

MILLING AROUND ZIRCON OPACIFIER MARKETS AND TRENDS

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ABSTRACT

Over the last four years, the prices for milled zircon – both opacifier and flour – have doubled. At the same time the regional distribution of consumption has shifted markedly. Both developments have created forces for change in the zircon milling sector. In this article we examine the state of the global zircon milling industry and some of the factors which may influence its future.

1. PRICES

Milled zircon is widely used throughout the global ceramics industry. It is a major ingredient in the manufacture of ceramic glazes and it is an even more important component in the production of unglazed porcelain tiles. Taken as a whole, ceramics manufacture accounted for nearly 55% of total zircon sand consumption in 2006.

In a cost competitive sector such as ceramics, the prices of important raw materials receive plenty of attention, especially when they rise steeply over a sustained period and for this reason milled zircon has come in for its share of attention in recent years. As Figure 1 shows, today's prices for milled zircon – both flour and opacifier (see Box 1) - are twice as high as their level of mid 2003, and they have stayed that way for the last twelve months.

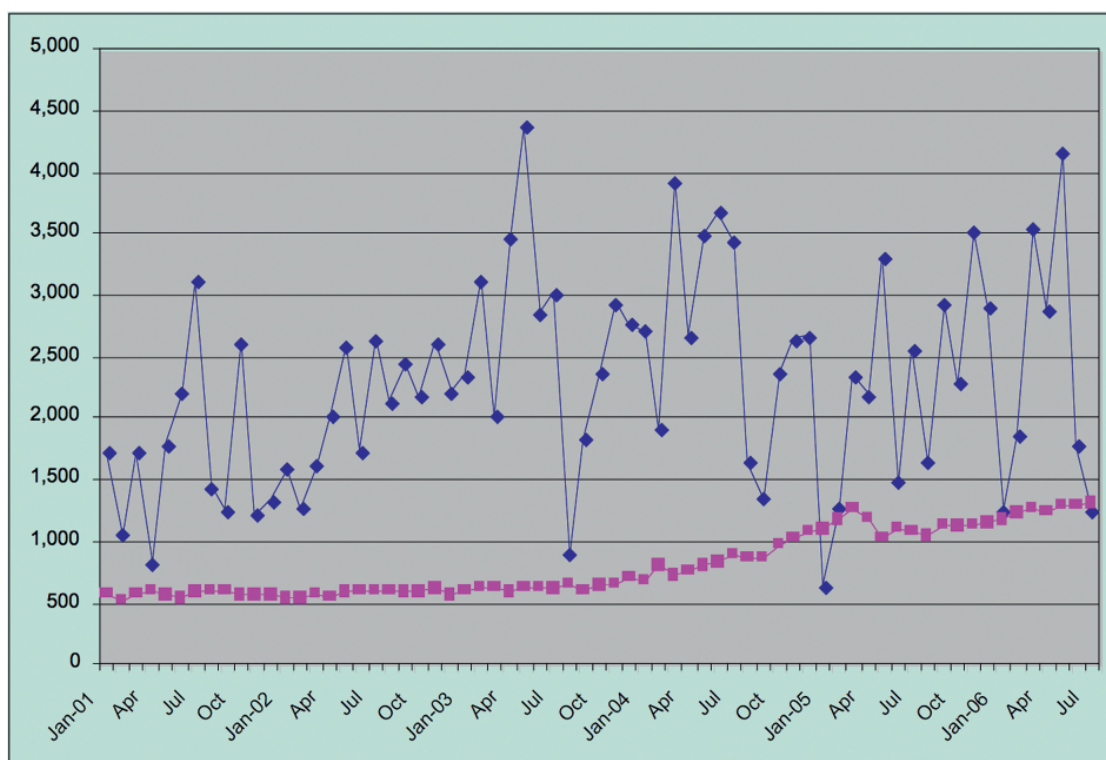


Figure 1.

Such a price rise is no minor matter for any ceramics producer, but the impact has not been felt evenly across all products. Despite its importance in the glaze, even at current prices milled zircon only contributes between 1% and 2% of the total manufacturing and distribution cost of a high quality glazed wall tile. For unglazed porcelain tiles the cost of milled zircon is an issue of greater significance. Using the data from a recently-published survey commissioned by Confindustria, the Italian ceramics industry association, in early 2006 milled zircon would have been contributing up to 10% of the cost of producing a white unglazed porcelain tile. This is because in such tiles zircon is used throughout the entire vitrified body, not merely in the surface glaze as is the case with glazed floor and wall tiles.

