ILUKA

BRIEFING PAPER
EMERGING TRENDS IN CHINA PIGMENT

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CONTENTS

ILUKA INDUSTRY ANALYSIS AND STRATEGIC CONTEXT

Iluka's titanium dioxide feedstock business has historically been oriented to the supply of western chloride pigment producers. This reflected the nature of the company's resource base which has comprised, predominately, chloride feedstocks, including chloride ilmenite and the higher grade rutile and synthetic rutile.

As part of Iluka's strategic planning, the company has for some time conducted detailed industry analysis of emerging and likely longer term trends in the China pigment market, including:

- a detailed review of China's expanding sulphate pigment production and its potential to supply global markets as domestic quality improved (in this respect the company was interested in the relevance of historical analogies with other commodities, such as nickel pig iron and alumina);
- extensive in-country analysis by its marketing team and by external research agencies, including numerous site visits with existing and emerging pigment producers;
- consideration of government policy settings on China's pigment production trends and, in particular, the potential for China to develop significant chloride pigment capacity; and
- opportunities and risks to Iluka's position as a pigment industry feedstock supplier.

The major opportunity Iluka foresaw and continues to pursue, is the potential to supply high grade chloride feedstocks to the emerging China chloride pigment industry.

The analysis Iluka has commissioned and conducted has included detailed consideration of factors such as:

- sulphate pigment: plant location, capacity, utilisation, raw material sources, waste management approaches and economics (both capital and operating costs);
- domestic feedstock (including linkages to domestic iron ore production and the economics of ilmenite produced from titano-magnetite deposits);
- comparison of the China pigment industry capacity versus global pigment production and demand; and
- China chloride capability: government policy setting; emerging players; the nature of chloride technology being adopted; availability of domestic feedstock and the potential for imported material, including Iluka supplied feedstock.

Several decisions made by Iluka over recent years reflect the analysis undertaken. These include, but are not limited to:

- research and development work on high grade feedstocks suitable for sulphate pigment production;
- the reacquisition of sulphate ilmenite deposits in Sri Lanka;
- extensive engagement with existing and emerging industry participants in China; and
- the recent announcement of plans to establish a China Technical Centre in 2015, with a mineral sands laboratory and bench-scale chlorinator to advance the company's engagement with current and prospective chloride pigment producers.

Through the analysis and market development work the company has undertaken, Iluka considers itself well positioned to pursue opportunities to supply the developing China chloride pigment market, and to be able to supply into the increasingly sophisticated China sulphate pigment market.

This paper provides selected information related to Iluka's analysis of the China pigment market.

CHINA PIGMENT MARKET – SULPHATE

China represents the world's largest sulphate pigment production base. Installed pigment production capacity is overwhelmingly sulphate technology, in comparison to North America, which utilises predominantly chloride technology and Western Europe, which has a mix of chloride and high quality sulphate pigment plants.

China's initial adoption of sulphate-based pigment technology reflects the relatively low technical barriers to entry for the adoption of this technology and the ability for it to be supplied, in large measure, by domestic feedstock sources. Nonetheless, imported feedstocks, mainly ilmenite, for the sulphate pigment sector represent about 40 per cent of typical supply.

