EUROPEAN REFRACTORIES PRODUCERS' FEDERATION

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Refractory Ceramics and Industrial Minerals are Critical for European Industry

1. Refractory Ceramics are Vital for Europe

Practically all major European material industries such as the iron & steel industry, the cement industry, the glass industry, and the chemical and petrochemical industries are energy intensive and use refractory ceramics as a protective lining in their high temperature reactors. Refractory ceramics limit corrosion and reduce heat loss. For each ton of product produced by the materials industries, a certain quantity of refractory ceramics are consumed through corrosion and erosion:

- steel 10 kg/ton
- glass 4 kg/ton
- cement 1 kg/ton
- waste incineration 5,5 kg/ton.

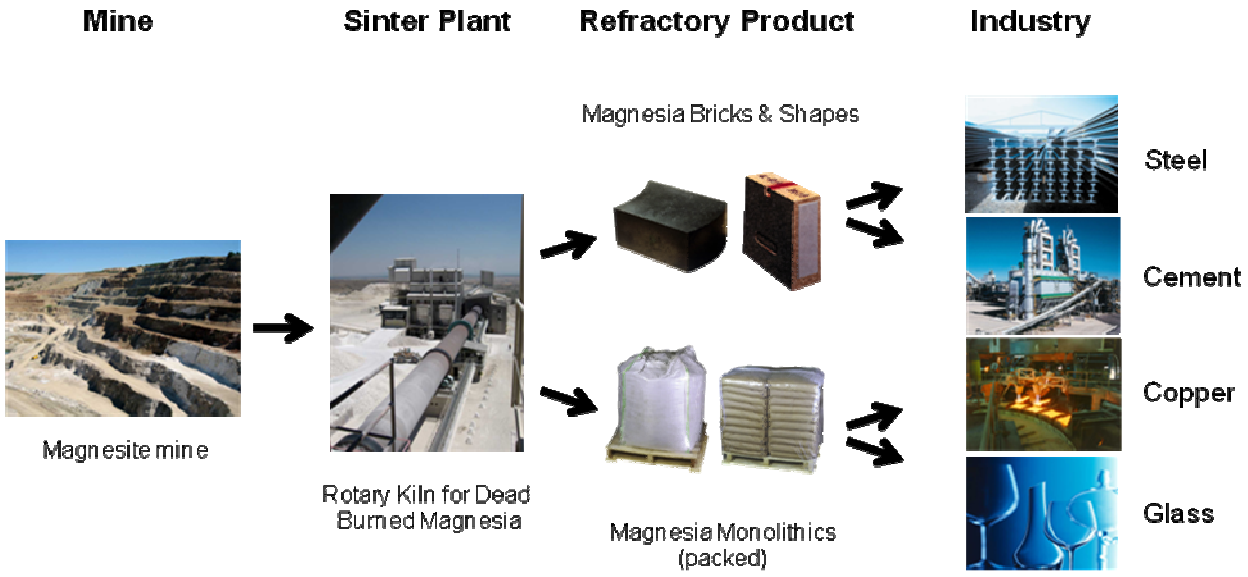


Figure 1: Refractory material flowchart from mine to industry customer (example magnesia).

Although refractory ceramics rarely count for more than 1 to 2% of the total cost of the various finished materials, refractory ceramics cannot be substituted, and their supply to the industry is therefore of a strategic importance which is out of proportion to their specific cost. In fact, without refractory ceramics there would be no steel, cement, copper or glass. Nor would there be any automobiles, trains, airplanes, houses, bridges or even electricity, just to name a few of the amenities we are used to and cannot do without…

Furthermore, refractory ceramics very often have a direct influence on the quality of the finished products. The more sophisticated steel and glass qualities produced by the European industries require refractory ceramics of high purity tailored to the specific conditions of the manufacturing processes involved.

Some special metals and rare earth elements have recently been targeted by the Commission in its Communication on Raw Materials as of particular importance for the development of high tech products such as computers, mobile telephones and so on. It is perhaps not so well known that the very production of special metals such as platinum, or of the rare earth metals would not be possible without refractory ceramics, and that these refractory ceramics have been developed and are produced in Europe.

2. The European Refractory Industry is World Leader

The European refractory industry has a workforce of 28.000 employees and produces 5,5 million tons of refractory ceramics annually, with a value of 3,6 billion €. The main products are (source: PRE):

- Magnesia refractories 2,4 million tons
- Fireclay refractories 1,2 million tons
- High alumina refractories 0,8 million tons.

Magnesia brick and monolithic refractories are made from magnesia raw materials with additives such as graphite (for magnesia carbon bricks). Fireclay refractories are made mainly from refractory clay raw materials. High alumina refractories are made from raw materials such as bauxite, andalusite, mullite, fused alumina or sintered alumina raw materials with additives such as refractory cements (for high alumina monolithics).