Given this high contribution to the manufacturing cost, it is not surprising that one of the main developments in the milled zircon market in 2006 was a noticeable shift away from its use in porcelain tile bodies. Indeed, in some of the porcelain tile

factories of southern Europe, the use of milled zircon fell from an average of about 5% by weight of the tile body to around 3% over the course of 2006. Its replacement was facilitated by the use of different mix of kaolin and white clay.

This has been one outcome of the higher prices.

A second outcome has been that more supply has been attracted on to the market. For a start, the global production of zircon sand increased by 8% between 2005 and 2006 and this happened even despite a 12 month delay in the commissioning the Douglas project, a major new Australian zircon production operation. The big increase in the supply of zircon sand in 2006 was caused by the production of zircon-rich concentrates from Indonesia. These were produced by the re-processing of the alluvial gold tailings which are found in many places in the flat former mangrove swamps which are found in the south of the Indonesian province of Kalimantan.

In addition to the increased sand supply, over the course of 2006 and the first half of 2007 the global zircon milling capacity is estimated to have increased by nearly 10%. The reason is easy to understand. As Figure 1 shows, the margins enjoyed by zircon millers have widened considerably over the last 3 or 4 years. Note that the graph shows only the margin between the import price of zircon sand and the export [rice of milled zircon. It does not account for the fact that energy prices have risen over that time, as have, more recently at least, freight rates. Nevertheless, it is true to say that the business of zircon milling has enjoyed prosperous conditions in the last few years. Inevitably, this has attracted new entrants, especially when the barriers to entry are quite low and the demand for the product very strong.

The net result of these developments has been that prices for milled zircon have levelled out. As Figure 1 shows they have in fact been flat for the last twelve months. Further price weakness is expected in the future. According to the price forecast published in TZ Minerals International's recently-published study, *The Global Zircon Industry – Outlook to 2015*, the short-term outlook is for an actual decline in prices.

2. DISTRIBUTION OF PRODUCTION CAPACITY

Prices are not the only feature of the milled zircon sector which has seen change in the last five years. The distribution of global production capacity has also undergone a marked shift, and looks set to change even more.

To begin looking at this, it may be best to start by saying that the zircon milling sector is a global industry. This is because milled zircon is a high value material, with prices well above US\$1,000 per tonne, and is widely traded. It is also dominated by large, globalised companies such as Industrie Bitossi and Endeka Ceramics.

That said, there are distinctly different regional trends in the consumption of milled zircon, and these trends have resulted in a great change in the distribution of global consumption since late the 1990s, and it seems inevitable that eventually the distribution of milling capacity will change with it. Indeed, this is already happening.

Figure 2 shows the regional consumption of zircon sand. Whilst not all zircon is milled before consumption, this distribution is nevertheless a good proxy for the distribution of milled zircon consumption.

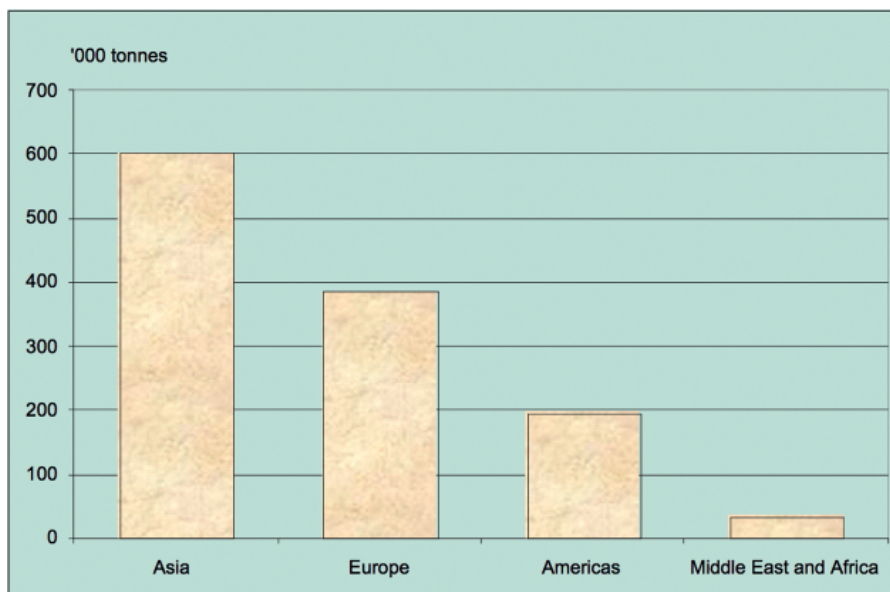


Figure 2.