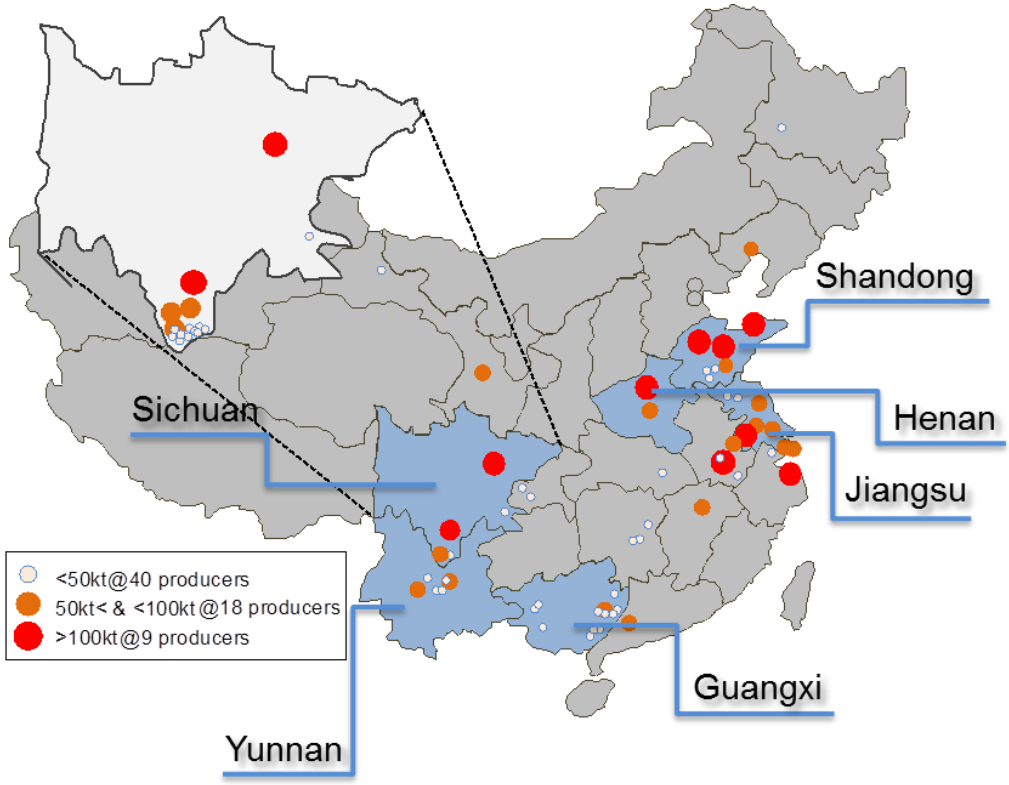
Estimates of the size of China's sulphate pigment industry vary. Since 2011, Iluka's estimates are based on plant by plant data built up by a combination of site visits and interviews by Iluka China-based staff and external consultants. For 2013, Iluka estimates China's total sulphate pigment capacity was 3.1 million tonnes in 2013 (not all of which was active during the year) and the country produced an estimated 2.1 million tonnes of pigment. To put this into perspective, TZMI estimates rest of the world (excluding China) total pigment production at 3.6 million tonnes. Of global pigment capacity, approximately 45 per cent is chloride and the remainder sulphate. (Source: TZMI Pigment Annual Review 2014).

Growth in China sulphate pigment has involved the proliferation of a large number of small pigment plants. Given inherent inefficiencies with many of these plants and current market conditions, it is estimated that much of this capacity is not fully utilised; with China's average pigment plant utilisation estimated at ~60 to 65 per cent (as at 2013), compared to ~80 - 90 per cent currently for western chloride pigment producers, based on disclosed data by a selection of western chloride pigment producers.

Despite the disparate nature of the China sulphate pigment market, there are some large, integrated producers, increasingly producing high quality product. Based on Iluka's commissioned research:

- the top nine producers (each with above 100 thousand tonnes capacity per annum) represent ~40 per cent of national capacity;
- inclusive of the next 18 Tier 2 producers (50 – 100 thousand tonnes capacity per annum), ~70 per cent of national sulphate pigment capacity is represented by these producers; and
- the total estimated number of sulphate pigment plants in China is just above 65.

