CLSA EMERGING MARKETS

3 May 2000

2K/05037

Yixing Xinwei – HK$0.95 BUY

The rare necessities

As China's first private business to be listed in Hong Kong, Yixing Xinwei offers a rare opportunity for investors to share the fruits of China's private entrepreneurial development. The company has two product lines: rare earth products (widely used by IT companies, automobile and chemical industries and representing two thirds of sales) and high-grade refractory materials (of which it is the sole supplier, ensuring it a full order book for the year). Trading at 5x FY01CL EPS against our estimated EPS Cagr of 24.4% between 00-02CL and 1.5x FY01CL P/B against its sustainable ROE of 32%, the stock is hugely undervalued. We estimate the stock's fair value to be 10.0x FY02CL EPS or 3.5x FY02CL P/B. Our 18-month price target is HK$3.12 to HK$3.50.

- Rare earth materials are widely used by both IT/ electronics and traditional sectors, with China accounting for 80% of global rare earth ore reserves and 85% of production. Yixing Xinwei has emerged as one of the largest rare earth processors in China thanks to its consistent high quality of products, efficiency and economies of scale.

- Now widely used by heavy industries, demand for top-grade refractory materials is growing fast in China. As the sole supplier of top-grade refractory materials such as RH steel furnace bricks, Yixing Xinwei's order books are full this year and the next.

- The company's new workshops, slated for completion by June 2000, will double its refractory materials capacity to 60,000 tons and increase its rare earth processing capacity by 40% to 4,900 tons. Price surges for its four major rare earth products and volume growth brought about by capacity expansion will enable the company to enjoy robust earnings growth.

- Once current capacity expansion is completed, the company will pursue a vertical integration strategy to grow shareholder value. With a sustainable ROE of 32%, the stock should trade at 10.0x forward earnings and 3.5x P/B. Our 18-month price target is HK$3.12-3.50.

EARNINGS FORECAST

Year to 31 Dec	98A	99A	00CL	01CL	02CL
Revenue (HK$m)	420	448	620	767	885
Net profit (HK$m)	62	81	127	157	188
EPS (HK¢)	13.8	16.7	21.2	26.2	31.3
EPS (% YoY)	13.6	21.3	26.8	23.7	19.4
PEx(@HK$0.95)	6.9	5.7	4.5	3.6	3.0
P/FCF (x)	7.6	8.3	3.0	4.7	3.0
DPS (HK¢)	3.9	4.9	5.9	6.9	7.9
Yield (%)	4.1	5.2	6.2	7.3	8.3
CLSA/consensus (x)			1.04		

VALUATION MEASURES[1]

Year to 31 Dec	98A	99A	00CL	01CL	02CL
Earnings yield-RFR (%pt)[2]	6.7	9.8	14.6	19.9	25.2
ROAE (%)	67.8	38.2	36.6	35.8	34.0
EVA™/cap employed (%)	9.9	4.1	5.5	10.9	16.8
EntVal/EBITDA (x)	4.3	3.3	2.0	1.5	1.1
Price/book (x)	3.6	1.5	1.5	1.2	0.9
PE relative to index (x)	0.3	0.3	0.4	0.4	0.3

[1]See Appendices for definitions, methodology and rationale
[2]Risk-free rate = 7.8%

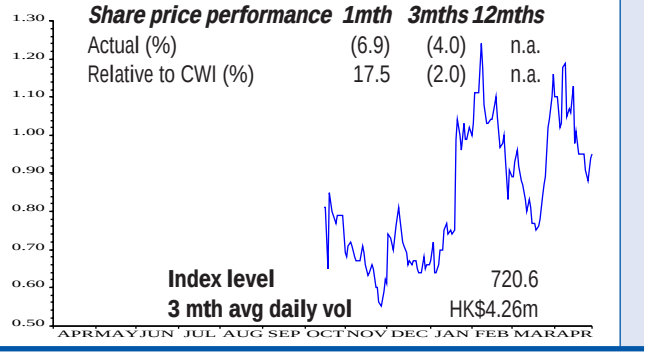
KEY EARNINGS DRIVERS

Year to 31 Dec	98A	99A	00CL	01CL	02CL
Rare earth sales (ton REO)	2,862	3,000	3,608	4,181	4,591
Wtd avg price (Rmb'000/ton REO)	86.8	91.2	99.2	103.9	106.2
Sales of refractory mat ('000 ton)	18.2	23.0	35.0	45.4	54.4
Wtd avg price (Rmb'000/ton)	7.2	6.3	6.5	6.5	6.5

KEY DATA

12 month high/low	HK$1.24/0.75
Market capitalisation	HK$570.0m (US$73.3m)
Shares in issue	600.0m
Major shareholder	YY Hldgs (75.0%)
Estimated free float	25.0%

DAILY SHARE PRICE CHART (HK$)



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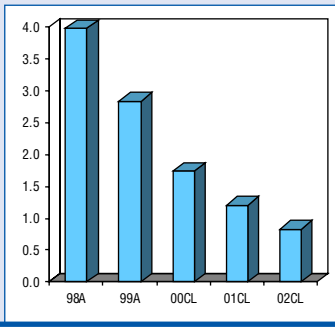
e-mail : **huangc@clsa.com**

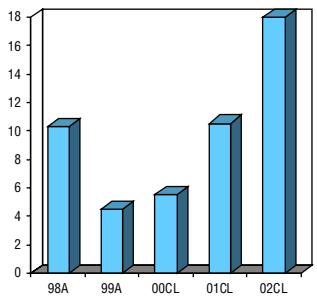
Reuters 0769.HK
Bloomberg 769 HK

PICTURE THIS . . .

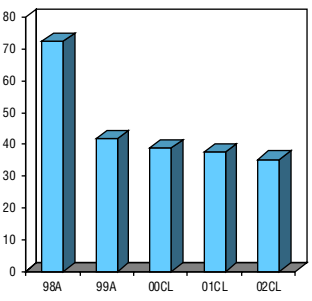
EntVal/EBITDA (x)



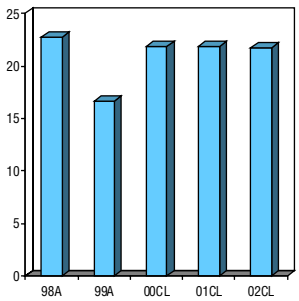
EVA™/cap employed (%)



ROE (%)



ROCE (%)



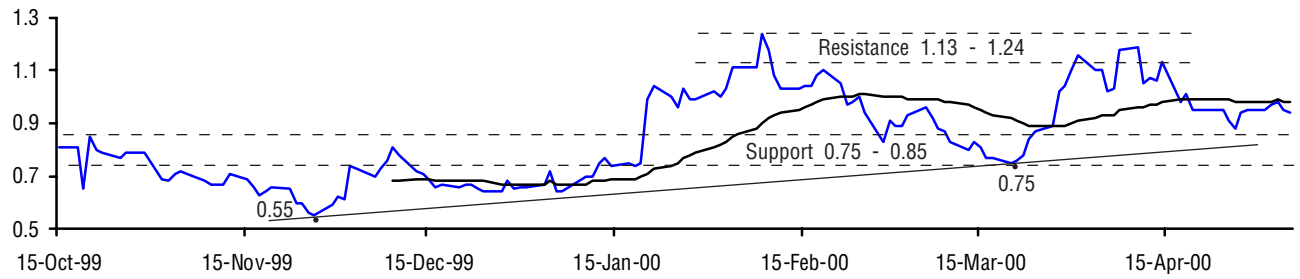
STRESS TEST ®

As at 31 December	*1997A*	*1998A*	*1999CL*	*2000CL*	*2001CL*	*2002CL*
Net debt(cash)/equity ratio	(93.93)	(27.97)	24.18	28.04	29.53	26.91
Net debts(cash)/FCF (x)	1.08	0.59	(1.33)	(0.58)	(1.20)	(0.87)
Receiveables-no. of days	56.08	60.90	81.50	79.47	83.24	82.49
Inventories-no. of days	66.26	44.37	44.83	47.10	59.45	65.99
Operating margins (%)	30.73	28.03	34.08	35.77	36.19	36.97
Z-score	38.95	61.03	136.54	92.57	172.77	228.84

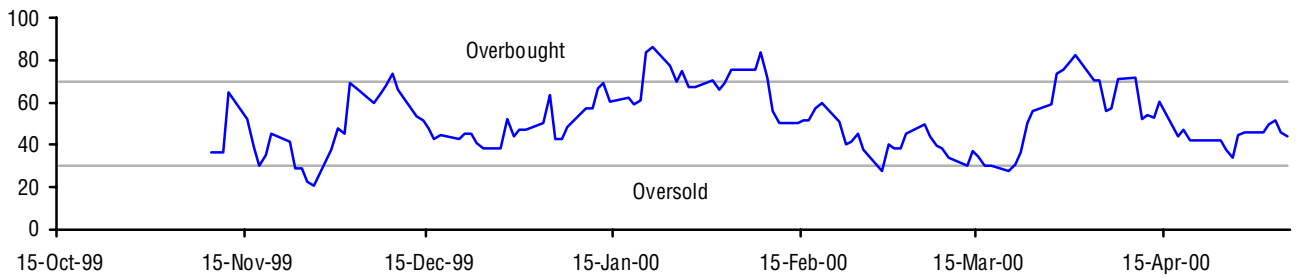
Stress Test® is a registered trademark of Credit Lyonnais Securities (Asia) Ltd

WHAT THE CHARTS SAY

Daily close with 40-day WMA



Short-term overbought/oversold



- ❏ The stock's limited price history shows an unimpressive, volatile uptrend.
- ❏ There is support at HK$0.75-HK$0.85 and resistance at around HK$1.13-HK$1.24.
- ❏ Expect price activity to be contained by support and resistance for now.