The graph shows that Asia is the largest consuming region, and in 2006 it accounted for nearly half of all zircon consumed globally. Europe is in second place, accounting for about one third of global consumption in 2006. The Americas and the Middle East and Africa were smaller regional consumers.

This distribution has changed considerably since the last years of the 1990s, when it was Europe which accounted for the lion's share of global consumption. One of the main reasons for the shift has been the extraordinary growth of the Chinese ceramics sector, and to a lesser extent the growth of ceramics production in countries such as India, Indonesia, Thailand, Vietnam and Malaysia. In addition to this, the Chinese production of zirconia and zirconium chemicals has also seen rapid growth.

It is interesting to contrast the distribution of consumption with the distribution of production of milled zircon. This is shown in Figure 3.

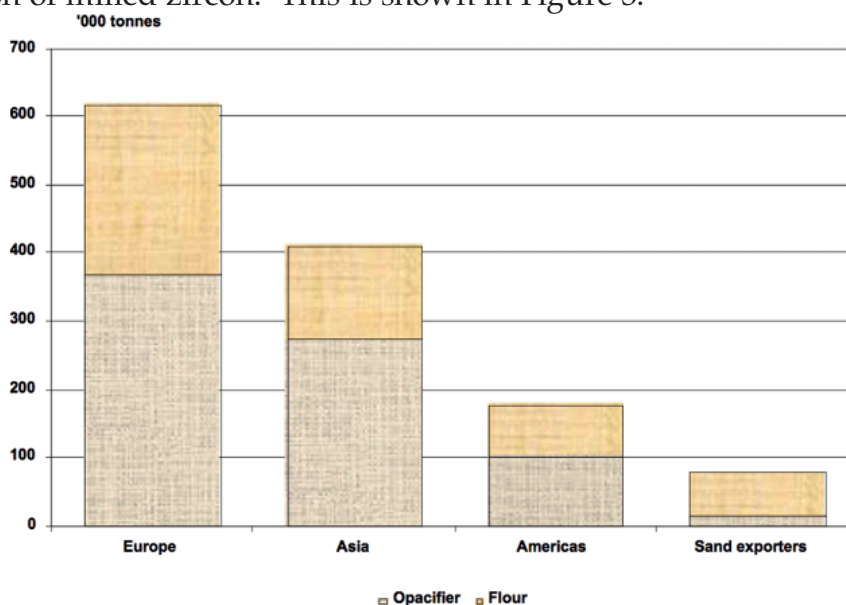


Figure 3.

As can be seen from the graph, Europe was home to over half of global production in 2006, while Asia produced about one third. This is the reverse of the consumption share. One notable aspect of the distribution of the zircon milling sector is that the major zircon sand producing countries are only very minor players. In South Africa and Australia, which together produce 70% of the world's zircon sand, there is only 70,000 tonnes of milling capacity, or 6% of the global total. Most of this is designed for flour production, a far less sophisticated product than opacifier.

This absence of milling capacity underlines two characteristics of the zircon industry:

- Zircon processing operations have tended to be established in close proximity to end-users of the processed products.
- Sand producing companies have by and large not engaged in the downstream processing of their sand, even when that downstream processing only involves milling, a technology familiar to the mining sector.

The consumption of milled zircon tends to mirror the distribution of ceramics production. Countries with a significant deficit of domestically milled zircon are China, Indonesia, India, Iran, Turkey and the ceramic producing nations of Northern Africa and Eastern Europe. TZ Minerals International estimates that in 2006 about 220,000 tonnes of milled zircon was exported either as flour, opacifier or processed intermediate products such as frits and glazes. Those countries with a surplus of milled zircon are in Europe, principally Spain, Italy, Germany and the Netherlands, and in Asia, principally Japan, Korea and Taiwan. Australia and South Africa are also significant exporters.

