Chrome and Ferrochrome Markets Recent Trends & Challenges

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Industry data is sourced from ICDA, FerroalloyNet, LME, MB, ISSF, TEX, UN Trading Data, Eurostat, OANDA (2018).
Today’s Market: is there a way forward to less volatility?
## Commodity market volatility

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Jan 2016 vs Dec 2017</th>
<th>Dec 2017 vs 2018 YTD</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cobalt</strong></td>
<td>209%</td>
<td>9%</td>
</tr>
<tr>
<td><strong>Ferrovanadium</strong></td>
<td>196%</td>
<td>33%</td>
</tr>
<tr>
<td><strong>Crude oil Brent</strong></td>
<td>92%</td>
<td>1%</td>
</tr>
<tr>
<td><strong>UG2</strong></td>
<td>84%</td>
<td>18%</td>
</tr>
<tr>
<td><strong>FeSi MB</strong></td>
<td>69%</td>
<td>12%</td>
</tr>
<tr>
<td><strong>SiMn MB</strong></td>
<td>67%</td>
<td>4%</td>
</tr>
<tr>
<td><strong>Zink</strong></td>
<td>65%</td>
<td>9%</td>
</tr>
<tr>
<td><strong>HC FeCr EU MB</strong></td>
<td>57%</td>
<td>5%</td>
</tr>
<tr>
<td><strong>Benchmark</strong></td>
<td>51%</td>
<td>-6%</td>
</tr>
<tr>
<td><strong>CIF Shanghai</strong></td>
<td>50%</td>
<td>11%</td>
</tr>
<tr>
<td><strong>Average China Tender</strong></td>
<td>43%</td>
<td>9%</td>
</tr>
<tr>
<td><strong>Iron ore</strong></td>
<td>29%</td>
<td>6%</td>
</tr>
<tr>
<td><strong>Aluminium</strong></td>
<td>26%</td>
<td>6%</td>
</tr>
<tr>
<td><strong>Copper</strong></td>
<td>24%</td>
<td>3%</td>
</tr>
<tr>
<td><strong>Tin</strong></td>
<td>21%</td>
<td>9%</td>
</tr>
<tr>
<td><strong>LC FeCr MB</strong></td>
<td>16%</td>
<td>2%</td>
</tr>
<tr>
<td><strong>Gold</strong></td>
<td>11%</td>
<td>2%</td>
</tr>
<tr>
<td><strong>Nickel</strong></td>
<td>-3%</td>
<td>15%</td>
</tr>
<tr>
<td><strong>Platinum</strong></td>
<td>-14%</td>
<td>9%</td>
</tr>
</tbody>
</table>

Source: MB, LME, Ferroalloynet
Currency volatility and its impact on FeCr prices

Currency exchange FeCr producing countries

ZAR Price vs RMB Price

Source: MB, Ferroalloynet, Oanda

25% difference in growth

26% difference in growth

Source: Oanda

Q1 2016 Q2 2016 Q3 2016 Q4 2016 Q1 2017 Q2 2017 Q3 2017 Q4 2017 Q1 2018

ZAR/USD KZT/USD CNY/USD RUB/USD INR/USD TRY/USD

CIF Shanghai in ZAR China Tender in RMB
Benchmark and Tender expressed in local currencies

Source: MB, Ferroalloynet, Oanda
Global vs China domestic FeCr prices

Source: MB, TEX, Ferroalloynet

LC/MC FeCr Global Prices

- Delta between China and RoW in %
- Average Global Price
- China USD per pound
- Average difference

HC FeCr Global Prices

- Delta between China average price
- Average global price
- Europe
- USA
- China USD per pound
- Average difference
Market Trends Worldwide

- Over past several years many commodity markets have shown volatile behavior. Cr ore and FeCr indexes were within the top of most volatile indicators for the metals and commodities in general.
- Historically, the Benchmark was the leading index to reflect the market of FeCr not only in EU but also globally.
- Few years ago more and more indexes were developed on a basis of spot prices in different regions. Tender results announced by consumers in China were getting more and more used to reflect the market worldwide.
- FeCr in China was following a mature markets trend. After 2008 shock it was driven by domestic situation with a very little link to the rest of the world. Since 2015 one could see more and more correlation between benchmark moves and a pattern of indexes and tender results in China with one quarter time lag.
- European HC FeCr market is driven by its own supply/demand on higher Cr-content FeCr and only follows in general ChCr.