European production corresponds to nearly 14% of the approx. 40 million tons total world-wide consumption of refractory ceramic products. Due to the large proportion of high quality products which are manufactured for export, the European refractory industry supplies approx. 17% in value of the 21 billion € World market. This outstanding position is further underlined by the fact that five out of the World's ten largest refractories companies have their headquarters and their main research facilities in the European Union, thus effectively supplying and developing an even larger proportion of the World's needs.

3. Refractory Industrial Minerals are Not Readily Available

Refractory ceramics are produced from a large number of naturally occurring or synthetic industrial minerals. The most important of these in terms of volume are magnesite, fireclay, dolomite, bauxite, silica, graphite, silicon carbide and chrome ore.

Contrary to the view that these industrial minerals are readily available world-wide and in Europe, often only a few refractory grade sources are really adapted to the needs of present day industry. In fact only fireclay, silica and to some extent magnesite and dolomite minerals can be termed as commonly available. Europe's important magnesite mining industry can however not supply high purity magnesia, nor can the synthetic magnesias produced from underground brines or from

seawater supply the demand under present economic conditions. The situation is even worse for bauxite, chrome ore and graphite where only a handful of countries can readily supply the market with the required volume of high grade refractory industrial minerals.

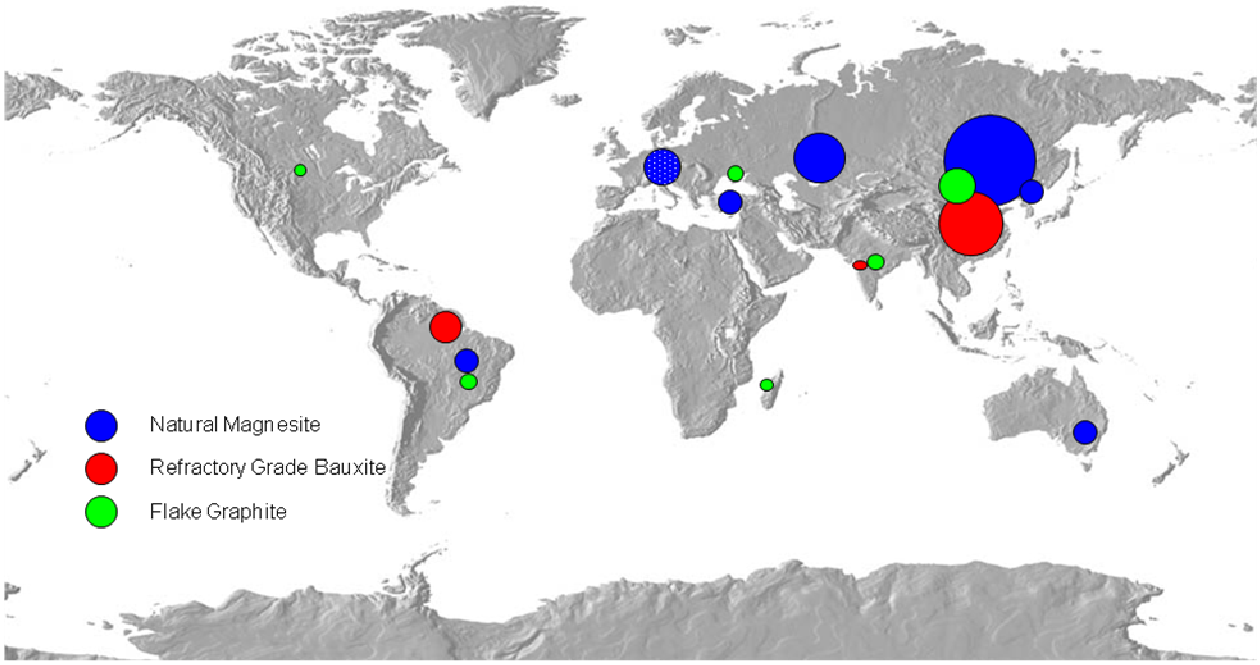


Figure 2: Production capacities of some important refractory industrial minerals (source: USGS).

In the following the supply situation for the three most important and critical refractory industrial minerals will be reviewed: magnesite, bauxite and graphite.

