1. Overview

Zircon is crystal and shows a structure of the quarter column. It usually occurs with ilmenite, rutile, monazite and xenotime etc. in beach sand and is refined by water, electricity and magnetic beneficiation process. Its theoretical composition is: ZrO2: 67.1%; SiO2: 32.9%.

1.1 Properties

Pure zircon is a colorless and translucent crystal. It appears yellow, orange, red, and brown with different origins and impurities. Its hardness is 7.8, specific gravity 4.6-4.71, refractive index 1.93-2.01 and melting point at 2550 °C.

1.2 Applications

Zircon sand can be used in ceramics, refractory, foundry, electronics, zirconium compounds and other fields. Another important application is the preparation of nuclear reactor structural materials and the control rod with zirconium and hafnium as irreplaceable raw materials, making it an important strategic material.

1.2.1 Ceramics

As a major end-user, zircon sand is used as glaze emulsion in ceramics (such as glazed floor tiles, wall tiles, sanitary ware, tableware). The consumption for zircon sand in ceramics increases to 500,000tons in the end of last century from 100,000tons in the early 1980s, and it equivalent to the annual growth rate of 5%. The consumption reached 600,000tons in 2008 and the ceramics becomes the largest consumer of zircon sand. The demand for zircon sand in ceramics is mainly boosted by fast-emerging production of ceramics tiles in China and Brazil.

1.2.2 Refractory

Refractory mainly use zircon sand and zirconia. The consumption in refractory accounts for a considerable proportion in the 20th century, and it dropped to 158,000 tons in 2000 and accounts for about 15-16%. In 2008, the consumption reached 180,000tons, and it
primarily increases or decreases with the output of steel.

1.2.3 Foundry

The consumption of zircon sand basically stabilizes at 155,000-160,000 tons annually in foundry, which is mainly in Europe, the United States and China (the leading producer of foundry in the world). The United States is the largest consumers of zircon sand in foundry with the annual consumption of 55,000-60,000 tons, followed by Europe with the consumption of 40,000-45,000 tons.

1.2.4 TV glass

As television and computer display panel glass active ingredient, zircon sand is primarily used to absorb the UV rays from cathode ray tubes. The consumption has increased to 80,000 tons in 2000 from 70,000 tons in 1997, and it is expected to reach 100,000 tons in 2010. TV glass screen production in Asia accounts for 90% of the world and the consumption of zircon sand in this region accounts for 80-85% of the total consumption of the world in this field.

1.2.5 Zirconia and zirconium chemicals

Zircon sand is raw materials of zirconia and zirconium chemicals and the consumption in this field also shows the trend of growth with close to 85,000 tons in 2000 and 115,000 tons in 2008.

1.2.6 Others applications

With the construction of nuclear power plants in China and the resumption of building nuclear power plants in the United States, the consumption for zircon sand will have substantial growth in nuclear power, but not large in total.

2. Distribution

Zircon sand mainly centralizes in Australia, Richards Bay Deposit area in South Africa, Florida in the United States, as well as Mozambique in Africa, Indonesia, Vietnam and India. At present, the annual output of zircon sand is 125-130 million tons in the world.
2.1 Distribution around the world

<table>
<thead>
<tr>
<th>Country</th>
<th>Capacity (ton)</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>460,000</td>
<td>35.38%</td>
</tr>
<tr>
<td>South Africa</td>
<td>430,000</td>
<td>33.08%</td>
</tr>
<tr>
<td>The United States</td>
<td>180,000</td>
<td>13.85%</td>
</tr>
<tr>
<td>Indonesia</td>
<td>100,000</td>
<td>7.69%</td>
</tr>
<tr>
<td>China</td>
<td>20,000</td>
<td>1.54%</td>
</tr>
<tr>
<td>Other Countries</td>
<td>110,000</td>
<td>8.46%</td>
</tr>
</tbody>
</table>

![Zirconium sand distribution in the world](image)

2.2 The major producers of zircon sand

2.2.1 Australia

Australia is the largest zircon sand producer in the world and accounts for more than 1/3 market share in the world. Iluka Resources Ltd. and Tiwest Joint Venture are two leading producers in Australia.

**Iluka Resources Ltd.**

Iluka is the largest producer of zircon sand in the world and also China's biggest supplier of zircon sand. It is engaged in mining work at Australia and the United States. It has nine mines in Australia and two mines in the United States. WA Titanium Minerals, a subsidiary...
company of Iluka, operates six mines in Western Australia, that is, North West Mine in W.A. Cape region; North Mine, Newman concentrato, South Mine in Eneabba region; Yoganup Extended in Yoganup region as well as Busselton mines in W.A. southwest.In the East Australia, North Stradbroke Island and Queensland is operated by Consolidated Rutile Ltd. (CRL) company, and Iluka company has the dividends of 48.9%.

In the United States, Iluka has two mines, that is, Green Cove Springs locates in Florida and Old Hickory locates Stony Creek, Virginia.

**Tiwest Joint Venture**

Tiwest is a producers of ilmenite, zircon sand and titanium dioxide. It has an output of 80,000-90,000 tons for zircon sand.

### 2.2.2 South Africa

South Africa is the second largest producer of zircon sand in the world and accounts for about 1/3 of the total world market share. The leading producers are Richards Bay Minerals (RBM) and Namakwa Sands Limited in South Africa.