Major Sulphate Pigment Production Locations



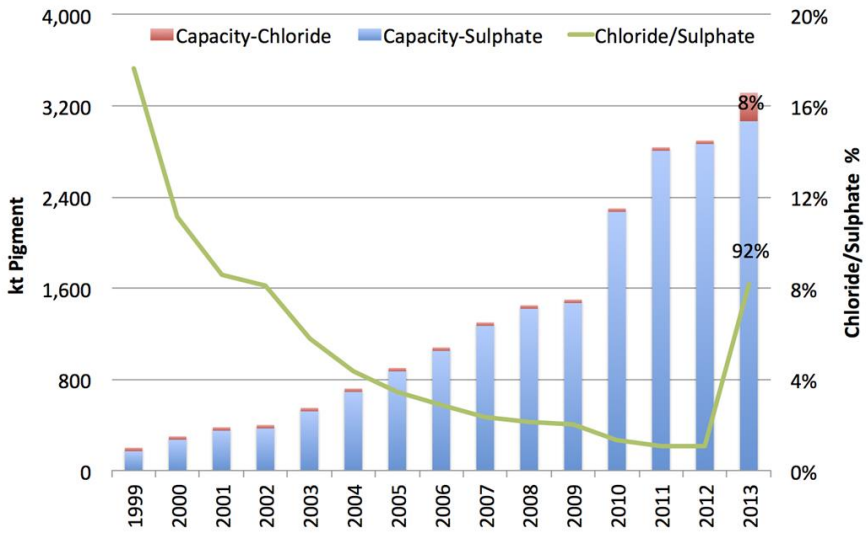
Source: CM Study 2014, commissioned proprietary research by Iluka

Sichuan province is the largest pigment producer, due to proximity to indigenous resources, although final product cost to domestic coastal and export markets is influenced by logistic costs. On the other hand, coastal producers benefit from lower logistics costs and access to imported feedstocks. Recent government policies seek to encourage pigment capacity in provinces closer to downstream applications.

Much of the sulphate pigment production base in China may be uneconomic currently, which when associated with government environmental policies, has seen restrictions on new plant construction as well as the closure of some pigment plants, a trend which Iluka expects to continue.

The following chart shows the increase in China sulphate pigment capacity and the recent establishment of chloride pigment capacity (refer below for further details on chloride pigment growth in China).

China Pigment Capacity 1999 – 2013



Source: CM Group, commissioned proprietary research by Iluka

Pigment Demand in China

In 2013, China produced an estimated 2.1 million tonnes of titanium pigment, having grown at an average annual rate of 8 per cent over the previous five years. The country imported an estimated 200 thousand tonnes of pigment (mainly chloride) and exported ~400 thousand tonnes of sulphate pigment, implying overall pigment consumption in China of around 2 million tonnes in 2013.[1]

Within China, it is estimated that of demand for pigment for various end uses, sulphate pigment supplies 80 – 85 per cent of demand, with 15 – 20 per cent of demand (mainly for applications such as automotive paint, for manufactured goods and for high quality external architectural paint) met from mainly imported chloride pigment.

China's Titanium Dioxide Feedstock Requirements

Feedstock supply for China's sulphate pigment capacity has been from a combination of domestic supply and imported material.

In 2013 China consumed approximately 2.7 million tonnes of titanium dioxide equivalent units of feedstock[2] for pigment manufacture, with approximately 40 per cent imported, mainly in the form of sulphate ilmenite.

While the average grade of domestic ilmenite concentrate was ~47 per cent titanium dioxide, imported ilmenite concentrate is ~50 per cent titanium dioxide. Therefore, the share of imported ilmenite concentrate (on a 100 per cent titanium dioxide equivalent basis) was higher due to higher feedstock grade.

The primary source of titanium dioxide in China is associated with magnetite production, mainly in the provinces of Sichuan and Hebei. Hainan Island is the largest domestic source of ilmenite in conventional sand form, however, represents only a small proportion of overall domestic titanium dioxide feedstock supply. As such, the availability of feedstock for the sulphate pigment market in the past has been strongly correlated with magnetite and steel production in China. Based on Iluka's commissioned research, a ratio of around 30: 1 conversion of magnetite to titanium concentrate can occur, at a 47 per cent titanium dioxide content. That is, 1 tonne of ilmenite concentrate is produced from 30 tonnes of magnetite. It should be noted that the ratio depends on – magnetite and titanium grade in ore and recoveries, which Iluka's analysis found to be variable across deposits. Iluka's analysis has included "breakeven" analysis of iron ore production in the main magnetite producing provinces, as an indication of the impact of local iron ore production on likely pigment feedstock availability.

