

INDUSTRY OVERVIEW

The information provided in this section and elsewhere in this prospectus relating to the PRC is derived from various government and private publications or obtained from communications with various PRC Government agencies. This information has not been prepared or independently verified by the Company, the Underwriters, the Sponsor or their respective advisers. The information may not be consistent with other information compiled within or outside the PRC or other information contained elsewhere in this prospectus. Unless otherwise stated, statements regarding the PRC do not apply to Hong Kong, Macau or Taiwan.

INTRODUCTION TO ZIRCONIUM

Zirconium is a metallic chemical element and is one of the transition elements with chemical symbol “Zr” and atomic number 40. It is grouped together with titanium (atomic number 22) and hafnium (atomic number 72) in Group IV B of the periodic table. The consequent similarity in the chemical and physical properties of these elements is because all these three elements have the same number of valence electrons. Zirconium is a very strong, malleable, ductile, lustrous silver-grey metal. Minerals containing zirconium were discovered by Martin Heinrich Klaproth in 1789 whilst pure zirconium was first manufactured by Van Arkel and De Boer in 1925.

Zirconium chemicals are extracted from commercial ores and concentrates, most commonly in the form of zircon sand and less commonly in the form of baddeleyite. Zirconium is found in at least twenty other mineral types, either as a silicate or an oxide. The following table shows the nine most common zirconium-containing minerals. Of these, only baddeleyite and zircon sand are presently of commercial significance due to their relatively high content of zirconium oxide.

Mineral types	Content of ZrO₂ (%)
Zircon	34.0-67.0
Baddeleyite	59.0-98.9
Catapleite	30.50-31.5
Elpidite	19.8-20.3
Eudialyte-eucolite	2.0-30.0
Polymignite	28.7-29.1
Rosenbuschite	19.8
Wohlerite	15.6-17.6
Zirkelite	50.9-51.7

Source: Industrial Minerals and Rocks (6th Edition), Soc. for Mining, Metallurgy, and Exploration, Inc., 1994

INDUSTRY OVERVIEW

Zircon sand is the primary raw material used in the production of other zirconium compounds. Initially, grades of zircon sand were distinguished simply as “standard” or “premium”, which referred principally to the iron oxide (Fe_2O_3) content of the product. Low iron zircon sand (typically less than 0.06% of Fe_2O_3) is classified as premium grade. Because of the multiplicity of applications of zirconium chemicals, producers of zircon sand tend to produce specific quality of zircon sand for every application. Therefore, a greater variety of zircon sand grades are now offering to suit consumers’ requirements and also to reflect the natural quality of zircon sand products. Recently, there has been a growing tendency to distinguish zircon sand grades according to their major applications, being primarily ceramic, refractory and foundry applications. Zircon sand always contains hafnium in association with zirconium, typically in a ratio of around 1 to 50, which can be found in crystal igneous metamorphic and sedimentary rocks.

ZIRCONIUM CHEMICALS AND THEIR USES

Zirconium is highly resistant to heat and corrosion. There is a wide range of zirconium chemicals for use in many commercial applications. Some are also traded as intermediate materials for further processing of other zirconium chemicals. According to *The Economics of Zirconium 2001*, the worldwide capacity for the manufacture of zirconium chemicals is approximately 65,000 tonnes per year, of which zirconium oxychloride and zirconium carbonate accounted for over 60%. Both zirconium oxychloride and zirconium carbonate are the principal intermediate products for the production of other zirconium compounds. The following table summarises the applications of certain major zirconium chemicals:

Types of zirconium chemicals

Zirconium oxychloride

Zirconium basic carbonate

Ammonium zirconium carbonate

Zirconium basic sulphate

Zirconium acetate

Zirconium nitrate

Zirconium hydroxide

Zirconium potassium hexafluoride

Zirconium octoate

Aluminium zirconium chlorohydrate

Zirconium sulphate

Commercial applications

intermediate chemicals for the manufacture of other zirconium chemicals, pigments, coating and catalysis

intermediate chemicals for the manufacture of other zirconium chemicals, paint driers and antiperspirants

food packaging and printing inks

intermediate chemicals for the manufacture of other zirconium chemicals, pigments and tanning

waterproofing and flame proofing

catalysis

pigments

flame proofing

paints, ink driers

antiperspirants

leather tanning, pigments and filler coating

Sources: Roskill

INDUSTRY OVERVIEW

ZIRCONIUM ORES AND CONCENTRATES

World supply of zirconium ores and concentrates

Zirconium minerals are produced and consumed in the form of the silicate mineral, zircon. The world's production of zircon sand is abundant. World production of zircon sand exceeded 1 million tonnes in 2000. Some of the zircon sand is used for the production of zirconia, zirconium metal and zirconium chemicals. According to Roskill Information Services Limited ("Roskill"), a UK company focusing on metals and mineral research, it is estimated that approximately 55,000 tonnes of fused zirconia and 4,000 tonnes of zirconium metals are produced annually.

The principal producing countries of zirconium minerals are Australia, South Africa and the US, which together account for more than 87% of the world production. The following table sets forth the production of zirconium minerals by the producing countries in the world:

World production of zirconium minerals, 1988 to 2000 ('000 tonnes)

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Australia	521	538	491	309	317	413	462	540	487	414	437	356	378
Brazil	18	33	20	19	17	13	17	16	16	19	20	29	30
China	18	17	17	16	13	10	7	10	12	16	15	15	15
India	17	17	18	18	18	20	22	19	21	14	20	19	19
Indonesia	n/a	3	3	3	3	3	3	2	2	n/a	n/a	n/a	n/a
Kazakhstan	–	–	–	–	–	–	–	–	–	2	3	3	3
Malaysia	26	19	4	6	3	2	2	4	5	4	4	3	2
Russia	(a)	(a)	(a)	(a)	3	3	3	3	5	6	6	6	6
South													
Africa	146	156	168	216	237	236	222	248	316	302	277	320	336
Sri Lanka	4	–	–	–	–	–	22	22	16	12	9	–	–
Thailand	5	1	–	3	2	1	n/a	–	n/a	–	–	–	–
Ukraine	(a)	(a)	(a)	(a)	75	70	65	60	55	65	65	65	65
US	115	118	102	103	108	105	114	115	117	123	152	190	195
USSR	85	85	85	65	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)
Vietnam	–	–	–	–	–	–	1	2	1	3	–	–	–
Total	955	987	908	758	796	876	940	1,041	1,053	980	1,007	1,006	1,049

Source: Roskill

Note: (a) Production in Russia and the Ukraine reported as the USSR prior to 1992.

Over the past two decades, there have been significant changes in the geographical distribution of zircon sand production. Most obvious is the decline in the total market share held by Australia. In 2000, Australia produced 378,000 tonnes of zirconium ores and concentrates. This is considerably below the peak level of approximately 540,000 tonnes seen in 1989 and again in 1995. According to Roskill, there are considerable heavy mineral resources delineating around the world and a number of projects planned and underway which will increase the available zircon sand capacity by 333,000 tonnes per year in the future. The next major new sources of zircon sand are located in Africa. Nevertheless, Australia is still the largest producing country of zirconium ores and concentrates in the world.

INDUSTRY OVERVIEW

As output from Australia started to decline in 1996, South Africa has emerged to be one of the major suppliers of zircon. South Africa's position as a producer has been further strengthened by the development in the mid-1990s of the Namakwa Sands project, which has an annual capacity of 140,000 tonnes per year of zircon.