These views are based on technical analysis and may or may not be in agreement with the 'fundamental' view.

For further information please contact **Chris Roberts, Global Technical Strategist Tel: (852) 2840 5576 e-mail: chris.roberts@clsasia.com**

In 1984, with just Rmb3,000 start-up capital, Chinese-born entrepreneur Mr Jiang Quan Long set to work building what is now China's most profitable rare earth production company Yixing Xinwei - soon to be renamed China Rare Earth Holdings. The happy combination of long-established customer relationships, effective cost control, economies of scale and consistently high product purity has squeezed many of the company's less-efficient SOE competitors out of the market. Yixing Xinwei is currently one of China's largest processors of rare earth materials and sole producer of high-grade refractory materials (such as RH Steel furnace bricks). With its rare earth products widely used in global IT and electronics sectors, Yixing Xinwei, though it is still relatively small, is an excellent value play on the global surge in technologies.

The rare necessities

- Rare earth materials' high density, high melting points and high electrical and thermal conductivity make them aptly suited for use in a range of products and industries, including memory alloys, magnetic materials, computer hard disk drives, mobile phone batteries, lasers and the aerospace industry. The company has taken just 15 years to become one of the largest processors of rare earth materials in China - which itself holds 80% of global rare earth ore reserves. Yixing Xinwei's competitive strengths lie with its consistently high product quality, longstanding ties with its major customers, high efficiency (standards set by its entrepreneurial management) and economies of scale.

- In addition to rare earth products (two thirds of sales), the company also produces refractory materials (the remaining third) that are used by petrochemical refineries and steelworks in the smelting process. As China's sole supplier of high-grade refractory materials, particularly RH steel furnace bricks, the company has steadily bled market share away from its weaker SOE peers. Its products are often used by major domestic clients as import substitutes.

- To resolve the problem of full capacity utilisation, the company is currently constructing a new plant (scheduled for completion by June 2000) that will add 40% to rare earth processing capacity (to 4,900 tons REO [rare earth oxide]) and double refractory materials production capacity to 60,000 tons. And with a full order book for its refractory materials division and prices surging for its four major rare earth products (Dy, Tb, Nd and Eu), the company is set to post robust growth.

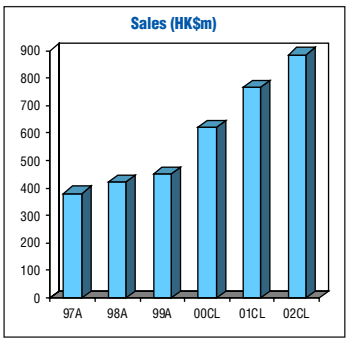
- The company is bent on improving shareholder value through the execution of a vertical integration strategy to extract more value from downstream processing and through acquisitions and/or alliances with rare earth mines and JVs. At 4.5x FY00CL EPS and 1.2x P/B, compared to an EPS Cagr of 25% and ROE of 32%, the stock is way undervalued. Our 18-month price target is HK$3.12-3.50, or 10.0x FY02CL EPS and 3.5x FY02CL P/B, giving more than 200% upside from current levels. A more bullish market sentiment will drive its share price beyond these levels should the company exceed our profit estimates and accelerate growth through value-enhancing acquisitions.

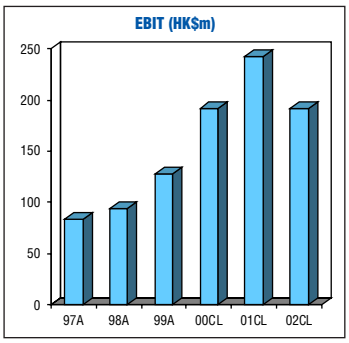
LEADING NICHE MARKET PLAYER (P.4)

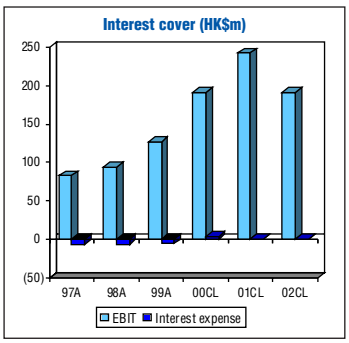
SOLE SUPPLIER OF HIGH-GRADE REFRACTORY MATERIALS (P.8)

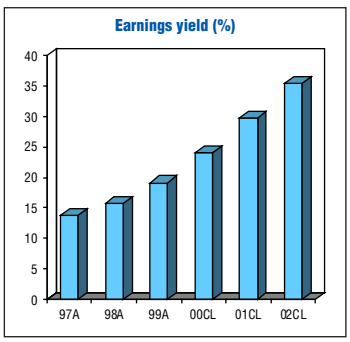
CAPACITY EXPANSION SECURES ROBUST GROWTH (P.9)

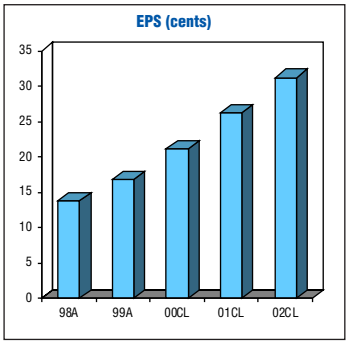
DIRT CHEAP VALUATION (P.11)











BUSINESS

Yixing Xinwei has two product lines: rare earth products (two thirds of sales) and refractory materials (one third of sales). Chairman Jiang Quanlong set up the refractory materials plant in 1985 with just Rmb3,000 and the rare earth processing operation in 1987. By 1999, the company's rare earth sales had exceeded those of its competitors, taking approximately 4.8% of global market share. This summer, the new plant will double capacity at the refractory materials division to 60,000 tons and add 40% (to 4,900 tons REO) to rare earth processing capacity. The company's strategy going forward is to vertically integrate its businesses, most probably through the formation of JVs with global firms.

COMPETITION AND MARKET POSITION

China's dominance in global rare earth ore reserves and production has confined competition in rare earth processing to domestic producers. Yixing Xinwei has emerged as the most competitive, efficient and profitable player in the industry, thanks to its entrepreneurial management, high efficiency and consistently high product quality (securing it stable long-term relationships with its major overseas customers). Globally, only Nippon Yttrium and a small division of Rhodia in France are still engaged in rare earth processing, using Chinese intermediary products. Toronto-listed AMR Technologies has two JVs in China that sell less product than Yixing Xinwei at lower profit margins. As the sole supplier of high-grade refractory materials, the company has a full order book and faces little competition in the fragmented market.

