



A ladle furnace at Erdemir's Ereğli steel plant, a major consumer of refractories as Turkey's leading steel producer. Photo credit: Erdemir

Refractory magnesia supply shake up

Corporate moves and changes in China re-shape future supply trends

A year on from the last major corporate shake-up in the niche but vital world of refractory magnesia supply – dead burned magnesia (DBM) and fused magnesia (FM) are imperative to refractory manufacturers to produce efficient steelmaking refractories – and we have another spate of change afoot.

Last year I wrote about the trend of vertical integration by refractory companies in magnesia raw material supply exemplified by the acquisition of leading magnesia producer Queensland Magnesia (QMAG) by Refratechnik (see IST March/April 2020 p.14-15).

This trend has continued into 2021 with Turkey's leading steelmaker Ereğli Demir ve Çelik Fabrikaları (Erdemir) acquiring Kümaş Manyezit Sanayi (Kümaş). Elsewhere, RHI Magnesita has decided to sell two of its refractory magnesia operations to private equity, while the Chinese magnesia sector, so influential in global supply and benchmark pricing, is set to undergo yet another disruptive year.

Erdemir secures Kümaş

After several years of speculation, and some close calls from leading competitors, one of the world's leading magnesite producers, Kümaş of Turkey was acquired in January 2021 by the country's leading steel producer Erdemir for US\$340m.

Erdemir is part of the Mining Metallurgy Group

of OYAK, Turkey's largest complementary occupational pension fund with assets worth around US\$16bn, headquartered in Ankara.

The move reinforces the prevailing ownership trend affecting the shrinking group of refractory magnesia producers worldwide, as they are subsumed into larger magnesia refractory end user groups.

OYAK now possesses two world leaders in the production of the key raw materials required for steel refractory manufacture – alumina and magnesia

In the case of Kümaş, a well-established integrated producer of magnesia and refractories, and fourth largest in the world (outside China), its buyer, Erdemir, is a major consumer of steel and cement refractories, with potential end user synergies for magnesia elsewhere in the OYAK group.

OYAK announced that the acquisition "...will achieve cost control and efficiency by ensuring vertical integration in its activities in the iron, steel, and cement industries."

There is no doubt of the synergistic benefits in merging Kümaş within OYAK, but perhaps

there was also an element of incentive in ensuring Kümaş remained under Turkish ownership. After all, most major magnesia operations, including integrated refractory producers, in Turkey are foreign-owned.

OYAK would also have been aware that on 11 August 2020, Paris-based global industrial minerals giant Imerys signed an agreement for the acquisition of a 60% stake (with options to purchase the remainder), of the Haznedar Group, Turkey's high grade monolithic refractories and refractory brick manufacturer. Haznedar is to be consolidated as Haznedar Durer Refractories in Imerys' High Temperature Solutions business area, led by major refractory subsidiary Calderys. Haznedar's refractory dolomite producing subsidiary, Vadar Dolomit, North Macedonia, was not included in the sale and remains independent.

And it was no secret that Vienna-headquartered RHI Magnesita (RHIM), global leader in magnesia and refractories, which already has a magnesia production facility in Turkey (MAS, Eskişehir) had been eyeing Kümaş for the last two and half years, with formalities in train as recently as May 2020, but then dropped its interest later that year.

OYAK's Mining Metallurgy Group is already fully integrated with iron ore mines, iron ore pelletising plant, crude and finished steel plants, and owns two ports. The addition of a primary integrated magnesia and refractory producer significantly reinforces the group's self-sufficiency. The group

produced 8.53m tonnes of crude steel in 2020, accounting for about 25% of Turkey's total crude steel production.

The obvious synergy between Kūmaş and OYAK is with its steel production by Erdemir and Isdemir, where magnesia-based refractories are consumed in a range of steelmaking applications, and magnesite and caustic calcined magnesia can be used as a slag conditioner.

Turkey's steel industry is in relative good health, comprising 24 electric arc furnace plants (EAF), seven induction furnace plants and three basic oxygen plants. Turkey's crude steel production for 2020 was 35.8m tonnes, up by 6% on 2019.

The 2020 pandemic-impacted global steel industry saw Turkey somewhat buck the trend with a swift recovery and surpass German production, the country is now ranked 7th in world production.

Elsewhere in the OYAK Group, magnesia and dolomite refractories manufactured by Kūmaş could be supplied to the OYAK Cement Concrete Paper Group, with a combined 32.6m tpa cement production capacity from Turkish and overseas plants.

And just a final and relevant note on OYAK's Chemical Group. In 2015, the world's largest speciality alumina producer, Almatiss, was acquired by OYAK from Dubai International Capital. Almatiss produces some 600,000tpa speciality aluminas from nine production facilities in the USA, Germany, the Netherlands, India, China and Japan. The refractories market is a core sector for Almatiss, consuming its range of calcined, tabular, and sintered aluminas, spinels and alumina cements.