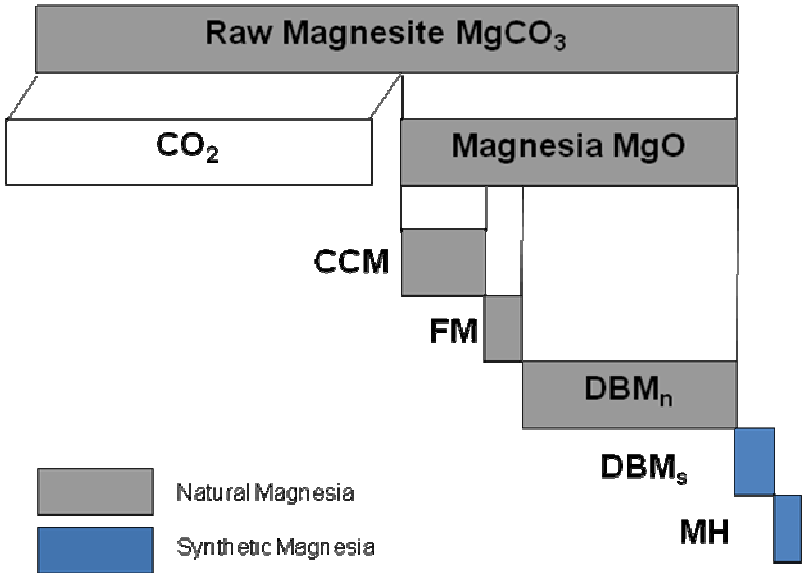
4. Magnesite

Magnesia containing refractories are one of the most widely used types of refractories, with applications in the steel industry (converters, electric arc furnaces, ladles), the cement industry (hot zone of rotary kilns), the copper industry (converters, flash smelters), and the glass industry (recuperators).

The refractory ceramics industry uses various types of magnesia raw materials: Refractory or dead burned magnesia MgO (DBM) is usually produced from naturally occurring magnesite $MgCO_3$ by sintering in kilns at temperatures above 1700 °C. So called caustic calcined magnesia (CCM) is produced at lower temperatures for various industrial and agricultural uses. The particularly corrosion resistant fused magnesia (FM) is won by melting magnesia in an electric arc furnace at temperatures well above 2.500 °C. On the whole, naturally occurring magnesites contain a certain amount of impurities even after beneficiation of the raw magnesite, and their MgO content only ranges from 90 to 97%. Magnesia with an MgO content above 97% is therefore produced from magnesium chloride $MgCl_2$ contained in salt brines or directly from seawater in an elaborate and more onerous chemical process involving magnesium hydrate (MH).

The World production of refractory magnesia (DBM and FM) is approximately 7,3 million tons from natural magnesite and 0,8 million tons from brines and seawater. The EU minerals industry can supply approx. 1,3 million tons of magnesia raw materials and a further 0,8 million tons of mainly

high quality magnesia raw materials (plus various additives such as graphite and chrome ore used in some magnesia refractories) must be imported to supply the refractory ceramics industry. Due to its large resources and cheap energy, China dominates the supply of natural dead burned magnesia (over 40%) and practically controls the supply of fused magnesia (over 85%). The access to Chinese raw materials is therefore vital for European industry.



World	China	EU	RoW
15,3	7,5	2,7	5,1
7,3	3,6	1,3	2,4
1,8	1,0	0,3	0,5
0,7	0,6	0	0,1
4,8	2,0	1,0	1,8
0,8	0	0,3	0,5
0,5	0	0	0,5

Figure 3: Magnesite and magnesia production chart (in million tons). Source: Roskill, RHI.

5. Bauxite

Bauxite refractories are used mainly in the steel industry for transport ladles and electric arc furnace roofs, and in the cement and lime industry for rotary kiln linings.

The total World production of bauxite is close to 200 million tons. However, this is mainly metallurgical grade bauxite used for the production of aluminium. The more pure and less iron rich refractory grade bauxite is only produced in three locations: China, Guyana and (for local use only) in India.

The World production of refractory grade bauxite is approx. 9 million tons of which 8,6 million tons are mined in China, and 0,3 million tons in Guyana. The only company active in Guyana is owned by the Chinese state. European refractory producers are therefore obliged to import all of their requirements amounting to approx. 0,5 million tons from China or a Chinese controlled source.

6. Graphite

Graphite refractory ceramics are only used in iron-making for blast furnace linings. Flake graphite is of much greater importance as an additive to magnesia or alumina bricks and shapes, for instance in magnesia carbon bricks for the steel industry (converters, electric arc furnaces, ladles), in alumina carbon shapes for the continuous casting of steel, or in foundry crucibles.

Natural graphite is a small volume material with total world production of only approx. 1,8 million tons. About 1,5 million tons are mined in China. Synthetic graphite made from coke is used in large quantities for instance to make carbon anodes, graphite electrodes, and batteries, but is not an alternative for refractories products due mainly to its inferior oxidation resistance. In most refractory applications natural flake graphite with large crystals is by far the preferred raw material. This type of graphite is found mainly in China, but also in Ukraine, Sri Lanka, Madagascar, Brazil and Canada. The market supply is however largely dominated by China (over 80%).