All the indexes and markets described above are non hedgeable and quite volatile. Therefore, the market requires the mechanism which will allow all market participants to measure future expectations on a longer term, with more accuracy and financial responsibility than what exists now.
China: two years roller coaster and long term future for FeCr supply/demand
Cr ore production vs. import into China

Source: ICDA, FerroalloysNet
Turkish and UG2 Cr ore prices and Chinese Cr ore stocks since 2011
(China CIF basis, USD/dry metric ton unit and Mt)

Source: ICDA
China Tender Prices vs Monthly Apparent FeCr Availability

Source: ICDA, FerroalloysNet, Unichrome Model
Estimated average stainless scrap consumption in China is 11.2% for 300ss in 2017 (Tisco at 12%, Z.Posco at 25%, Tsingshan Fu’an at 28%).

Moderation of the further growth of SS production will lead to accumulation of more stainless scrap in China. In 15-20 years scrap ratio will increase and partially replace the least competitive and low Cr content ferrochrome as a source of chromium units. However, this will create additional demand for high Cr content FeCr.

Scrap ratio will be limited and not reach mature countries level due to the competition from NPI. Some new capacities in China and Indonesia are using non EAF stainless steel making process. Further advance in this direction will decrease potential future substitution of FeCr by stainless scrap in China and other production areas of SS production development like Indonesia.
Essentials of Market in China

- Economic indicators have recently shown the sign of decrease and the question is whether this correction over or further drops are expected?

- Control over real estate industry in China has been kept in place, while basic tone of finance has been kept as neutral;

- In the beginning of 2018, it was believed that the effect of last round of QE in China was about to end, but in April China’s CB decreased required reserve first time since H1 2016!

- Although some concern appeared about weaker Chinese FeCr demand growth in 2018, it was growing at extremely high rate during last two years, and this will mean normalization of the growth.

- Capacity in Indonesia will gradually replace some less competitive production in mainland China.

- This will create additional demand for FeCr outside China and will put a pressure on domestic FeCr production in the country.

- As the result, it will change balance of imports of Cr ore and FeCr

- Export duties on FeCr in China create a gap between the China’s domestic FeCr market price and international market
Ferrochrome industry global and inter-regional trends
Charge & HC FeCr classification by Cr content and market share

- **Albania, Kazakhstan, Russia, Sweden, Turkey**
  - Market Share: 19%

- **China, India, Iran, Zimbabwe**
  - Market Share: 48%

- **Brazil, Finland, South Africa**
  - Market Share: 19%
FeCr production Globally

**HC FeCr Production**
- China: 38%
- South Africa: 11%
- Kazakhstan: 10%
- India: 5%
- Western Europe: 1%
- Eastern Europe: 1%
- Turkey/Albania: 2%
- RoW: 2%

**LC/MC FeCr Production**
- China: 63%
- Russia: 18%
- Kazakhstan: 4%
- Turkey: 4%
- Germany: 6%
- Brazil: 3%
- RoW: 3%
Refined FeCr imports to Europe in proportions to tonnages affected by antidumping investigation and tonnages for possible substitution

Total tonnage: 39,631

Global imports ex EU

Tonnage available for Substitution
Total tonnage: 39,631

Tonnage affected by Antidumping investigation
Total tonnage: 49,642

Source: Eurostat
• First column is the percentage of the total resources split by High Quality and Low Quality Ores
• Second column is the split of percentage of High Quality and Low Quality Ores produced annually
• Third column is the total percentage of the known resources used in production annually
Chromium quality and Ferrochrome quality

- Chromium ore is divided into two types: stratiform deposits (lower Cr/Fe ratio) and podiform deposits (higher ratio)
- The majority of the deposits are stratiform, used mainly for production of charge chrome and low Cr content ferrochrome
- Podiform deposits are used mainly in production of high Cr grade high carbon ferrochrome and refined ferrochrome
- From the graphs you can see that production levels of podiform deposits are much higher than stratiform be pressed ass a percentage of the total resources
- In the long run, such disproportion will decrease availability of high Cr content ferrochrome, thus driving the markets for high and low Cr content FeCr more and more far from each other.
Ferrochrome industry consolidation in South Africa and new capacity in China

