shanxi.

CMP Guizhou Co. Ltd commenced calcined bauxite production with a new 100,000 tpa natural gas-fired rotary kiln near Xiuwen, fed by raw material from its own 2m tonne bauxite reserve Xiaotun mine.

Sky Metallurgy Mineral Co. Ltd owns 15 mines, a crushing plant, and a coke-fired rotary kiln in the Qingzhen area, which is expected on stream soon. Elsewhere in Guizhou, some 18 new gas-fired round (down draught) kilns and three new gas fired shaft kilns are in construction.

Other key areas of Chinese refractory development include using more silica and lime in refractories, evaluating new shapes of raw material grains, and synthetic raw materials, such as sintered alumina (tabular, modified, micro-pored, lightweight grades) to replace fused alumina grades, as well as increased refractory recycling.

Industry response: outside China

Outside China, certain refractory producers, such as Wonjin Worldwide, South Korea, have been forced to develop their own captive production of FM; likewise, world refractories leader RHI Magnesita restarted its Norwegian FM plant.

Unsurprisingly, the China situation boosted prospects of new and alternative refractory mineral projects in development worldwide, in particular: magnesite in Saudi Arabia, Serbia, Greece, Morocco, Turkey, Jordan, Australia, Brazil, Pakistan; bauxite in Guyana, Brazil, Australia; and graphite in Africa, Sri Lanka, Canada.

The ongoing U.S.-China trade war initially scared the U.S. refractory industry with all refractory minerals on the new import tariff list. However, industry lobbying succeeded in eventually excluding bauxite, BFA, DBM, FM, graphite, silicon carbide, and tabular alumina (remaining on the list are: andalusite, chamotte, dolomite, fused silica, kaolin, mullite, quartzite, sillimanite, zircon, abrasives, ceramics, refractories, slags, mineral wool).

That said, there has been talk of some commodities possibly being reinstated on the list, so perhaps the U.S. industry is not out of the woods yet.

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The high grade refractory bauxite mining area at Qingzhen area, Guizhou, operated by Sky Metallurgy Mineral.

Credit: Mike O'Driscoll, INFORMED, UK

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A “temporary truce” to deescalate trade tensions was agreed on at the G20 Summit in Buenos Aires on Dec. 1, 2018, which resulted in the US refraining from increasing the tariffs that were slated to increase from 10 percent to 25 percent on Jan. 1, 2019.

Outlook for Year of the Pig

The outlook is one of expected continued tight supply of refractory raw materials from China, remaining at relatively high price levels, although unlikely to rise much higher, for the foreseeable future.

Certainly, some of the larger western refractory producers will seek to do what they can to secure and “stabilise” as much as possible mineral supply from their favoured sources in China—and Refratechnik is demonstrating one way of achieving this.

But will that be enough? And what kind of guarantee of uninterrupted availability and prices can be given under these conditions?

So, at the same time there will be urgent evaluation by the refractory sector for securing raw material supply outside China combined with the increasing likelihood of a step-change in refractory formulations.

The latter will prompt use of alternative materials and more recycled materials to be assessed with more zeal, and with special regard to increasing the “recyclability” of refractories for the future.

About the author

Mike O’Driscoll is director of IMFORMED and has over 30 years of experience in the industrial minerals business. IMFORMED has conferences this year covering industrial minerals outlook, magnesia, oilfield, fluorspar, and India’s industrial minerals—see www.imformed.com for more information. Contact O’Driscoll at mike@imformed.com. ■