SUMMARY PROFIT & LOSS FORECAST (HK$m)

Year to 31 December	*1997A*	*1998A*	*1999A*	*2000CL*	*2001CL*	*2002CL*
Revenue						
Rare earth	261.9	288.1	303.7	392.8	472.2	529.7
Refractory materials	118.2	131.4	144.1	227.2	295.2	355.2
Total	**380.1**	**419.5**	**447.8**	**620.0**	**767.4**	**884.9**
% change	0.2	0.1	0.1	0.4	0.2	0.2
COGS	(263.3)	(301.9)	(295.2)	(398.2)	(489.7)	(557.7)
Gross profit	**116.8**	**117.6**	**152.6**	**221.8**	**277.7**	**327.2**
-Rare earth	79.7	74.7	90.1	123.5	148.5	166.6
-Refractory	37.1	42.9	62.5	98.2	129.2	160.6
Gross margin	0.3	0.3	0.3	0.4	0.4	0.4
Op expenses	(34.1)	(23.8)	(30.8)	(29.6)	(34.8)	(38.0)
EBITDA	90.7	102.8	131.1	209.5	264.7	315.2
Dep & amort	(8.0)	(9.0)	(9.3)	(17.3)	(21.8)	(26.0)
EBIT	82.7	93.8	121.8	192.2	242.9	289.2
Fin costs/int income	(6.5)	(6.3)	(4.8)	4.0	1.0	1.0
Pre-tax profit	76.2	87.5	117.0	196.2	243.9	290.2
Tax	(20.7)	(22.6)	(32.8)	(64.7)	(80.5)	(95.8)
Profit after tax	55.5	64.9	84.2	131.4	163.4	194.4
MI	(0.9)	(2.9)	(3.0)	(4.2)	(6.0)	(6.5)
Attr profit	**54.6**	**62.0**	**81.2**	**127.2**	**157.4**	**187.9**
Profit growth (%)	53.2	13.6	31.0	56.7	23.7	19.4

SUMMARY CASH FLOW FORECAST (HK$m)

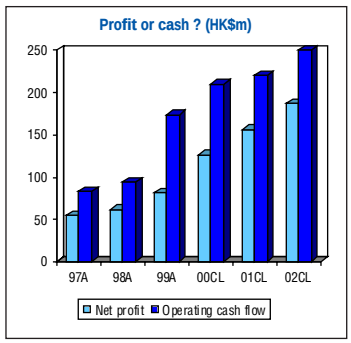
Year to 31 December	1997A	1998A	1999CL	2000CL	2001CL	2002CL
EBIT	82.7	93.8	121.8	192.2	242.9	289.2
Depreciation	8.0	9.0	9.3	17.3	21.8	26.0
WC changes	(7.8)	(17.4)	(62.9)	40.5	(64.4)	(31.3)
Others	0.0	0.0	25.0	0.0	0.0	0.0
Net cash from op	82.9	85.4	93.2	250.0	200.3	283.9
Net interests	(6.5)	(6.3)	(4.8)	4.0	1.0	1.0
Tax paid	(20.7)	(22.6)	(32.8)	(64.7)	(80.5)	(95.8)
Div received	0.0	0.0	0.0	0.0	0.0	0.0
Free CF	55.7	56.5	55.6	189.3	120.8	189.1
Capex	(47.9)	(20.3)	(27.0)	(105.0)	(22.0)	(97.0)
Div paid	(11.5)	(17.4)	(17.6)	(13.0)	(44.5)	(55.1)
Net CF	(3.7)	18.8	11.0	71.3	54.3	37.0
Shares issued	0.0	0.0	120.0	0.0	0.0	0.0
Net change in CF	(3.7)	18.8	131.0	71.3	54.3	37.0
Op net cash (debts)	(52.2)	(55.9)	(37.1)	93.9	165.2	219.4
Cl net cash (debts)	(55.9)	(37.1)	93.9	165.2	219.4	256.4
BS net cash (debts)	(60.4)	(33.2)	74.0	109.0	145.0	165.0

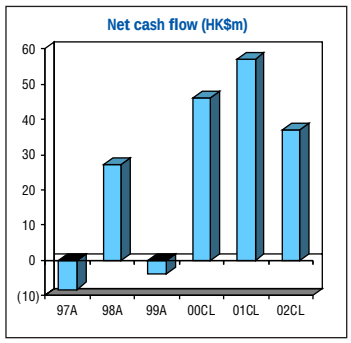
SUMMARY BALANCE SHEET FORECAST (HK$m)

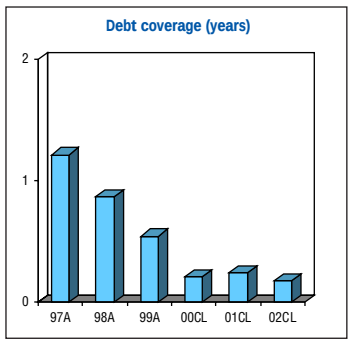
As at 31 December	1997A	1998A	1999A	2000CL	2001CL	2002CL
Current assets						
Cash & bank deposits	7	23	124	140	170	176
Accounts rec'able	58	70	100	135	175	200
Other rec'able	3	4	3	4	4	6
Inventories	69	51	55	80	125	160
Prepayments & others	21	16	41	24	35	35
Total	**158**	**164**	**323**	**383**	**509**	**577**
Cons-in-progress	10	27	65	40	30	50
Other tanigbles	1	2	2	2	3	3
Fixed assets	119	122	111	241	273	350
Accumulated dep	(26)	(35)	(46)	(63)	(85)	(111)
Net FA	93	87	65	178	188	239
Total assets	**261**	**280**	**455**	**603**	**730**	**869**
Current liabilities						
ST loans	22	11	11	11	12	11
Bills payable	7	0	0	6	7	8
Accounts payable	40	34	25	42	50	58
Accruals	24	28	31	23	25	27
Advance payments	18	10	12	15	18	22
Tax payable	26	15	12	20	24	27
Dividend payable	3	10	13	45	55	66
Other payable	7	0	0	27	30	32
Total current liab	**147**	**108**	**104**	**189**	**221**	**251**
LT loans	45	45	39	20	13	0
Due to affiliates	2	3	0	0	0	0
Share capital	21	21	60	60	60	60
Premium	0	0	108	108	108	108
Dedicated capital	7	26	26	26	26	26
Retained profits	37	72	112	195	297	419
S/h funds	**64**	**119**	**306**	**389**	**491**	**613**
MI	3	5	6	6	6	6
Total liab & s/h funds	**262**	**280**	**455**	**603**	**731**	**870**
Net cash	(60)	(33)	74	109	145	165
Gearing (%)	93.9	28.0	(24.2)	(28.0)	(29.5)	(26.9)
ROE (%)	84.9	52.2	26.5	32.7	32.1	30.6
WC-assets	151	141	199	243	339	401
WC liab	125	97	93	178	209	240
WC	26	43	106	65	130	161

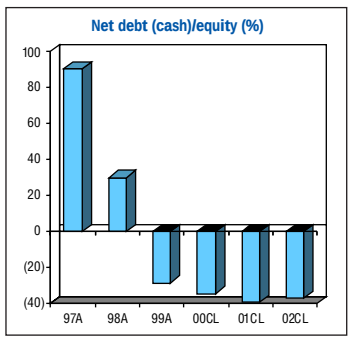
OTHER RATIOS

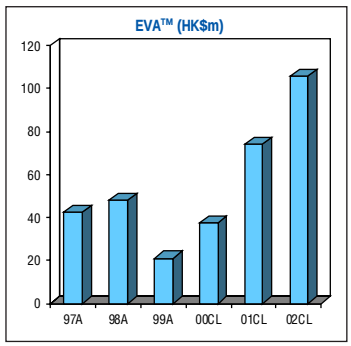
Year to 31 December	1997A	1998A	1999A	2000CL	2001CL	2002CL
Net debt (cash)/equity (%)	90.0	29.7	Net cash	Net cash	Net cash	Net cash
Interest cover (x)	12.7	14.9	22.0	Net cash	Net cash	Net cash
Current ratio (x)	1.1	1.4	2.2	1.9	2.2	2.5
Dividend cover (x)	6.9	5.5	7.1	4.4	4.4	4.4











LEADING NICHE MARKET PLAYER

WIDE USE OF RARE EARTH PRODUCTS IS A RECENT PHENOMENON

Rare earths appear as elements 57-71 on the Chemical Periodic Table, commonly called lanthanides, element 39, yttrium (Y) and element 21, scandium (Sc). These 17 rare earth elements possess qualities that, once synthesised into materials, can reduce the size and increase the speed, efficiency, environmental benefits and sophistication of certain products. These elements share common traits that make them indispensable to high-technology applications: high densities, high melting points and high electrical and thermal conductivity. Very few places in the world have rare earth ores that can be commercially mined, hence their "rare" nametag. Although the first rare earth element, yttrium (Y), was separated as early as 1794, the majority were discovered in the 20th century. The wide use of rare earth products is a fairly recent phenomenon. Some rare earth elements, such as lanthanum (La) and cerium (Ce), are synthesised into non-toxic, environmentally friendly products.

RANGE OF APPLICATIONS

Rare earth products are used both by traditional sectors - such as automobile, petrochemical, glass-making - and hi-tech industries such as IT/electronics. Estimated global sales in this niche market were US$2.5bn in 1998. Driven by the fast growth of IT industries, global demand for rare earth products has accelerated from 12% annual growth in the late 1990s to 18-20% currently. The following table shows the wide applications attributed to each rare earth element.