[1] CM Group, commissioned proprietary research by Iluka.

[2] This refers to the equivalent titanium dioxide content in various forms of imported product, from concentrate to ilmenite in various grades, as well as some rutile, hyti and upgraded ilmenite products in the form of slag.

A portion of titanium raw material (including ilmenite) feedstocks are upgraded in China via an installed base of slag furnaces and very limited synthetic rutile capacity as a sulphate pigment feedstock. Feedstock and energy costs are the main economic drivers for slag production.

In summary, Iluka expects sulphate pigment capacity in China to continue to grow over time, but not at the rate observed in the last five years. Within this context, production will increasingly be underpinned by larger, more efficient plants, and smaller scale, sub economic and plants with poor environmental performance are expected to be gradually rationalised and closed. This production base is expected to continue to be served by a combination of domestic and imported feedstocks (the latter both as a direct feed and capable of being upgraded).

It is likely that higher quality feedstocks may be a feature of the continued growth of larger, more sophisticated sulphate pigment plans. While sulphate pigment incontrovertibly remains a part of China's pigment future, a new and emerging major trend is the adoption of chloride pigment capacity.

THE EMERGENCE OF CHLORIDE PIGMENT MANUFACTURE IN CHINA

The chloride pigment technology trend is influenced by a number of factors, including:

- continued domestic demand growth, with Chinese pigment-per-capita consumption expected to continue to grow in line with domestic GDP-per-capita growth over time;
- import replacement of a pigment and/or paint product which is a necessary component of cornerstone industries such as automotive and white goods manufacturing (and where China's requirements have historically been met exclusively by imports);
- major private and state owned enterprises championing, through the utilisation of western technical experts and in some cases licensing arrangements, the adoption of chloride technology;
- Chinese Government policies that provide a strong imperative – mainly on environmental grounds – for chloride technology to be investigated, acquired and adopted in China (refer Appendix 1) and which appear to discourage small sulphate producers;
- a slow-down in sulphate pigment capacity growth given current over-capacity and potential rationalisation of capacity; and
- increasing availability of high grade imported chloride feedstocks, which have in the past been subject to exclusive long term contractual arrangements.