South African Ferrochrome Producers in 2014/2015

- “The magnificent seven”:
  - Glencore-Merafe (capacity 2,000,000 t/y)
  - Samancor (capacity 1,200,000 t/y)
  - Tata KZN (capacity 150,000 t/y)
  - Afarak (capacity 110,000 t/y)
  - Hernic (capacity 420,000 t/y)
  - IFM (capacity 267,000 t/y)
  - ASA (capacity 410,000 t/y)

South African Ferrochrome Producers 2018

- Last men standing:
  - Glencore-Merafe
  - Samancor:
    - Acquired IFM, with plans to restart the furnaces (capacity 267,000 t/t)
    - Acquired ASA, with plans to restart the furnaces (capacity 410,000 t/y)
    - Rumoured to have acquired Hernic (capacity 420,000 t/y)
  - Afarak (capacity 110,000 t/y)
  - Traxys acquired Tata KZN, all the furnaces still offline

China New Capacity by region, Mt

<table>
<thead>
<tr>
<th>Region</th>
<th>Capacity (Mt)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inner Mongolia</td>
<td>2,067,100</td>
</tr>
<tr>
<td>Shanxi</td>
<td>72,000</td>
</tr>
<tr>
<td>Sichuan</td>
<td>72,500</td>
</tr>
<tr>
<td>Guangxi</td>
<td>32,400</td>
</tr>
<tr>
<td>Gansu</td>
<td>21,600</td>
</tr>
<tr>
<td>Henan</td>
<td>72,000</td>
</tr>
<tr>
<td>Guizhou</td>
<td>72,900</td>
</tr>
<tr>
<td>Hunan</td>
<td>22,500</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>2,430,300</strong></td>
</tr>
</tbody>
</table>
Important regulatory actions for the Cr and FeCr industry within last year.

• Current actions with major effect on international trade
  • Various recent measures in Aluminum and steel industries create additional uncertainty in the direction of further development for many markets and the indirect impact is yet to be seen/analyzed.

• China tightening ecological norms and control:
  • Ecological controls made the big impact on ferroalloys industry earlier this year

• Mining rules in RSA:
  • The New Mining Charter decision is postponed to the end of May, due to election of new president and decision to review it again
  • It appears that new draft of the Charter has received a bigger support from the mining industry, but the final ruling is still ahead

• LCFerCr anti-dumping probe in EU:
  • No decision has been announced yet
  • Simple supply analysis in EU shows that increase in import from countries not involved in anti-dumping ruling will not be able to cover EU demand from the countries under investigation

• Power issues in South Africa:
  • As a result of deceleration in pace of power cost increase in RSA, the electricity deficit worries have being easing last year. However due to recent news, including Eskom facing coal shortages and attempts by Eskom to claim back lost revenues, might alarm that the bottleneck in the way of FeCr production in the region is still there, and might result in an acceleration in the costs increase.

Ferrochrome and chrome industries have been suffering from continued low demand, which in turn created price disadvantage for most suppliers. Price volatility not only caused by market circumstances, but also uncertainty over further decisions from regulators. This will lead to re-evaluation of the raw material stock targets for consumers of both FeCr and Cr ore. This process already started last year.
Evolution of Global FMS top "tail risk"
Summary

• Specialization in different grades and types of FeCr by Cr content as well as Si, P, e.t.c will continue. FeCr market is split with its own supply and demand by different segments. An example is the difference in the high and low Cr content resources versus relative consumption rates.

• Consolidation of the FeCr production outside China has created very high concentration of supply. On the other hand, impressive growth of new capacities in China has led to rebalancing in ore import to China versus FeCr import by means of indirect competition between integrated FeCr producers and pure ore suppliers.

• Shift of the new SS production from China to Indonesia and other Asia will support demand on imported FeCr. Combined with increase of scrap ratio in China this will threaten less competitive part of the domestic FeCr capacities.

• Growth of the risks of constrains in or between different regions and countries will require serious revision of stock targets towards higher levels and will lead to an increase of the stocks held at the consumption points.

• Purchasing strategy makers will have to consider shifting priorities towards ‘key raw material supply sustainability’. Graphite electrodes are within the most alarming illustrations for this statement

• Volatility over past two years does not help developing and long term planning for the industry. Cr and FeCr need a mechanism to decrease volatility or hedge in order to ensure sustainable growth in both consumption and production of FeCr.
Thank you for your kind attention

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