WIDE USE OF RARE EARTH ELEMENTS

FIGURE 1: USE OF RARE EARTH MATERIALS

Rare earth element/symbol	*Uses*
Lanthanum (La)	a) high-grade capacitors; b) optical fibres; c) mobile phone batteries; d) aluminum alloys for aircraft and glass decolourising agents (for reinforcement); e) pigments and glass agents for ceramics; f) road signs and reflection pellets on the surface of highways and expressways; g) optical glass such as cameras and video camera lenses;
Cerium (Ce)	a) automobile exhaust purifiers; b) production of fluorescent powders; c) optical glass and radiation resistant glass; d) special additives for glass reinforcement; e) catalyst for petroleum cracking to enhance petroleum refining; f) electronic components for computers, ovens, micro-ovens, air-conditioners
Praseodymium (Pr)	a) manufacture of high-grade ceramic pigments; b) alloys for watch movement; c) permanent magnets
Neodymium (Nd)	a) manufacture of permanent magnetic materials, control systems of cars; b) superconductors for electronics industry; c) mobile phone batteries; d) computer hard disk drives
Samarium (Sm)	a) high-grade permanent magnetic materials for defence industry; b) control materials for nuclear energy industry
Europium (Eu)	a) fluorescent screen of colour TV sets, computer display units and trichromatic fluorescent lamps; b) control rods for nuclear power plants
Gadolinium (Gd)	a) laser equipment; b) GGG crystals; c) magnetic refrigeration materials
Terbium (Tb)	a) fluorescent activators; b) memory chips for computers; c) high-grade magnetic materials
Dysprosium (Dy)	a) neutron energy spectrum detector for nuclear power plants; b) materials for metallic halogen lamps; c) optical-magnetic memory alloy; d) permanent magnetic materials; e) lasers
Holmium (Ho)	a) thermal-nuclear reaction activators; b) surgical-use laser for removal of blood clots (as in arteriosclerosis)
Erbium (Er)	a) illuminants; b) superconductors; c) optical fibres; d) infra-red glass (as in night vision)
Thulium (Tm)	a) x-rays; b) superconductors
Ytterbium (Yb)	a) manufacture of super-alloys; b) heat insulation coating
Lutecium (Lu)	a) PET medical equipment; b) electronic colour display
Yttrium (Y)	a) principal component for illuminants; b) man-made gems; c) metal alloys

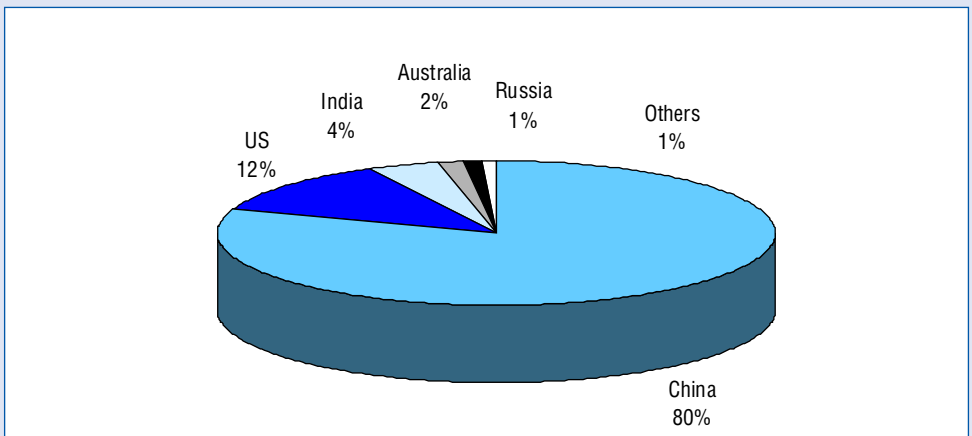
Source: Company listing prospectus

The high densities, high melting points and high electrical and thermal conductivity of rare earth materials mean that they can be used in a wide range of products and industries, including memory alloys, magnetic materials, computer hard disk drives, mobile phone batteries, lasers and aerospace. According to the US Minerals Dept, China has 80% (and the world's richest variety) of global rare earth ore reserves and accounts for roughly 85% of global production of rare earth products. In 1998, the US accounted for 40% of global rare earth consumption, followed by China (24%) and Japan (15%). Global consumption of rare earth products amounted to 65,000 tons REO (rare earth oxide).

CHINA DOMINATES RARE EARTH PRODUCTION, WHILE THE US IS THE NO. 1 CONSUMER

80% OF RARE EARTH ORE RESERVES IS IN CHINA

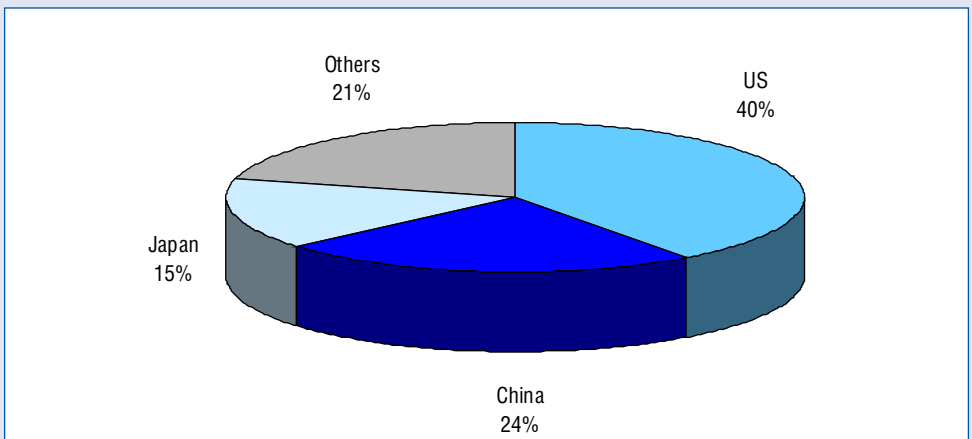
FIGURE 2: RARE EARTH ORE RESERVES



Source: US Minerals Departments (1989)

USA IS THE LARGEST CONSUMER OF RARE EARTHS

FIGURE 3: RARE EARTH CONSUMPTION (1998)



Source: Rare Earth Circular (4th Issue, 1999)

DIFFERENT USES

In the US, which is the world's largest market for rare earth products, 46% of rare earth materials were used by the automobile sector (as exhaust purifiers, anti-locking systems, airbag systems, anti-locking braking and catalyst converters), 25% as oil refinery catalysts, 12% in permanent magnetic materials, 7% in glass-making, 7% in metallurgy and 3% in fluorescents in 1998. The consumption ratio differed in China: 33% was used in smelting, 25% by petrochemical plants, 10% by glass and ceramic plants, and 13% in new material production.

STEADY GROWTH IN RARE EARTH CONSUMPTION

FIGURE 4: CHINA's USE OF RARE EARTH MATERIALS

	Rare earth consumption (ton REO)				As % of total consumption in China		
Year	1996	1997	1998	1999	1996	1997	1998
Smelting	4,950	4,960	5,000	5,200	34.1	32.9	32.7
Petrochems	3,500	3,710	3,800	3,800	24.1	24.6	24.8
Glass & ceramics	1,400	1,540	1,540	1,800	9.6	10.2	10.1
New materials	1,600	1,850	2,000	2,200	11.0	12.3	13.1
Other uses	3,080	3,010	2,960	3,010	21.2	20.0	19.3
Total use in China	14,530	15,070	15,300	16,010			
Exports	30,808	31,430	44,700	50,000			
Total production in China	45,338	46,500	60,000	66,010			

Sources: Rare Earth Circular, 3rd Issue, 1999; Annual Review of Rare Earth, China's Rare Earth (1996-97), the Rare Earth Office of the State Planning Commission

YIXING XINWEI IS A LEADING GLOBAL PLAYER

With an estimated global market share of 4.2% in 1998 (and growing to 6.0% by 02CL), Yixing Xinwei is one of the largest rare earth processors in the world. The company owes its success to the consistent high quality of its products (the company is able produce rare earth products at purities as high as 99.9999%), long-term relationships with its major customers, the high operational efficiency instilled by its entrepreneurial management and economies of scale. Since China has a virtual monopoly on global rare earth ore reserves, international competition is extremely limited. The last US rare earth processing plant, owned by Molycorp, closed in 1998, having been unable to keep costs competitive. Advanced Material Resources (AMR) Technologies (AMR CN), of Canada, has two JVs in China (one in Jiangyin, Jiangsu province, the other in Zibo, Shandong province) to process rare earth materials. High staff costs and a loss-making JV in Thailand producing magnetic products have also cut deep into AMR Technology's competitiveness, while the company's financial performance has been poor ever since its listing on the Toronto Stock Exchange. While AMR's rare earth production facility in China posted US$3.09m net profit in FY99, its magnetic division in Thailand (commencing business in 4Q99) could only manage a loss of US$1.8m for the year. Given that AMR has a workforce of some 1,125, including 240 staff in Thailand, we estimate its two China JVs to employ over 700 people. Yixing Xinwei had a rare earth production workforce of 350 in 1999. AMR Technology's rare earth sales of US$35m in 1999, up 10.9% (net income from this division grew a moderate US$3.09m), were still below Yixing Xinwei's rare earth product sales of US$40m.