International trade in zirconium minerals

The major consuming market regions are Western Europe, the US, the PRC and Japan. Of these regions, only the US has significant domestic production. Consequently, the trading of zirconium ores and concentrates mainly originated from these producing countries. In fact, most of the Australian and South African zircon sand mined are exported. The following table illustrates the trade flows in zirconium ores and concentrates from Australia, South Africa and the US to the principal consuming countries from 1993 to 2000:

Trade flows in zirconium ores and concentrates, 1993 to 2000 ('000 tonnes)

	1993	1994	1995	1996	1997	1998	1999	2000
Australia to								
China	12	36	33	23	21	47	79	91
France	20	30	39	27	35	27	22	29
Italy	65	85	95	61	66	65	47	62
Japan	77	99	118	81	65	62	51	51
The Netherlands	15	55	33	58	19	13	17	20
Spain	n/a	11	20	28	45	40	22	43
UK	19	9	7	18	9	22	13	15
US	35	45	51	47	26	30	24	32
Others	144	128	119	83	56	84	99	29
Total	387	498	515	426	342	390	374	372
	1993	1994	1995	1996	1997	1998	1999	2000
South Africa to								
China	16	32	41	46	35	31	31	40
Italy	23	22	38	45	47	56	57	61
Japan	31	28	26	23	18	9	17	31
Spain	28	25	35	48	47	50	79	66
UK	12	14	26	34	39	26	21	15
US	32	36	39	47	35	57	29	29
Others	35	39	70	80	89	71	58	56
Total	177	196	275	323	310	300	292	298

INDUSTRY OVERVIEW

	1993	1994	1995	1996	1997	1998	1999	2000
US to								
Canada	3	6	10	9	6	7	4	7
Germany	15	6	9	8	3	1	4	1
Italy	n/a	n/a	n/a	n/a	n/a	6	17	23
Mexico	9	9	9	5	4	7	4	15
Others	9	13	15	14	32	20	40	28
Total	<u>36</u>	<u>34</u>	<u>43</u>	<u>36</u>	<u>45</u>	<u>41</u>	<u>69</u>	<u>74</u>

Source: Roskill

Notes: Figures in italics are estimates based on recorded imports

Australia has consistently been the world's largest exporter of zircon sand. Exports reached 470,000 tonnes to 480,000 tonnes in 1988-89 and reached similar levels in the period 1995-96, peaking at 515,000 tonnes in 1996. However, due to declining production, increased competition and lower demand from consuming markets, recorded exports from Australia declined to approximately 370,000 tonnes per year in 1999 and 2000.

Until the mid-1990s, Japan was the largest market for Australian zircon. Since 1997, however, Western European markets have replaced Japan as Australia's largest export customer, with the major ceramic-producing country, Italy, being the largest importing country in the region.

Since 1993, China has become a major market for Australian zircon sand due to the rapid growth in the production of ceramic tiles using zircon sand-based opacifying glazes. In 1999, China became the largest importer, accounting for 79,000 tonnes. In 2000, China imported a total of 91,400 tonnes of zircon sand from Australia.

South African exports of zirconium ores and concentrates are estimated to have totalled almost 300,000 tonnes in 2000. The major markets are Italy, Spain, the US and China. The above data for South African exports includes baddeleyite, which until recently has accounted for 15,000-20,000 tonnes of the total. Baddeleyite exports are estimated to have declined to less than 10,000 tonnes by 2000.