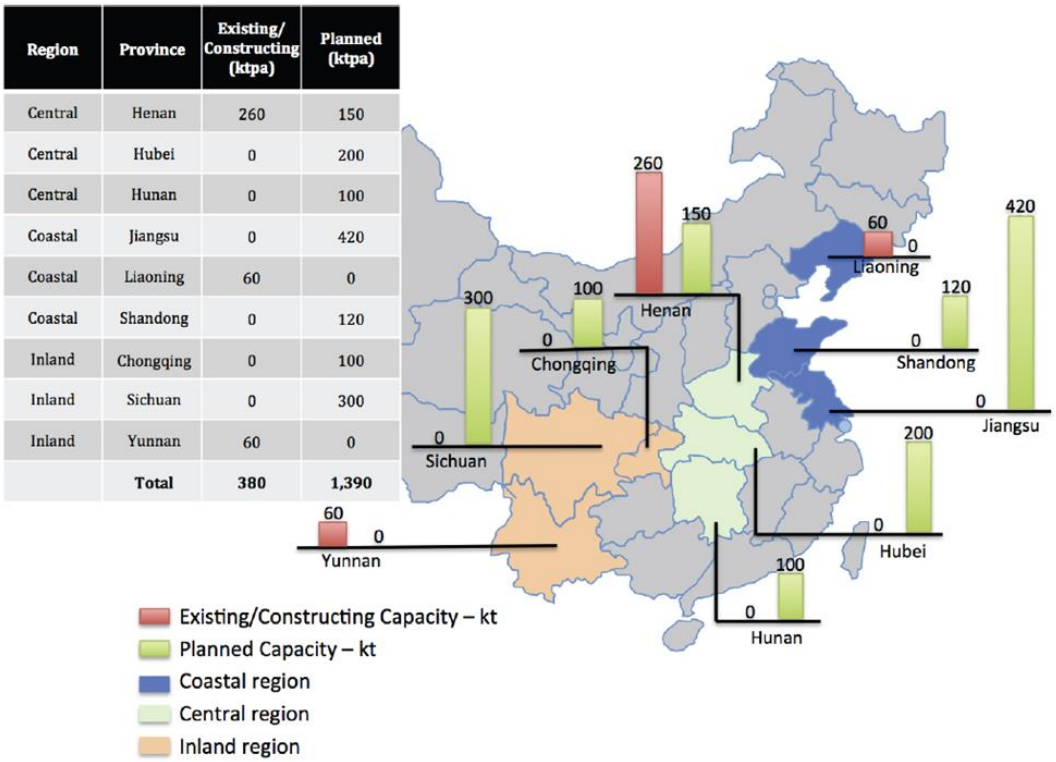
China's pigment capacity has been dominated by sulphate-route technology, and until recently CITIC Jinzhou's 30 thousand tonne molten salt plant was the only chloride pigment operation. However by the end of 2013, China's chloride capacity had increased to 180 thousand tonnes, with the addition of the following fluidized-bed pigment plants currently in various stages of commissioning: Yunnan Xinli (60 thousand tonnes), Henan Luohe Xingmao (60 thousand tonnes) and CITIC Jinzhou's phase two (30 thousand tonnes). The addition of Henan Billions' 100 thousand tonne plant will bring China's chloride pigment capacity to 280 thousand tonnes by the end of 2014, with several more plants understood to be in planning phase.

Iluka's own market analysis, combined with commissioned research, indicates that additional planned capacity of a potential ~1.4 million tonnes per annum of chloride pigment capacity may be possible by around 2018.

The timing and extent of the adoption and successful commissioning of chloride pigment production remains uncertain, but the advancement to a domestic source of such production is evident.

Planned Chloride Pigment Capacity in China

Region	Province	Existing/ Constructing (ktpa)	Planned (ktpa)
Central	Henan	260	150
Central	Hubei	0	200
Central	Hunan	0	100
Coastal	Jiangsu	0	420
Coastal	Liaoning	60	0
Coastal	Shandong	0	120
Inland	Chongqing	0	100
Inland	Sichuan	0	300
Inland	Yunnan	60	0
	Total	**380**	**1,390**



Source: CM Group, commissioned proprietary research by Iluka

China has limited indigenous sources of high grade feedstocks which would satisfy the stated government policy requirement (National Development Reform Commission, 2011) for the "…use [of] feedstock that contains no less than 90 per cent TiO_2 (including synthetic rutile, natural rutile and high titanium slag)." As such, Iluka, through its in-country marketing presence, has been engaging over the last three years with prospective and current chloride pigment producers and has supplied quantities of both rutile and synthetic rutile for testing as a potential feedstock for new chloride capacity in country.

IMPLICATIONS FOR ILUKA

Iluka's strategic and analytical work over several years, relating to overall trends in the global pigment market, and in particular, China have influenced its business approach. In China, Iluka is seeking to develop a business model which will enable the company to supply both sulphate and chloride feedstocks into the China pigment market.