The main trade flows include:

- Western European flour, opacifier and processed products to Eastern Europe, the Middle East, India and Northern Africa, and China and Indonesia.
- Japanese, Korean and Taiwanese opacifier to China and other Asian countries.
- Australian flour to Korea and Taiwan.
- South African flour to Northern Africa.

It is this regional production/consumption imbalance which is placing pressure on the existing major millers, many of whom have the majority of their production capacity in Europe. They are facing the threat of hungry and nimble new players establishing milling facilities in China and elsewhere in Asia and capturing market share by virtue of a lower cost structure and a willingness to accept a lower operating margin.

Of course, the existing millers are well-equipped to take on the newcomers and can be expected to do so according to the strengths of their different business models. It may well be that the next five years sees some major restructuring in the global zircon milling sector. Consolidations, new technology, vertical integration and, above, a regional shift in the production base, are all on the agenda.

3. THE STRUCTURE OF THE GLOBAL MILLING SECTOR

In the first group, zircon milling is part of a broad portfolio of mineral processing activities. Often these companies buy unprocessed industrial minerals and act as a warehousing and processing centre, onselling the processed minerals to downstream customers. Companies in this group include:

- **Mario Pilato Blat**, which is a privately-owned enterprise which mills and trades in a wide range of industrial minerals. Its base of operations is in Valencia, Spain.
- **Grupo Guzman**, which is another privately-owned Spanish enterprise based in Valencia. Guzman has a number of operations throughout Spain, dealing with minerals, chemicals, rubber and plastics. The zircon milling is a part of the minerals business, Arenas Minerales, with two facilities located in and near the port of Castellon.
- **American Minerals**, which is a subsidiary of the privately-owned Prince Minerals, which is a US-based processor of a range of industrial minerals.
- **Hakusui Tech Co.**, an Osaka-based multinational mineral processing company specialising in zircon, zinc oxide and baryte milling.
- **Zirtile Milling**, which is a subsidiary of the South African diversified minerals house, Fer-Min-Ore Pty Ltd. Fer-Min-Ore processes and trades in a range of industrial minerals in addition to its engineering design activities.

There are many other businesses – including Eggerding and the French group, CMMP – whose zircon milling operations are part of larger groups. For all of these companies, their involvement in the ceramics business is limited mostly to supplying processed raw materials.

In the second, and much smaller, group, zircon milling is part of a broader portfolio of products and services focused on serving the international ceramics industry. Other parts of this product and service offering include the manufacture of frits and ceramic pigments, and working with ceramics producers to develop new glaze and body formulations, and new aesthetic designs for decorative tiles. These companies are often referred to as coloroficios. A feature of the coloroficios is that each of them operates a materials development centre in which are tested new glaze, body and colour formulations. Companies in this group include:

- **Gruppo Colorobbia**, which is an Italian firm privately-owned by the Bitossi family. It has milling operations in Spain, Italy, Turkey and Brazil and has recently opened a plant in China. The company produces frits, colours, glazes and alumina grinding balls in some or all of these various locations. The company also owns Inkabor, a Peruvian borate mining and processing concern. Its Colorobbia Research Centre, known as Cericol, is a leader in developing ceramic bodies, glazes and colours. The Cericol facilities are located outside of Florence, to the south of Italy's main ceramics producing area.
- **Endeka Ceramics**, formerly Johnson Matthey Ceramics, which was acquired in 2006 by the private equity group, Pamplona Capital Partners. Endeka has milling operations in Spain, Italy, China, Malaysia, India and the US. It also

produces frits, glazes and ceramic colours in most of these countries as well as in Brazil and the UK. The company operates a Ceramics Technology Centre in the town of Spezzano, in the Sassuolo-Fiorano ceramics manufacturing region of Italy.

- **Grupo Industrial Trebol**, which is based in Monterrey, Mexico and operates milling plants in Mexico, Brazil and the US. It also operates frit and colour plants in Mexico. More recently, Trebol has established a facility in Monterrey in order to work with customers in developing improved colour and glaze formulations.
- **Torrecid**, which is another large coloroficio which mills zircon and produces the full range of ceramic glazes and frits. Its operations are centred on the town of Alcora in the Spanish province of Castellon. Torrecid owns 80% of Chilches Materials, a Spanish based milling operation.