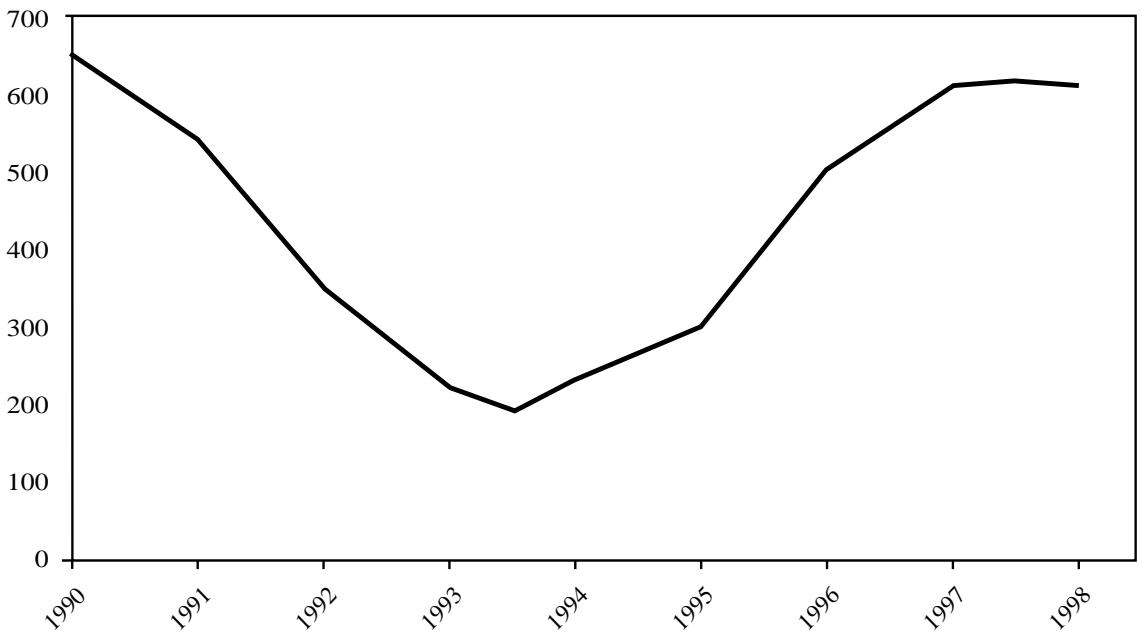
As mentioned above, the US is one of the principal zircon sand producers, it is also a major market for Australian zircon. Until 1999, the US was a net importer of zirconium ores and concentrates. The recent increase in US production meant exports exceeded imports in both 1999 and 2000.

INDUSTRY OVERVIEW

Price of zirconium ores and concentrates

Historically, Australia has dominated the production of zircon sand since the commencement of zircon sand production in the late 1940s. Due to Australia's overwhelming position as a producer of zircon sand during this period, prices for zircon sand were almost universally set in Australian dollars. The following graph sets forth the movements in the average annual zircon sand price for Australian zircon sand exports from 1990 to 1998:

Price of zircon sand, 1990 to 1998 (A\$/tonne)



Source: *Zircon Sand to 2005*, TZMI

Zircon sand has experienced a relatively turbulent price history. In the early 1990s, zircon sand prices declined sharply as consumption in major markets dramatically declined due to the worldwide recession. As a consequence, zircon sand prices declined to new historical lows in real terms, with the lowest level reached in mid-1993, at prices of A\$160-200 per tonne.

1993 also witnessed the commencement of rapid growth in consumption of zircon sand in China. Over a period of two years, this considerable increase in demand turned a serious over-supply into a looming shortage. At the same time as demand in China grew at unprecedented rates, consumption of zircon sand in other countries in the Asia-Pacific region also increased and there was also strong growth in demand from the traditional zircon sand consuming markets in southern Europe. This situation led to a sustained increase in the price of zircon sand from mid-1993 until early 1997, when prices again peaked at over A\$600 per tonne for bulk material.

INDUSTRY OVERVIEW

From their peak in early 1997, zircon sand prices gradually eased due to a moderation in the growth of consumption, particularly in China and, to a lesser extent, in southern Europe. This led to some increase in producer stocks and a consequent easing of price levels. The Directors believe that in the longer term, the development of new zircon sand operations in Australia and South Africa should lead to a slight over-supply, and prices may stabilise in the range of US\$340-350 per tonne for bulk material.