The two other international firms processing rare earth materials are Rhodia (RHA US) of France and Nippon Yttrium in Japan. Primarily involved in downstream processing, both companies import their rare earth intermediary products from China. Rare earth represents a small fraction of the business handled by Rhodia's Services & Specialties Division. Since Nippon Yttrium is not a listed company, public information on its exposure to, and the extent of, its rare earth activities is hard to come by. Of the eight companies engaged in rare earth processing in Japan ten years ago, only Nippon Yttrium remains active. We suspect that Nippon Yttrium's rare earth processing business may not last long.

KEEN DOMESTIC COMPETITION, BUT YIXING XINWEI LEADS THE PACK

Competition for rare earth sales is mainly between Yixing Xinwei and its fellow domestic producers. There are currently some 130 firms processing rare earth materials in China. However, only a dozen are operating at economies of scale. Yixing Xinwei is one of the largest players, followed by Shanghai's Yuelong and **China Rare Earth High-Technology** (600111.SS) located in Inner Mongolia. The Inner Mongolian firm claims to produce 5,500 tons REO each year, which makes it the world's largest producer. However, annual sales amounted to only US$30m

in 1999, which is smaller than those of both Yixing Xinwei (US$39m from 3,000 tons REO sold) and AMR Technologies (US$35m from 2,800 tons REO sold). This would suggest that the firm's processing techniques are either very primitive and/or the products it manufactures are far less pure, inviting lower selling prices in the domestic and international markets. Shanghai Yuelong is an unlisted SOE and releases little public information. What we do know is that the company has recently had a dozen top managerial and technical staff poached by Yixing Xinwei. Yuelong sells a similar weight of rare earth products to Yixing Xinwei, but incurs substantially higher costs. Labour costs for its over 2,000 staff represent 16.2% of Shanghai Yuelong's cost of sales, compared to 2.0% for Yixing Xinwei (350 staff in rare earth processing). Inner Mongolia Baotou Steel Rare Earth High Technology, listed in Shanghai, sells less rare earth than Yixing Xinwei. Moreover, ROE was under 10.0% in 1999, compared to Yixing Xinwei's nearly 30.0%. China Rare Earth High Technology has seen flat sales over the past four years compared with the steady sales growth enjoyed by Yixing Xinwei.

YIXING XINWEI IS THE TOP PERFORMER

As indicated by Figure 5, of the three listed rare earth processors, Yixing Xinwei has not only shown the steadiest sales growth, its operating margins have also improved every year. Conversely, the company's major domestic competitor, Inner Mongolia Bait Steel Rare Earth Technology, has seen operating margins decline in each of the past three years.

YIXING XINWEI HAS MADE THE GREATEST PROGRESS OF THE THREE COMPANIES

FIGURE 5: OPERATING PERFORMANCE COMPARISON (RARE EARTH DIVISION ONLY) (US$m)

Company	*Yixing Xinwei*	*AMR Technologies*	*Rare Earth Hi-Technology*
Code	769 HK	AMR CN	600111 SS
96A sales (US$m)	26.4	24.4	30.0
97A sales (US$m)	33.8	25.5	24.4
98A sales (US$m)	37.1	32.3	27.5
99A sales (US$m)	39.0	35.4	29.7
99 sales (ton REO)	3,000	2,801	5,500
99 work force	350 people	700 people	1,703 people
Rare earth op profits (US$m)			
97A	9.9	2.5	8.1
98A	9.6	3.8	8.4
99A	12.7	3.7	6.1
97 op margins (%)	29.5	8.9	33.6
98 op margins (%)	26.0	11.7	30.6
99 op margins (%)	32.6	10.5	20.5

Sources: Company annual reports, Yixing Xinwei listing prospectus, CLSA estimates

REGULATIONS GOVERNING THE RARE EARTH PRODUCT INDUSTRY

The regulations set by China, as the dominant entity, effectively govern the global rare earth market. These include restrictions on foreign participation in rare earth mining and processing in China (AMR Technologies is the only foreign firm to have made it into China, which it did before current regulations were in place), export quotas for rare earth oxides and compounds and the revocation of companies exporting rare earth oxides below price floors. There is as yet no restriction on the export of certain rare earth metals, such as Nd-F-B and other rare earth-based magnetic materials and fluorescent powders. Some of these measures were only implemented in 3Q99, immediately reversing the competitive dumping of rare earth oxides by some small, desperate producers in China. So far this year, prices of the four major rare earth materials have climbed by 20-45%, an upsurge that continues.

YIXING XINWEI'S COMPETITIVE EDGE

Four key factors have contributed to Yixing Xinwei's present position as one of the largest rare earth processors in China. First, the company only puts out high quality products, as indicated by their 99.9999% rare earth purity, which, even by international standards, is extremely high. Moreover, by attaining ISO9002 certification in February 1999, the company has won the confidence of its major customers, which include GE, GM, Toshiba, National, Phillips Electronics and Samsung. Stable relationships with these customers have given the company an important competitive edge. Second, Yixing's sales force of a dozen is far smaller than those of its peers. The company has substantially less marketing costs than its competitors, though the flow of orders is steadier. Third, the company's operating efficiency is far higher than its peers. For example, it only needs 350 staff to run its rare earth processing operation, compared to the 700 people employed by AMR Technologies' two JVs, 1,700 at Baotou Steel Rare Earth Technology Co, and over 2,000 people at Shanghai Yuelong. None of these companies can match Yixing Xinwei's rare earth sales figures. Yixing Xinwei's new plant will further improve its operating efficiency. Management expects the plant, which will require only 73 workers, to match its existing workshop's production volume. Finally, the company's 30-strong R&D team allows it to respond quickly to changes in the international markets, adopt new technology and introduce innovative products from both its rare earth and refractory divisions. Its new rare earth processing workshop is the most technologically advanced in the world, while its new refractory workshop is able to run at 1,850ºC – the highest temperature attainable among China's refractory materials plants.

SOLE SUPPLIER OF HIGH-GRADE REFRACTORY MATERIALS

SOLE SUPPLIER OF RH STEEL FURNACE BRICKS IN CHINA

In addition to rare earth products (two thirds of sales), the company also produces refractory materials (the remaining one third) used for smelting by petrochemical refineries, metallurgy industry steel works and glass-making plants. As the sole supplier of high-grade refractory materials, particularly RH steel furnace bricks, the company has steadily taken market share away from its weaker SOE peers. Its products are often used by major domestic clients as import substitutes.

CONCENTRATING ON TOP-GRADE REFRACTORY MATERIALS

Yixing Xinwei currently manufactures 31 high-grade refractory materials, classified under five categories:

a) High-purity, low-silicon corundum products, mainly used by large chemical fertiliser plants;
b) Electric-melted re-combined chrome-magnesium products, used by large steel plants, principally RH steel furnaces;
c) Magnesium refractory materials used by the non-ferrous metallurgy industry for smelting copper, aluminum, lead and zinc, as well as for making glass kilns and large cement rotational kilns;
d) Zirconium refractory materials used to make oversized float glass kilns;
e) Unshaped refractory materials used in such thermal-working facilities as power plants, oil refineries and chemical plants.

AN UNRIVALLED LEADER IN A FRAGMENTED MARKET

Yixing Xinwei is currently the sole domestic supplier of many top-grade refractory materials. Currently, there are over 3,000 refractory materials plants throughout China, with a combined annual production of approximately 12.0m tons. However, only four of these plants are capable of producing high-grade refractory materials: Yixing Xinwei, He'nan Luoyang Refractory Materials, Liaoning Haicheng Magnesium Refractory Materials Plant and Shanghai No. 2 Refractory Materials. Of these, Yixing Xinwei is the only plant that can produce RH steel furnace bricks, one of the most difficult refractory materials to make. Once in operation, the

company's new refractory materials workshop will be able to bake at 1,850°C, the highest temperature attainable among all of China's refractory materials plants. The workshop will also be China's most cutting-edge refractory materials plant, boasting a fully computerised control system.