Thus, OYAK now possesses two world leaders in the production of the key acidic and basic raw materials required for steel refractory manufacture, alumina and magnesia, respectively. A powerful complementary supply package to the refractories market.

Top producer in Turkey's rich magnesia supply sector

Turkey hosts several areas rich in magnesite and dolomite deposits, and is the world's second largest producer of magnesite after China, ranked third in magnesia (CCM, DBM,



One of the many typical magnesite mining operations in the Haicheng-Dashiqiao district of Liaoning province, China, now facing a raft of reforms in integration, modernisation, and environmental rectification. Photo credit: Mike O'Driscoll

FM) after China and Russia, and fourth in world magnesia exports.

Kūmaş is Turkey's top producer, both in magnesia products and integrated refractory production, supplying the steel, cement, lime, glass, and non-ferrous metal industries. Non-refractory magnesia markets are also served. Kūmaş is the fourth largest DBM producer outside China. Founded in Kütahya in 1972, Kūmaş was established to provide a domestic-owned source of magnesite. The OYAK buy maintains that objective.

Kūmaş produces magnesia and refractory products in two facilities in Kütahya, and completed major upgrades in FM capacity in 2015. According to OYAK, in 2020, Kūmaş increased its sales by 14% year-on-year and exports to more than 50 countries with an annual processing capacity of approximately 1.2m tonnes magnesite ore.

The two other main magnesite producers in Turkey are Magnesit, Eskişehir (260,000tpa capacity DBM), and Konya Selçuklu Krom Magnezit Tuğla Sanayii, Konya (45,000tpa capacity DBM); the former is owned by RHIM and the latter is an independent integrated refractories producer.

Elsewhere, Madkim Maden, Bursa supplies raw magnesite; Asmaş, Kütahya, is a leading monolithic refractory producer with captive DBM production (40,000tpa capacity) owned by US-based Minteq; Akdeniz Mineral Kaynakları, Eskişehir, produces CCM

(36,000tpa capacity) and is majority owned (89.6%) by Grecian Magnesite SA, Athens.

Turkmag Madencilik Sanayi ve Ticaret, a subsidiary of Cihan Group, has a 100,000tpa capacity DBM plant. RHIM was to acquire the operation in 2014 but later abandoned proceedings.

Mineral supply strategies

Perhaps the acquisition of Kūmaş by Erdemir is not that surprising. The last few years, and 2020 in particular, have certainly pointed towards primary mineral consumers increasing vertical integration and preserving security of key raw material supply, and in general, re-assessing sourcing options.

Add to that the threat of increasing foreign ownership of mineral resources and the whole 'critical' or 'strategic' mineral supply over-reliant on limited key sources, with magnesia from China a case in point, then it starts to make sense.

This now leaves just a handful of small to medium size natural DBM, and three synthetic DBM producers independent worldwide. Indeed, Erdemir will be alert to that fact that Kūmaş, as one of the world's leading high quality magnesia suppliers outside China, will be a potential alternative supplier to consumers wary of relying too much on Chinese magnesia supply.

Since November 2020, the Chinese magnesia supply sector, mostly concentrated in Liaoning province, has been subject to an extended period of disruption (see later). On the upside for Kūmaş and other refractory mineral suppliers, the outlook for steel refractories may not be too bad.

Erdemir officials said, "After the effects of the pandemic eased in May 2020, there was a stronger recovery than expected in Turkish domestic consumption and steel demand. Steel demand is highly correlated with GDP growth, and the IMF has forecast Turkey's GDP growth as 5% for 2021. Considering the potential improvement in local steel supply-demand dynamics, and recovery in hot-rolled coil prices, it is expected that the recovery will continue in the first and second quarters of 2021. However visibility is low after the first half."

OYAK Industry Groups*	Products**	Synergies	Kūmaş Products
 Mining Metallurgy (new Kūmaş owner)	8.6m t crude steel 2019 7.2m t flat steel 2019 1.5m tpa cap. iron ore pellets	Refractories MgO slag agents	Mineral products Dead burned magnesia 300,000 tpa cap. Fused magnesia 40,000 tpa cap. Caustic calcined magnesia 100,000 tpa cap. Dead burned dolomite 20,000 tpa cap.
 Cement Concrete Paper	32.6m tpa cap. cement 100,000 tpa cap. Kraft paper	Refractories MgO chemicals	
 Agriculture Animal Husbandry	Plant nutrition Animal feed >250 products	CCM additives	Refractory products magnesia, doloma and alumina based refractory bricks and mortars Total 150,000 tpa estimated
 Chemicals	300,000 tpa cap. PVC 600,000 tpa cap. speciality aluminas	Mg(OH)2 flame retardants Key acid-basic refractory raw materials package	



The main Saludere Ana Damar magnesite mine of Kūmas; one of 12 mining sites exploiting a 160m tonne magnesite resource. Photo credit: Dr Ian Wilson

Chinese magnesia: reforms in the Year of the Ox

As we emerge from the Chinese New Year holiday period and enter the Year of the Ox, reports from China suggest change may well be in the air yet again for the magnesia supply sector as well as continued disruption to supply. News from China is notoriously conflicting and confusing, and announced plans may often not come to fruition for some time, if at all. However, what is clear, is that the authorities in Liaoning province, China's primary centre of magnesite and magnesia production, have been active in two main areas:

1. Implementation of a range of mine and plant shutdowns based on official inspections
2. Plans to unleash a range of reforms essentially integrating, modernising, and developing the magnesia supply sector in stages from 2021 to 2030.