World consumption of zirconium ores and concentrates

World zircon sand consumption is estimated to have totalled almost 1 million tonnes in 2000. On a regional basis, the major consuming markets for zircon sand are Asia and Europe, which together accounted for over 70% of the world total demand. The largest zircon-consuming region is Asia, which Roskill estimated to have accounted for over 360,000 tonnes in 2000. This total is divided between China, consuming approximately 150,000 tonnes, Japan, approximately 88,000 tonnes and other Asian countries, approximately 131,000 tonnes. Europe consumed approximately 350,000 tonnes of zircon sand in 2000, representing approximately 35% of the world total. Northern America is estimated to have consumed approximately 195,000 tonnes per year of zircon. The other significant zircon-consuming region is Latin America, which is estimated to have consumed a further 80,000 tonnes per year. The following table sets forth the consumption of zircon sand by major geographic regions from 1995 to 2000:

World consumption of zircon sand by region, 1995 to 2000 ('000 tonnes)

	1995	1996	1997	1998	1999	2000
Europe	329	326	321	334	340	348
North America	170	180	191	186	191	195
Japan	115	106	93	79	83	88
China	125	128	119	117	131	150
Other Asia	112	121	111	106	118	131
Other	69	70	70	76	78	87
	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>
Total	<u>920</u>	<u>931</u>	<u>905</u>	<u>898</u>	<u>941</u>	<u>999</u>

Source: Roskill

INDUSTRY OVERVIEW

ZIRCONIUM INDUSTRY IN THE PRC

The zirconium industry in China was in its infant stage in the 1970s. The zirconium industry grew with the Chinese economy in the past three decades. Consumption of zircon sand in China increased strongly during the 1990s due to rapidly increasing demand from the ceramics industry. The demand for zircon sand in China increased from under 15,000 tonnes in 1990 to approximately 150,000 tonnes in 2000. In 1999 and 2000, China's consumption of zircon sand was approximately 131,000 tonnes and 150,000 tonnes, respectively, which accounted for approximately 14% and 15% respectively of the total world consumption. The ceramics industry was believed to account for over one-half of the total demand, with refractories and the production of zirconium chemicals accounting for most of the remainder. As the demand for zircon sand far exceeds the supply of zircon sand, most of the demand for zircon sand is met by imported material. Imports were reported to be 161,000 tonnes in 2000, compared with 11,000 tonnes in 1990, which were principally imported from Australia and South Africa. The following table shows the details of imports of zirconium ores and concentrates from 1997 to 2000:

Imports of zirconium ores and concentrates in China, 1997 to 2000 ('000 tonnes)

	1997	1998	1999	2000
Australia	20.9	47.4	78.6	91.4
South Africa	35.0	31.4	30.9	40.3
Others	26.1	19.8	21.2	29.3
Total	<u>82.0</u>	<u>98.6</u>	<u>130.7</u>	<u>161.0</u>