HUGE DEMAND FOR RH STEEL FURNACE BRICKS

China consumes 80,000 tons of RH steel furnace bricks per annum, last year importing US$320m of the material from Austria (which currently exports to the country's most advanced steel plants, including Baogang Steel in Shanghai, Wuhan Steel Works, Panzihua Steel Works and Tiayuan Steel Works). Since such bricks are necessary for the operation of high-grade steel plants, as steel plants upgrade their product lines and technologies, demand for RH steel furnace bricks is set to grow. Including the output from its new workshop, Yixing Xinwei will only be able to produce 30,000 tons of RH steel furnace bricks per annum. Japan's Nippon Steel alone requires a minimum 13,000 tons of the product from Yixing Xinwei each year. Since Yixing Xinwei's bricks are 50% cheaper than Austrian imports, without any compromise in quality, there is huge room for Yixing Xinwei to increase RH steel furnace brick production. New competitors are unlikely in the short term since setting up a modern refractory materials plant requires a minimum investment of Rmb50m. The vast majority of existing refractory materials plants cannot muster such financial resources. Moreover, even if they did have the cash to build a modern refractory materials plant, they would find it very difficult to compete with Yixing Xinwei on product quality. After all, the company already has a 16-year track record of manufacturing high-quality refractory materials.

HIGH-SPEED RAILWAY TRACKS CREATE MORE DEMAND FOR RH STEEL

China plans to spend Rmb300bn building a modern high-speed railway network over the next five years. Such tracks needs a special class of steel that can only be made from RH steel furnaces. Hence, in order to capitalise on this titanic construction project, many large steel plants, including Baosteel and Wuhan Steel, are planning on upgrading their facilities so that they can manufacture RH steel materials. The huge, additional demand for RH steel will ensure robust growth for RH steel furnace bricks that can currently only be made by Yixing Xinwei.

CAPACITY EXPANSION SECURES ROBUST GROWTH

VERTICAL INTEGRATION AND CAPACITY EXPANSION

Once Yixing Xinwei has fulfilled capacity expansion on its existing plants, it will look to extract more value from downstream processing for its rare earth products and through acquisitions and/or JVs in both rare earth processing and refractory materials production. The company is in the midst of constructing the world's largest, and China's most advanced, rare earth materials processing plant. The new plant, due on stream at the end of June, will increase rare earth processing capacity by 40% to 4,900 tons (REO) and double refractory materials production capacity to 60,000 tons. This fully computerised plant will also further enhance product quality and production efficiency, thereby improving pricing power and operating margins within the global rare earth market. For example, production capacity at the new rare earth processing workshop is higher than the existing workshop, yet it requires only 73 workers compared to 350.

FLUORESCENT WORKSHOP AND PURE METAL WORKSHOP

Plans are also afoot to renovate the existing new fluorescent workshop (at an estimated HK$25m) and a pure metal workshop (at a cost of HK$10m) with capacity enough to produce 300 tons of fluorescent powder and purify 1,000 tons of rare earth pure metal. The company will recover the cost of these two projects within 12 months. While rare earth oxide sells for an average HK$100,000 per ton REO, rare earth pure metals fetch more than HK$320,000 per ton. Given the conversion ratio of 1.3 rare

earth oxide into 1.0 metal and the processing costs of Rmb150,000 per ton ROE, the new metal workshop can generate additional profit of HK$40m pa once fully utilised. We have decided not to include this plant's contribution into our profit estimate until we know exactly how much capacity can be utilised over the next few years. The new fluorescent workshop is targeted to make 300 tons of fluorescent, which is used in colour TV screens, colour PC monitors and various electronics devices. In 1999, the company manufactured only 60 tons of fluorescent powder. Once the renovated fluorescent-powered workshop is fully utilised, it will generate additional profit of Rmb40m pa.

HUGE DEMAND FOR RARE EARTH PRODUCTS FROM CHINA'S AUTOMOBILE SECTOR

The major share of rare earth materials is used in the manufacture of automobile exhaust purifiers, exhaust discharge control and converters. In 1995, America's automobile sector consumed 44% of rare earth materials, or 11,000 tons (REO), representing 28% of global consumption. In January 2000, the Chinese government begun enforcing new engine emission standards (GB14761-1999) requiring all motor vehicles to be fitted with electronic fuel injectors and exhaust purifiers. As such, ninety-nine percent of the 18m motor vehicles using China's roads will require installation of exhaust purifiers to meet the new standard. Beijing, Tianjin and Kun'ming in Yun'nan province have been the first to satisfy the requirement, with Shanghai, Hangzhou, Xiamen and Guangzhou due to follow suit by July 2000. In addition, annual automobile sales (currently 1.75m units) in China are growing at over 10% pa. The government estimates that the number of motor vehicles will increase from the current 16.2m units to 41.8m by the end of 2010, based on an estimated annual compound sales growth of 12.5%. Assuming that 80% of motor vehicles are equipped with exhaust purifiers by 2010, demand for exhaust purifiers will grow from 1.5m units currently to 8.5m units - a Cagr of 18.9%. The figure includes the assumption that some 2.5m units are exported by 2010. China currently produces 2.0m exhaust purifiers, bringing in Rmb2.5bn annual sales revenue. By 2010, sales will reach Rmb10.5bn, even assuming a constant product price during that time. All this suggests that, by 2010, we will see the emergence of several major exhaust purifier manufacturers. In 1996, global sales of automobile exhaust purifiers amounted to 78.0m units, or approximately US$10bn.

CHINA'S EXHAUST PURIFIER MARKET HAS NOT YET TAKEN OFF

FIGURE 6: ESTIMATED FUTURE DEMAND FOR AUTOMOBILE EXHAUST PURIFIERS

Year	*2000E*	*2002E*	*2005E*	*2010E*	*2000-2001 Cagr (%)*
Annual automobile sales (m units)	1.85	2.4	3.4	6.0	12.5
Motor vehicles on road at year-end (m units)	16.2	20.5	26.4	41.8	9.9
Annual demand for exhaust purifiers (m units)	1.5	5.0	6.0	8.5	18.9

Sources: CLSA Emerging Markets; Application of Rare Earth (Jul 1999)

BACKWARD AND FORWARD INTEGRATION FOR RARE EARTH DIVISION

Yixing Xinwei plans to reach financial arrangements with key rare earth mines under which the company will make prepayments for use as working capital, in return for the guaranteed delivery of agreed quantities of rare earth raw materials at a 5.0% discount to the market price (minus the money owed). In downstream rare earth processing, rare earth materials can be used as key input in products such as automobile exhaust purifiers and exchange discharge control. The company is looking into the feasibility of establishing a JV with a reputable automobile giant to produce automobile exhaust purifiers.

DIRT CHEAP VALUATION

At the current share price, Yixing Xinwei is trading at dirt cheap valuations of 3.3x FY01 EPS and 1.0x FY01 P/B (compared to our estimated EPS Cagr of 25% 99-01CL and FY01CL ROE of 34%). These valuations are unmerited given the company's unique position as China's first private business to be listed in Hong Kong, its robust growth prospects and its standing as an indirect and solid play on global technology growth.

FIGURE 7: VALUATION COMPARISON

	Yixing Xinwei	*AMR Technologies*	*Rare Earth Hi-Tech*
Bloomberg code	769 HK	AMR CN	600111 SS
Share price	HK$0.88	C$2.50	Rmb13.10
98A PE (x)	6.4	71.4	60.9
99 PE (x)	5.2	21.0	75.3
2000 PE (x)	4.2	6.8	n.a.
2001 PE (x)	3.4	n.a.	n.a.
99A P/B (x)	1.5	1.4	7.7
2000 P/B (x)	1.4	1.3	7.5
99A ROE (%)	28.6	4.6	9.6
2000E ROE (%)	34.7	13.6	10.5
V-score (99 ROE/(P/B))	3.7	0.8	1.9
Risk free rate assumed (%)	7.8	6.0	5.0

Sources: Bloomberg, CLSA Emerging Markets

AS THE CHEAPEST OF THE THREE, YIXING XINWEI IS HUGELY UNDERVALUED

For investors tired of listed SOEs with unpredictable management, uncertain earnings growth and low ROEs, Yixing Xinwei is an excellent alternative. After all, China's economic prospects are more tied up with private firms and foreign investments than with the state-owned sectors. Entrepreneur Mr Jiang Quan Long's family still holds a 75% stake in Yixing Xinwei and investors should take comfort from the fact that they share the same interests. The company's high ROE of 32% is likely to be sustainable in the long run and should enable the company to trade at high P/B multiples. Assuming a V-score of 1.0 to be a fair valuation, Yixing Xinwei should trade at 4.1x P/B, based on a risk-free rate of 7.8%.