**Richards Bay Minerals (RBM)**

Richards Bay Minerals is joint-venture owned by Australia and the United States. It mainly produces titanium slag and can produces 250,000 tons of zircon sand annually.

**Namakwa Sands Limited**

Namakwa is owned by the United States and has a capacity of four million tons of ore annually. The plan production capacity of zircon sand is 60,000 tons.

### 3. Zircon sand market review in 2008

#### 3.1 Import market

China mainly import zircon sand from Australia, Indonesia, South Africa, and Vietnam in 2008. The total import volume of zircon sand increases compared with that last year. In 2008, the imported volume of Indonesian zircon sand showed a great decline with more
than 50%

Australian zircon sand output accounts for more than 1/3 of the total world output and its price basically lead the global zircon sand price. In the third quarter of 2008, Iluka, Australia's largest zircon sand producer, increased the prices of zirconium concentrates by USD50-70/t to USD880-920/t CIF China, and suppliers from other countries also adjusted up the prices of zircon sand accordingly.

### 3.1.1 Import volume

China imported 511,892 tons of zirconium ores and concentrates in 2008, up by 9.84% compared with 466,054 tons in 2007. The import amount was 406 million US dollars, up by 26.09% compared with that 322 million US dollars in 2007.

The details are as follow:

![Zirconium ores and concentrates import in 2007 and 2008](chart)

### 3.1.2 Import countries and regions

Australian zircon sand accounts for 61% of total import volume in 2008, up by 46% compared with that in 2007. Indonesian zircon sand accounts for 13%, down by 57% compared with that in 2007. South African zircon sand accounts for 17%, up by 63% and Vietnamese zircon sand accounts for 4%, nearly the same with that in 2007.
Zirconium ores and concentrates import in 2008 (Unit: Kg)

<table>
<thead>
<tr>
<th>Country</th>
<th>2007</th>
<th>2008</th>
<th>Up/down</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>214,732,326</td>
<td>313,108,566</td>
<td>45.81%</td>
</tr>
<tr>
<td>Indonesia</td>
<td>150,930,064</td>
<td>65,004,670</td>
<td>-56.93%</td>
</tr>
<tr>
<td>South Africa</td>
<td>52,564,603</td>
<td>85,676,466</td>
<td>62.99%</td>
</tr>
<tr>
<td>Vietnam</td>
<td>21,746,075</td>
<td>21,845,134</td>
<td>0.46%</td>
</tr>
<tr>
<td>Other countries</td>
<td>26,081,336</td>
<td>26,257,310</td>
<td>0.67%</td>
</tr>
</tbody>
</table>

### Zirconium ores and concentrates import chart in 2008

- **Australia**: 61%
- **Indonesia**: 13%
- **South Africa**: 17%
- **Vietnam**: 4%
- **Other countries**: 5%

#### 3.1.3 Import prices

In the first half of 2008, the prices of Australian zirconium concentrates kept at USD800-850/t CIF China. In the second half of 2008, the import prices of zirconium concentrates increased by USD50-70/t to USD880-920/t CIF China. The prices of South Africa zircon concentrates are usually USD20-30/t lower than that of the Australian zircon concentrates prices. Indonesia zirconium concentrate prices was at USD850/t CIF China.

#### 3.2. Domestic market

##### 3.2.1 Output

Chinese origin zircon sand bases mainly locate in Wenchang and Wanning in Hainan province and Zhanjiang in Guangdong province. The total output of zircon sand is around 20,000 tons annually. Processing capacity of raw zirconium ores is 40,000-50,000 tons.
annually. The zirconium concentrates have better quality in Wenchang than that in Wanjong and Zhanjiang. With high radioactivity, Chinese origin zircon sand is not fit for raw materials of exported-oriented zirconium products.

### 3.2.2 Prices

The prices of zircon concentrates in China are mainly affected by the adjustment of Australian zircon sand as well as the demand from downstream markets. In 2008, the prices of Hainan zircon sand fluctuated in the range of RMB5,900-6,000/t and reached the peak in August driven by the increased prices of Iluka in the third quarter. The economic crisis and shrinking demand from downstream customers resulted in the declining of Hainan zircon sand prices in the rest of months.

The details are as follow:
4. Outlook for zircon sand market

4.1 Demand

According to statistics, world consumption of zircon was about 1.25Mt in 2006. Analysts thought overall growth in demand was likely to continue at around 3.8%py to reach just over 1.5Mt by 2011. However, the economic crisis in the second half of 2008 touches every corner, which makes the demand for zircon sand slow down, and it is expected that the global consumption for zircon sand will be maintained at 1.25-1.30 Mt in 2009.

Chinese consumption for zircon sand will still be the top in the world and is about 300,000 tons annually, mainly in ceramics, refractory and zirconium chemicals.

4.2 Price

It is predicted that it is difficult for the prices of zircon sand to rise up greatly in 2009 due to the oversupply and shrinking demand. However, it is possible for the prices to go up slightly if several major producers monopolize the market and manipulate prices.

In addition, there are some new zircon sand mining projects in progress in Australia, Mozambique, Gambia, Madagascar, Canada, India, Russia, Senegal and South Africa. In total these projects may represent around 250kt of new zircon supply in 2009. The impact of these new zircon-producing projects is that the oversupply will continue and prices are therefore forecast to decline to around USD450/t by 2011.