These two categories do not capture the full diversity of the milling sector. At least one company can be considered to occupy a place in both categories. Ferro Corporation operates several zircon milling facilities – including 20% of the Chilches Minerals operation in Spain - and is a coloroficio of considerable influence. It has an international reputation for innovation in ceramic pigments, and operates colour materials development centres in many of the major ceramics markets, including Spain, Italy and Brazil. Its activities are much broader than that, however, and Ferro Corporation is one of the world's leading manufacturers of advanced materials. Sales revenues for the full year 2006 were US\$2 billion.

It should be noted that not every coloroficio is engaged in the milling of zircon. Esmalglass Grupo is an example. This Spanish company, with its base of operations in Castellon, produces frits, glazes and colours and provides worldwide technical and decorative design services from its ITACA Centre in Poble Ternes, a town lying to the south of the port of Castellon. Imerys, a French industrial minerals conglomerate, is also an active participant in developing new materials and colours for the ceramics industry, especially in the formulation of porcelain tile bodies. It operates no zircon milling operations.

There is a subset of zircon millers which do not fit into either of the two categories. One of them is China Glaze. This is a publicly-owned Taiwanese group, with an opacifier milling operation in Shanghai and ceramic glaze plants in Taiwan, China and Indonesia. At present the company has no dedicated ceramic development facility and so cannot be classified as a coloroficio, but it is moving in this direction as it gains greater market share in China and throughout South East Asia.

A handful of companies are focussed solely on the zircon milling business. Included in this category are Helmut Kreutz, a privately-owned German group, and the US-based Continental Minerals. Several Chinese millers also fall into this category.

Lastly, there is a couple of milling companies with still other business models. Astron Chemicals has built what could be considered a China-based zircon business, and has interests in milling, zirconium chemical production and the manufacture of zirconia. It is seeking to develop a mineral sands operation in Australia's Murray Basin. Doral Minerals is the only integrated zircon mine-to-zirconia business in the world. It operates a mineral sands mine in Western Australia, and produces zircon flour, fused

zirconia and a range of zirconium chemicals from its plants in nearby Rockingham. It also has a longstanding interest in the development, in conjunction with its customers, of ceramic colours based on its fused zirconia products.

Opacifier milling is a fairly concentrated sector with 60% of the capacity being held by the top five producers. The coloroficios occupy three of the positions in the top five. The two largest of them – Colorobbia and Endeka – operate 40% of global capacity.

4. THE DIFFERENCE BETWEEN ZIRCON OPACIFIER AND FLOUR

The zircon flour milling sector is rather more fragmented, as befits its lower barriers to entry. The top five millers control 36% of global capacity. Once again the coloroficios are amongst the largest companies, but Colorobbia and Endeka own less than 20% of global capacity.

When zircon is produced as a sand product from mining and concentrating it is in a form which is too coarse for many of the uses to which it will ultimately be put. The median particle size (i.e. the 50% passing size) for sand is often in the range 110 to 130 microns, and 80% of the particles typically lie between 70 and 200 microns. In this size range zircon is a slightly pink coloured sand, as shown in Figure 2. Sand with this size range can be used as a feedstock to a fused zirconia or a zirconium chemical plant, as foundry sand or can be used directly in the manufacture of some refractories. For other purposes, however, this size range is far too coarse, and has too wide a distribution.

To render zircon useful for many of its applications it is necessary to reduce the average particle size range and also to narrow the distribution. Some examples of the target size range for different applications are shown in Table 1.

APPLICATION	PRODUCT CLASSIFICATION	95% PASSING	MEDIAN SIZE
		micron	
Frits for ceramic glazes	Flour	45	30 - 40
CRT glass manufacture	Flour	45 - 75	35 - 45
Opacifier for glazed tiles and gres porcellanato	Opacifier	5.0	0.9 - 1.0

Table 1. Zircon size range for different applications

As can be seen from the table, zircon flour is very much coarser than opacifier. The production of flour is relatively straightforward, whereas the production of opacifier tends to be the preserve of fewer companies.