RARE WINDOW OF CHINA'S PRIVATE ENTREPRENEURSHIP

We believe the company's growth prospects will remain robust. After all, it is one of only a very few listed companies engaged in the niche rare earth products market. It is unlikely that many other rare earth producers will list in China or overseas. AMR Technologies will remain the sole foreign firm processing rare earth products in China, at least until the ban on new foreign investments in the sector is lifted. Other PRC rare earth production firms are either too small or inefficient to quality for listing. Thus, Yixing Xinwei, further advantaged by its access to capital, is likely to see its competitive edge over small domestic competitors widen. On the demand side, China's automotive sector alone will create sizeable demand for rare earth products as the country gradually pushes through its anti-exhaust pollution programme. Globally, the increasing application of rare earth materials by more and more industries will continue to drive demand growth for these products.

Appendix 1: Valuation measures

(1) EVA™ ANALYSIS

EVA = EBIT - ADJUSTED TAX - COST OF CAPITAL

Economic Value Added is a way of measuring *real* corporate profits. That is, profits after taking into account the cost of all capital including equity. A positive EVA means that a firm is adding to shareholder value after paying for all its capital; a negative EVA means a firm is destroying value (ie the firm is earning a return lower than its true cost of capital).

What determines EVA?

EVA IS A FUNCTION OF THE AMOUNT OF CAPITAL USED, CAPITAL COST AND CAPITAL EFFICIENCY

There are three key determinants of EVA:

- ❏ Capital intensity - ie the amount of capital used in the business
- ❏ Capital cost - ie the weighted average cost of debt and equity as calculated using the capital asset pricing model (CAPM)
- ❏ Capital efficiency - ie the efficiency with which the capital is employed in the business

Each of these factors have key determinants of their own:

CAPITAL INTENSITY DEPENDS LARGELY ON THE INDUSTRY, BUT OTHER FACTORS ARE IMPORTANT TOO

Capital intensity. This is largely determined by the nature of the industry - steel is more capital intensive than stock broking - but there are other factors too. Import duties on capital goods affect the cost of setting up a plant; construction times affect the cost of a project, etc. In addition, companies that are rapidly-expanding capacity have a large amount of capital work in progress (CWIP) which does not contribute to earnings in that year. (While there is an argument that CWIP should be excluded from the total capital employed figure used for EVA calculations, it is our view that CWIP should be included in EVA calculations as it is the cost that a company needs to pay today for growth tomorrow.)

THE COST OF CAPITAL DEPENDS ON THE RISK-FREE RATE, CREDIT QUALITY, BETA AND GEARING

Cost of capital. The key determinants here are the risk-free interest rate, the marginal tax rate, the equity market risk premium, a share's beta and a company's financial structure. The underlying cost of capital is determined by capital controls, rates of inflation, government demand for funds (budget deficits) and the domestic savings rate.

CAPITAL EFFICIENCY IS LARGELY DOWN TO MANAGEMENT

Capital efficiency. This is largely a function of management and the economic environment. Clearly, a cement plant operating at 50% capacity utilisation is not likely to cover its capital costs. Similarly, poor management is reflected in lower returns on capital. These lower returns are a function of poor strategic decisions, the business cycle, unrelated diversifications and low-yielding treasury operations.

EVA = EBIT - ADJUSTED TAX - COST OF CAPITAL

EVA CAN BE DEFINED AS EBIT LESS ADJUSTED TAX - COST OF CAPITAL

EVA is defined as the post-tax return on capital employed minus the cost of capital employed and is calculated as follows:

EVA FORMULA

$$EVA = (EBIT - Adjusted\ tax) - (WACC \times Total\ capital\ employed)$$

Total earnings extracted from the given capital, (ie, **ROACE)**

Total cost of capital used in extracting value from the business

EVA is a service mark of Stern, Stewart & Co (New York Partnership) 20 Floor, 40 West 57th Street, New York, New York, USA 10019

Where:

EBIT is earnings before interest, tax and minority interests, but includes exceptionals and all profits from associates. (The reason we have included exceptionals is that they are part of the return extracted from the capital base and although they can be unusual in size, they are fairly recurrent in some businesses/countries.)

EBIT

Adjusted tax is the tax provision for the year (excluding deferred taxes) + the tax shield on interest payments. The tax shield on interest payments is calculated by applying marginal rate of corporate tax to the actual interest payments charged to the P&L.

ADJUSTED TAX

Total capital employed is the sum of average debt and average shareholders' equity. Shareholders' equity excludes revaluation reserves and any goodwill write-offs so that companies can be made more comparable.

TCE

WACC is calculated using the Capital Asset Pricing Model (CAPM) and can be defined as follows:

WACC

WACC = (D/V x Rb) + (E/V x Re)

Where:

- D = total debt at year end
- E = total equity (ie, market capitalisation). This is preferred as CAPM relies on market value and not book value)
- V = D + E (ie, total firm value)
- Rb = the company's post-tax marginal rate of borrowing
  = Borrowing rate x (1 - marginal tax rate)
- Re = the required rate of return on the company's shares
  = Risk free rate + (Beta x market risk premium)

Where:

- The risk-free rate is equivalent to the government long-bond yield.
- Beta measures the volatility of the company's share price relative to the market.
- Market risk premium is the extra return investors expect from the equity market over and above the risk-free rate.

EVA is not a valuation measure in itself. It measures the *real* profit a company makes after taking into account the cost of both debt and equity. So, while absolute levels of EVA are interesting, what is more important is the performance relative to either shareholders' funds (excluding all revaluation reserves) or total capital employed. Hence, when comparing different companies' EVA, we compare the following:

EVA/CAPITAL EMPLOYED USED FOR COMPANY COMPARISONS

EVA/Capital employed

Where capital employed is preferred to shareholders' funds because it includes debt which needs to be factored in because it is usually just as important a means of financing for most companies as equity.

(2) ENTERPRISE VALUE ANALYSIS

ENTVAL/EBITDA AVOIDS PE SHORTCOMINGS, INCLUDING . . .

By looking at an Enterprise Value to EBITDA ratio (EntVal/EBITDA), most of the shortcomings of the traditional PE ratio are avoided. As such, some investors prefer to use it - hence our inclusion of it in this report. By using Enterprise Value (EntVal) instead of the market capitalisation of a company:

DEPRECIATION

❏ The market value of the company's investments (including those in listed subsidiaries) is taken into account

CAPITALISED INTEREST

❏ The amount of debt the company has becomes important

OTHER INCOME

By using an EBITDA figure:

TAX

❏ The company's depreciation policy becomes irrelevant

❏ Companies that capitalise their interest payments do not appear cheaper

❏ Other income is completely excluded

❏ Tax paying and non-tax paying companies are treated alike

Here, we are defining EntVal/EBITDA as follows:

ENTVAL

EntVal = (Market capitalisation + Debt - Non-operating assets) and

EBITDA

EBITDA = (Sales - COGS excluding depreciation - S&A expenses)

Above, non-operating assets are essentially cash and liquid investments.

(3) ROE ANALYSIS

ROE - FIVE COMPONENTS

We break down ROE into five separate components

OPERATING MARGIN

Operating margin (EBIT/Sales) indicates pricing strategy, competition and cost advantages.

ASSET TURNOVER

Asset turnover (Sales/Assets) highlights product technology and management efficiency.

FINANCIAL LEVERAGE

Financial leverage (Assets/Equity) indicates the gearing ratio of total assets controlled by the equity base. (Here, we take equity to mean average shareholders' funds.)

INTEREST BURDEN

Interest burden (PBT/EBIT) highlights management's financial strategy and how interest rates impact earnings.

TAX BURDEN

Tax burden (Earnings/PBT) highlights government policies regarding overall taxation and depreciation allowances.

Putting it all together gives us ROE as follows:

ROE = Op margin x Asset t'over x Fin leverage x Int burden x Tax burden

(4) OTHER FINANCIAL RATIOS AND DEFINITIONS

PEx	Share price / EPS
CF (x)	Share price / Free cash flow per share (ie, before dividends and capex)
Growth-PE	EPS Cagr (CL1 + CL2 + CL3) / PE CL1
Gearing	Net debt / Equity (where equity is measured as average shareholders' funds)
Interest cover	EBIT / Net interest charge (before capitalised interest)
ROACE	EBIT / Average capital employed (where average capital employed is measured (average shareholders' funds + average net debt)

(5) WHAT IS THE ALTMAN Z-SCORE ?

Z-SCORE MODEL . . .

The ability to predict which firms are vulnerable to financial distress is of critical importance to creditors and even more so to equity investors. When a firm files for bankruptcy, creditors often lose portion of principal and interest payments, while equity investors can potentially lose all their investment. Additionally, even if the company survives after a financial distress, the "survival" costs will significantly reduce the future growth outlook.

. . . IS A PREDICTIVE TOOL FOR . . .