7. Trade Restrictions

On its accession to the WTO the People's Republic of China agreed to eliminate all taxes and charges applied to exports, unless specifically provided for in the Annex 6 of the Accession protocol. At the time, not a single refractory raw material was included in this annex. In the meantime, the European refractory industry has become increasingly exposed to trade restrictions in its imports of refractory raw materials from China. Export taxes have been introduced since on:

- Natural graphite (20%)
- Fireclay (15%)
- Artificial corundum (15%)
- Andalusite, sillimanite, mullite, bauxite (10%)
- Fused and dead burned magnesia (10%).

But in reality, the trade restrictions go much further than this and are composed of a cocktail of restrictive trade measures.

For dead burned magnesia for instance the total quantity of material available for export is fixed annually (approx. 1,3 million tons). Export licenses are auctioned to selected bidders only. Due to an artificial shortage, the export license cost by far exceeds the issue price. On top of this, an Output Value Added Tax of 17% has been raised (from September 2006), and an export tax of 10% added, with a minimum value (from March 2008).

Since 2002, the price for magnesia raw materials (Material Cost) on the domestic Chinese market has increased by approx. 80% due mainly to higher energy costs. For foreign buyers, and exclusive of freight costs, the price of magnesia has however increased by a further 170% to achieve 250% due to the above mentioned Duties. None of these Duties are borne by Chinese domestic producers of refractory ceramics, and exports of refractory ceramics made from magnesia or other raw materials are not taxed. In this way, Chinese domestic producers for instance of magnesia carbon bricks have a price advantage on the raw materials of more than 50%, and an unfair cost advantage for their magnesia carbon bricks in foreign markets from this factor alone of approx. 30%.

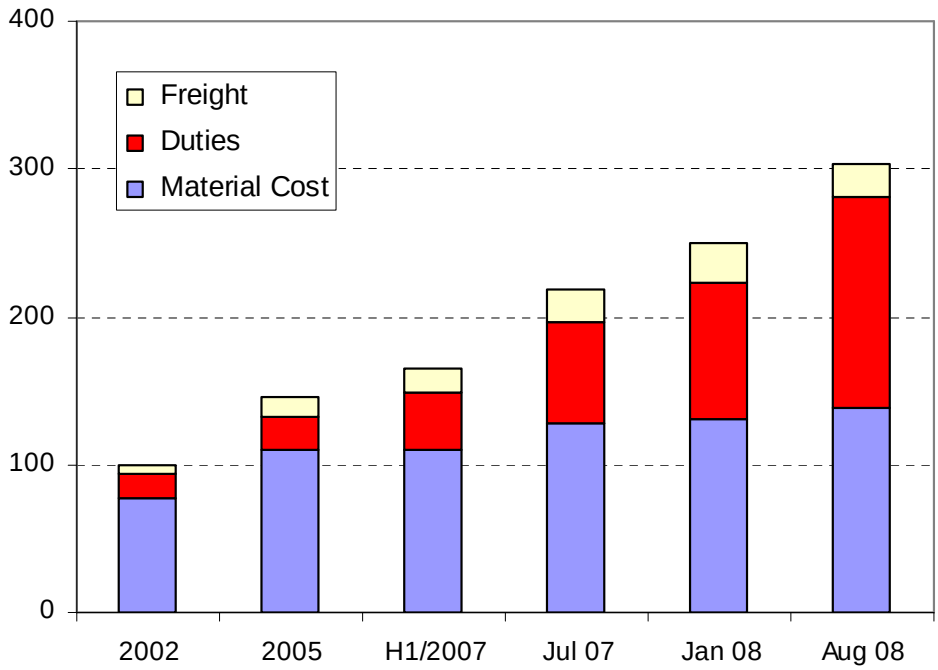


Figure 4: Price structure of Chinese magnesia raw materials: Material Cost, Duties and Freight to European port (Base 100 in 2002).

8. Summary

The EU refractory ceramics industry is vital for the EU industry as a whole, but is heavily dependent on imports of refractory industrial minerals. The supply situation for the European refractory industry is particularly critical for high grade magnesia, bauxite and graphite which are mainly sourced from China due its vast raw material reserves. The export policies of the Chinese authorities are restrictive and give an unfair advantage to its domestic refractory ceramic industry. A system of export licensing, auctioning, and taxation limits the quantities of raw materials available for European producers, and practically doubles their cost when compared to that for domestic competition.

In the short term, the European refractory industry expects the European authorities to vigorously act against the trade distortions described in order to safeguard its industry. In the medium term, measures should be taken to avoid further restrictions in the exploitation of existing European deposits for instance of magnesia. In the medium to long term, alternative raw materials sources and new deposits should be researched and put into operation together with reliable partners.

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