In the final quarter of 2020, Liaoning province carried out a widespread environmental inspection of magnesite companies in the province. The main inspection areas included Haicheng City, Dashiqiqiao City, Xiuyan County, Dongzhou District, Fengcheng City, Kuandian County, Liaoyang County, and Tieling County. Part of this crackdown included a much reported '100-day tackling of the industry' by the Dashiqiqiao Municipal Government.

Some 537 companies in the Dashiqiqiao area were inspected, with the upshot that 116 companies have been ordered to suspend production for rectification.

Likewise in Haicheng, following its inspections, starting from 1 January 2021, the Haicheng Municipal Government decided to suspend production and remediation of 95 magnesia calcination plants and 63 ore screening companies.

Calciners for light and heavy burned magnesia, mid-range magnesia and high purity magnesia were closed, but not apparently fused magnesia furnaces.

January 2021 saw a total ban on magnesite mining, although sale of magnesite ore was permitted. However, in early February, the Haicheng government decided to release a limited amount of explosives for just 28 mining enterprises in Haicheng for only a single month from starting from 3 February.

The overall outcome has been a steady rise in prices for all grades of magnesite and magnesia. Highest grade raw magnesite (47.2% MgO) was trading at US\$155-170/t, highest grade CCM at US\$310-340/t in mid-January, while DBM (97%min MgO) was averaging US\$460/t FOB at the beginning of February.

The new provincial government policies are essentially demanding producers to upgrade their facilities before being allowed to return to production. It is thought that most magnesia producers are not willing to make the necessary upgrades, which are costly and time consuming. Instead they are planning to 'ride it out' and bet on the local economic impact of the shutdown being so severe that the government will eventually back down on the policy. We'll see.

As well as a severe crack down on unlicensed mining, cross-border mining, destructive mining, and unsafe mining, all new open-pit mines are strictly prohibited

From most accounts it now seems that the integration of magnesite mining enterprises will become the main goal of reform in Liaoning this year. In summary, as well as a severe crack down on unlicensed mining, cross-border mining, destructive mining, and unsafe mining, all new open-pit mines are strictly prohibited.

Any new magnesia mines must meet integration conditions, which include a minimum mining rate of 300,000tpa, and before the end of 2025, must meet the requirements for 'green mine construction'.

By 2025, the Liaoning government wants the top five mining companies to account for more than 80% of the province's total mining volume. Each county (city) of Haicheng, Xiuyan, Dashiqiqiao, and Liaoyang is to have no more than two mining enterprise groups.

Other proposed measures include: improving safety and pollution levels; development

of industrial clusters of modern magnesia producers; new product development; and in an effort to resolve supply overcapacity, prohibition of any increase in magnesia production capacity without authorised planning.

These planned reforms signal a major shake-up to the Chinese magnesia supply sector, which is likely to influence export volumes and availability in general for both Chinese and western consumers. It also underlines the smart strategic thinking by large volume refractory magnesia consumers in the West, such as Erdemir, Refratechnik, RHI Magnesita, to secure their critical raw material supplies from sources outside China.

PPL regains independency

With somewhat excellent timing, given global consumers' quickening quest for ex-China magnesia sources, Premier Periclase (PPL), an important and well-established producer of DBM for steel refractories based in Drogheda, Republic of Ireland, was sold by RHI Magnesita (RHIM) in early February 2021 to Callista Private Equity.

The PPL sale came as part of a double divestment by RHIM to Callista, which also included RHI Normag, Porsgrunn, Norway (formerly SMA Mineral Magnesia). RHIM had acquired both companies in 2011 to reinforce its captive magnesia supply base, with RHI Normag having a new 85,000tpa FM plant built on site to supply RHIM refractory plants and reduce its reliance on imported Chinese FM.

However, the plant was beset with technical problems, high costs, and periods of mothballing and restarts with reduced capacity utilisation (around 30,000tpa). In the first half of 2020, after a review of raw material inputs, RHIM concluded that its internal costs to produce FM were too high relative to Chinese-sourced 'equivalent materials' triggering its decision to suspend FM production in Porsgrunn, and to enter into long term alternative supply arrangements.

RHI Normag's FM plant was not included in the sale to Callista. It has been dismantled, and the company renamed Magnor Minerals, with a focus on non-refractory magnesia production and markets.

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All key trends and developments in refractory magnesia supply and demand will be examined and discussed at INFORMED's upcoming Refractory Minerals Forum 2021 ONLINE 16-17 March, and at MagForum 2021, 28-30 June.

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