It is therefore important to focus more on trying to predict the companies which are vulnerable to financial distress in the near future. Considerable research has been done to develop bankruptcy prediction models using different financial ratios. The most well known amongst these is the Z-score Model.

. . . BANKRUPTCY TEST

The results of the model have been encouraging with the classification of errors for the model low, especially for the near term (see below).

CLASSIFICATION OF ERRORS FOR ALTMAN Z-SCORE MODEL

Years prior to bankruptcy	Prediction Actual	=	Non-bankrupt Bankrupt (Type I error)	Bankrupt Non-bankrupt (Type II error)
1			6%	3%
2			18%	6%
3			52%	n.a.

<1.81 = BANKRUPT

Z-SCORE DEVELOPED BY ALTMAN

The model was introduced in 1968 by Edward Altman through an article in the *Journal of Finance* titled "Financial Ratios, Discriminant Analysis and the Prediction of Corporate Bankruptcies". In the model, Altman explained the ratios needed to predict corporate bankruptcies. These easily-obtained ratios (mostly profitability and solvency ratios) yield what is known as the Z-Score. Altman then established a critical value point - 2.675 - below which is a indicator of bankruptcy. However, bankruptcy predictions can go wrong in two different ways: a type I error occurs when a company which is predicted to be solvent ends up bankrupt; a type II error occurs when a bankruptcy signal is given to a company which turns out to be non-bankrupt. Relating analysis of this misclassification on Altman's critical value resulted in the following intuitively appealing explanation:

"It is concluded that all firms having a Z-score of greater than 2.99 clearly fall into the "non-bankrupt" sector, while those firms having a Z below 1.81 are all bankrupt. The area between 1.81 and 2.99 will be defined as the zone of ignorance or grey area because of the susceptibility to error classification."

Z-SCORES. HOW ARE THEY CALCULATED?

Z = 1.2 x (working capital/total assets)
plus 1.4 x (retained earnings/total assets)
plus 3.3 x (EBIT/total assets)
plus 0.6 x (market value of equity/book value of debt)
plus 1.0 x (sales/total assets)

Key definitions :

Working capital	=	current asset - current liabilities
Market value of equity	=	market capitalisation at year end
Book value of debt	=	total interest bearing debt
EBIT	=	operating profit plus other income / charges

Source: *The Analysis and Use of Financial Statements* by White, Sondhi, Fried.
"Financial Ratios, Discriminant Analysis and the Prediction of Corporate Bankruptcy" by Edward Altman (*Journal of Finance* - 1968)
Corporate Financial Distress and Bankruptcy by Edward Altman (1993)

Appendix 2: The CLSA Stress Test®

THE TEST CONSISTS OF FOUR BROAD TYPES OF RATIOS . . .

STRESS TEST CONSTITUENTS, LIMITS AND THEIR RATIONALE

In the composition of the test we have tried to maintain a balance between the different types of ratios so that the test is not biased towards any particular type (see table below). We have also purposely avoided giving weightings to each ratio in order to avoid subjectivity. The importance of each type of ratio is taken into account by the number of individual ratios used under that type, hence the use of five debt- and liquidity-related ratios. Similarly, activity and operating ratios are also important and therefore have been furnished with four ratios each. The fourth type, the capital efficiency ratios, include three ratios.

. . . WITH PERFORMANCE LIMITS SET FOR EACH RATIO

STRESS TEST CONSTITUENTS, SCORING LIMITS

	Rationale/scoring	
Year to 31 December	*+1*	*-1*
Debt & liquidity ratios		
Net debt (cash)/equity (%)	<25%	>75%
Foreign debt/foreign rev (x)	< 1.1	> 1.25
Net debt/free cash flow(x)	<2x	>5x
Cash/current liab (x)	>1x	<0.5x
(FCF+cash)/ (curr matur+int payment)(x)	>1.5x	<1x
Property ratios		
Net debt/net profit ex-asset sales (x)	<2x	>4x
Trend (%)	<(15%)	>15%
Profit from asset sales/net profit (%)	0%	>20%
Trend (%)	<(15%)	>15%
Operational ratios		
Operating profit margin (%)	>15%	<5%
Operating leverage (FC/sales) (%)	<25%	>60%
Foreign sales to total sales (%)	>50%	<10%
Foreign costs to domestic sales (%)	<5%	>30%
Capital efficiency ratios		
ROAE (%)	>11.83%	<7.83%
ROCE (%)	>11.83%	<7.83%
EVA™/cap employed (%)	> 0	< 0

THE TEST RESULT SHOWS THE "HEALTH" TREND

Admittedly, the composition and the scoring limits of the test are arguable. The test nonetheless meets our objective of indicating the financial health of a company by taking into account different important ratios. The test is comprehensive yet simple enough to be understood easily. It is also applicable across the region so that "safe havens" and "vulnerables" on a regional basis could be identified.

CALCULATION

CALCULATE THE RATIOS

From each company's historical and projected profit and loss, balance sheet and cash flow statements, individual ratios of the stress test are calculated.

INDIVIDUAL SCORE

SCORE THE RATIOS

There are 16 ratios in total with healthy ratios scoring a 1, mediocre 0 and unhealthy -1 according to the set of limits established for each ratio. Ratio values which fall in between the limits are mediocre and score a zero, while values outside the set limits are scored accordingly. For example, a net debt-to-equity of less than 25% scores a 1, above 75% scores a -1 and in between 25% and 75% scores a 0. One-off adjustments are, however, necessary for some ratios. A net cash company, for example, automatically scores a 1 in the net debt-to-equity category. A company with foreign revenue and no foreign debt is given a score of 1. A company with no foreign revenue but with some foreign borrowings is given a -1.

TOTAL SCORE

PASSING SCORE CRITERIA

Adding the scores for all 16 categories, we arrive at a range of score of between -16 to +16. Any company which scores a zero or more passes the CLSA stress test. Negative scores fail the test. We have done the scoring for two years (1997-98) to incorporate the changing trends in different ratios due to the changing currency and general economic scenarios.

DEFINITIONS OF RATIOS - NUMERATORS/DENOMINATORS

	Numerator	*Denominator*
Debt & liquidity ratios		
Net debt/equity (%)	Total debt (LT loans (including convertibles) + ST loans and maturities) - cash - cash equivalent.	Shareholders' equity + minority interests.
Foreign debt/foreign rev (x)	Includes all foreign currency denominated debt.	Includes all foreign currency denominated revenues.
Net debt/free cash flow (x)	Total debt (LT loans + ST loans and maturities) - cash - cash equivalent.	FCF = EBIT+depreciation+/-Changes in working capital+/-deferred costs-interest expense+interest income-tax paid+dividend/other income received.
Cash/current liabs (x)	Cash includes cash and cash equivalents (ST investments, marketable securities).	Total current liabilities as reported in the annual reports.
(FCF+cash)/ (curr matur+int payment) (x)	FCF+cash as defined above.	Current maturities include all debt due within the next 12 months (short-term loans and maturities of long-term loans). Interest payment includes all cash interest paid (interest expensed and capitalised).
Activity ratios		
Receivables		
No. of days	Total amount of receivables on the balance sheet net of provision for bad debts.	Total sales.
No. of days (YoY)	Receivable days for Year(t).	Receivable days for Year(t-1)
Inventories (FG+WIP)		
No. of days	Total amount of finished goods (FG) and Work-in-process (WIP) inventories on the balance sheet.	Cost of goods sold for the year.
No. of days (YoY)	Inventory days for Year(t).	Inventory days for Year(t-1).
Operating ratios		
Operating profit margin (%)	Operating profits for the year.	Total sales figure for the year.
Operating leverage (FC/sales) (%)	Operating fixed costs.	Total sales figures for the year.
Foreign sales to total sales (%)	Foreign sales = Total sales - domestic sales - Asean sales[1].	Total sales figures for the year.
Foreign costs to domestic sales (%)	Operating foreign costs attached to the domestic sales alone. It does not include depreciation and/or interest expenses.	Domestic (local currency denominated) sales.
Capital efficiency ratios		
ROAE (%)	Net profit for the year.	Average shareholders' funds for the year.
ROCE (%)	EBIT = Earnings before interest and tax.	Capital employed [2] = Average shareholders' funds + Average long-term liabilities.
EVA/Cap employed (%)	Economic Value Added (EVA) = (EBIT-Adjusted tax) - (WACC x Total capital employed).	Capital employed = Average shareholders' funds + Average interest-bearing liabilities.

[1]Depending upon data availability

[2]Capital employed used for ROCE = Shareholders' funds + LT liab + Interest-bearing short-term liab - Cash - Cash Equivalents - Assets under construction

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