This has included the following:

- on the marketing front, a strong in-country presence, reflected in the building of a specialist local team covering sales, marketing, analysis, logistics and customer/commercial arrangements, supplemented by senior expatriate staff;
- a senior executive whose role encompasses joint ventures and strategic partnerships; with much of the role's focus related to further development of relationships with emerging and potential future chloride pigment producers in China;
- advancement of mineral sands projects potentially relevant to supply into China, as well as other markets. This includes the Puttulam deposit in Sri Lanka, and Tapira in Brazil;
- development work on a higher grade sulphate feedstock via a kiln process for sulphate pigment producers; and
- the announcement at the November 2014 TZMI Congress in Shanghai of Iluka's China Technical Centre, planned to open in 2015. The Iluka Technical Centre, which will be located near Shanghai, will be staffed by Chinese and international experts, and include a full service laboratory with a chlorinator. The Centre will provide an opportunity for Iluka to further build upon its relationships with customers and producers in China, servicing the titanium dioxide market, as well as zircon customers.

Iluka Technical Centre located in China

Note: Illustrative design

The Iluka technical centre is designed to strengthen Iluka's industry position in China. It is expected that this initiative will provide customers with technical support and product knowledge; enable the demonstration of performance characteristics of different feedstocks, and assist with determining product specifications and quality criteria in customer feedstock formulas.

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Appendix 1 - China Government Policy Pronouncements Regarding Pigment Development in China

Outlined below is a summary of Chinese Government policy statements regarding chloride and sulphate pigment developments. They suggest a clear intent to transform China's predominant reliance on sulphate pigment to chloride pigment production.

2011	National Development and Reform Commission (NDRC) update domestic titanium pigment industry regulations.	• Brownfields expansions to be greater than 50 thousand tonnes per annum. • Individual upgrades to be greater than 30 thousand tonnes per annum. • No new greenfields sulphate pigment capacity after June 2011 (for applications received after June 2011). • Elimination of undersized capacity (less than10 thousand tonnes per annum by end 2012 and less than 20 thousand tonnes by end 2015).
	Ministry of Industry and Information Technology published "Cleaner Production Technology Implementation Scheme for Five Industries Including Titanium Dioxide"	By 2014, it is anticipated that TiO_2 production capacity using the chloride process will reach 300ktpa.
	NDRC published the "Guiding Catalogue for Industrial Structure Adjustment". In this, industry segments are divided into three categories: to be encouraged; to be restricted; and to be eliminated.	With respect to titanium pigments, it states: • To be encouraged: chloride titanium dioxide plants with individual line capacity of 30,000 tons/year and above, and use feedstock that contains no less than 90 per cent TiO_2 (including synthetic rutile, natural rutile and high titanium slag). • To be restricted: new sulphate pigment plants.
2012	NDRC published "Comprehensive Utilization of Vanadium and Titanium Resource and Industry Development Plan for the 12th Five Year Plan".	Key objectives of the Plan include: • Encourage vertical integration, the formation of industry base, and promote champion enterprises. • Plan supply (both quantity, and scale of operations) according to demand. • Process and production innovation. • Improvement in waste treatment The Plan also endeavours to eliminate out-dated and non-compliant technology and equipment by the end of 2015, including: • Sulphate pigment plants with an individual production capacity of 20 thousand tonnes and below. • Chloride pigment plants with an individual production capacity of 15 thousand tonnes and below. The Plan also states that by end 2015, production of chloride titanium pigment should take up 15 per cent of total titanium pigment production in China.

Iluka is aware of other recent policy developments, expected to become effective by end 2014, which also encourage use of high grade chloride feedstocks, including:

- "Admittance Requirements for the TiO_2 Pigment Industry", published by the NDRC; and
- "Policy of Pollution Prevention and Treatment Techniques in the TiO_2 Pigment Industry", published by the Ministry of Environmental Protection.

Both policy documents articulate pigment industry development priorities, encouraging fluid-bed chloride technology and development of greenfield capacity greater than 100 thousand tonnes, supported by well constructed environmental protection systems.

Disclaimer

This briefing paper contains information that is based on projected and/or estimated expectations, assumptions and outcomes.

These forward-looking statements are subject to a range of risk factors associated, but not exclusive, with potential changes in:

- exchange rate assumptions
- product pricing assumptions
- mine plans and/or resources
- equipment life or capability
- current or new technical challenges
- market conditions
- management decisions

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