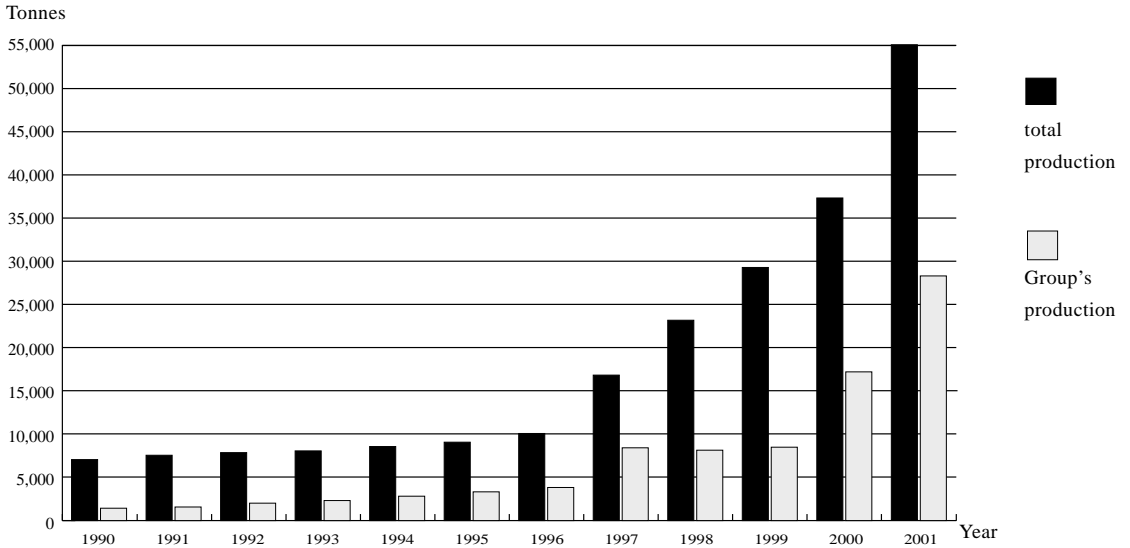
Source: Roskill

At present, China is one of the most important zirconium chemicals manufacturing countries both in Asia and worldwide. Most of the overseas zirconium compound manufacturers gradually decreased their scales of production because of the comparatively high production costs involved and stringent environmental controls imposed by foreign governments. The relatively low cost of production and abundant chemical supplies benefit the zirconium industry in China. As a result, the manufacturers of products containing zirconium heavily depend on producers in China for the supply of zirconium chemicals.

According to Roskill, there is considerable capacity for the production of zirconium oxychloride in China, amounting to over 70% of the total world capacity. Much of the Chinese production is exported to Japan and Japan is now heavily reliant on China for supplies of zirconium oxychloride.

INDUSTRY OVERVIEW

At present, there are more than ten zirconium chemical manufacturers in the PRC with an aggregate annual production capacity of approximately 29,000 tonnes. Set out below is a chart summarising the production of zirconium chemicals in China during the period from 1990 to 2001:



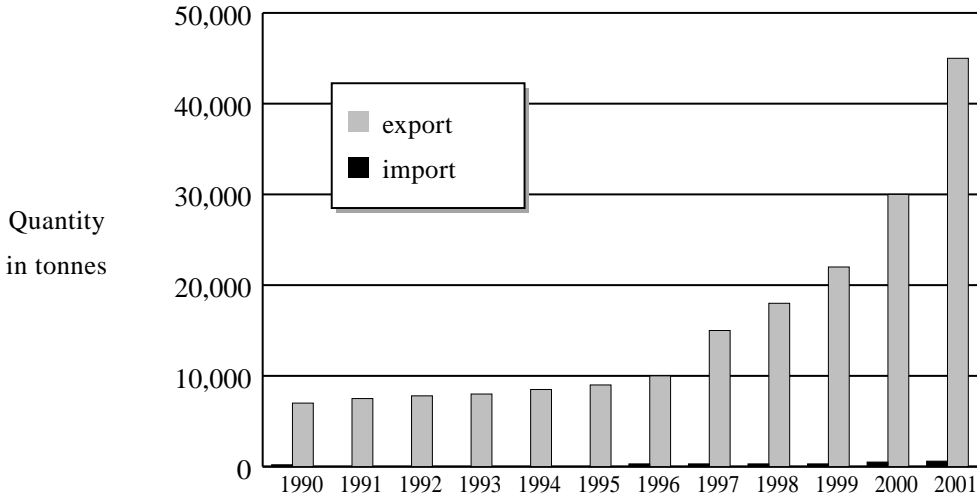
Source: *The Nonferrous Metals Society of China* (中國有色金屬學會)

Import and export

Most of the zirconium chemicals produced in China are for export purposes whereas internal consumption only accounts for an insignificant portion of the total production of zirconium chemicals in China. The trend of increasing exports is in line with the increase in the production of zirconium chemicals over the past ten years.

INDUSTRY OVERVIEW

In 2001, the PRC exported approximately 45,000 tonnes and imported 600 tonnes of zirconium chemicals (for the manufacture of high-tech ceramic products). Set out below is a chart summarising the import and export of zirconium chemicals (for the manufacture of high-tech ceramic products) in the PRC during the period from 1990 to 2001:



Source: *The Nonferrous Metals Society of China* 中國有色金屬學會