Contents

• History

• Market

• Process and production data

• Comparisons with other zinc smelters

• Challenges
Corporate History

• 1965: GFSA closes Vogelstruisbult Gold Mine in Springs. Facility is temporarily converted to process uranium
• 1967: Zincor is established (65% GFSA; 35% Iscor)
• 1969, Apr: First ingot cast
• 1999, Feb: GFSA unbundles; Iscor acquires Zincor
• 2001, Nov: Iscor unbundles; mining division of Iscor, including Zincor, is consolidated into a new entity – Kumba Resources
• 2002-2006: Anglo American acquires controlling stake in Kumba Resources
• 2006, Nov: Kumba Resources is unbundled; iron ore business is separated to form Kumba Iron Ore Company; remaining assets and Eyesizwe Coal are consolidated into a new entity - Exxaro Resources. Zincor is now a division of Exxaro Base Metals

Exxaro Base Metals: 100% Zincor, 26% Black Mt and Gamsberg; 49% of Rosh Pinah; minor shareholding in Chifeng Smelter in China

GFSA – Gold Fields of South Africa

Iscor – now ArcelorMittal South Africa
Slab Production Milestones

• 1969: First ingot is cast
• 1970: 35 kt/a
• 1996: 101 kt/a
• 2002: 111 kt/a
• 2003: 112 kt/a
Zincor’s Role in the Economy

• Zincor is the only primary zinc producer in South Africa

• Slab zinc production of approximately 100 kt/a with inherent capacity up to 115 kt/a

• Sulphuric acid production of approximately 170 kt/a. Supplies 25% of traded sulphuric acid market
Domestic Market: Zinc

- Pretoria: 74%
- Richards Bay: 3%
- Durban: 4%
- Cape Town: 19%
Market: Zinc and Acid Usage

**Zinc**
- Zinc Alloys: 9%
- Brass Alloys: 7%
- Total Battery: 2%
- Total Chemical: 9%
- Total Other: <1%
- Total Galvanizing: 73%

**Sulphuric Acid**
- Exporters: 3%
- Sasol: 17%
- Fertilisers: 6%
- Other Cust.: 20%
- Distributors: 54%
## Product Range: Zinc

<table>
<thead>
<tr>
<th>Grade</th>
<th>Composition</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>SHG</td>
<td>Min 99.995% Zn</td>
<td>Customers requiring lowest impurities Spot exports</td>
</tr>
<tr>
<td>Zn 2</td>
<td>Min 99.95% Zn</td>
<td>Galvanising customers, including CGL’s*</td>
</tr>
<tr>
<td></td>
<td>Sub-grade – High Pb</td>
<td>Galvanising customers, excluding CGL’s</td>
</tr>
<tr>
<td></td>
<td>Sub-grade – Low Cd</td>
<td>Battery manufacturer</td>
</tr>
<tr>
<td>Zn 4</td>
<td>0.95 – 1.35% Pb</td>
<td>Battery manufacturer and general galvanisers</td>
</tr>
<tr>
<td>Zincal-10</td>
<td>10% Al alloy</td>
<td>CGL’s and general galvanisers for Al additions to pots</td>
</tr>
<tr>
<td>Pre-alloy jumbo ingots</td>
<td>0.6% Al</td>
<td>CGL’s only – ArcelorMittal and Duferco</td>
</tr>
<tr>
<td>Nickel alloy</td>
<td>1% Ni-Zn master alloy</td>
<td>Production by TeckCominco, Canada. Distributed by Zincor to general galvanisers. Mitigate effects of reactive steels on galvanising process</td>
</tr>
</tbody>
</table>

* CGL – continuous galvanizing line
Supply and Product Chain

Raw Materials
- Rosh Pinah
- Black Mountain Imports (ZnS)
- ZnO (from DRC)

Smelter
- ZINCOR

Sulphuric Acid
- Intermediate Fertilizer Product

Primary Consumers
- Galvanising Alloys
- Batteries
- Chemicals

Final Consumers
- Agricultural Industry
- Chemical Process Applications
- Automotive Transport
- General Consumers
- Infrastructure
- Construction
Production Data

2004: Shortage of concentrate
2005 – 2007: Poor concentrate grade
2006 – 2008: Roaster rebuild
Purification

Impure ZnSO₄

Zn Dust

Cu Cementation

Zn Dust

As₂O₃ soln

Cu/Co Removal

Scented Zinc Dust

Cu/Co/As Cake to further processing

To Purified Solution storage/Gypsum Removal

Zn° + M²⁺ = M° + Zn°; 
M = Cu, Co, Ni and Cd

Cd Scavenger cake

Cadmium Scavenger cake

Cd Removal

Cd-free, Zn-rich solution with Cu solids

Cd Upgrading

Upgraded Cd Cake to storage

Spent

To Neutral Leach

Filtration

Filtration

Filtration

Filtration

Spent Cu Cement to storage

Cu-sulphate production

Zinc Dust

Zinc Dust

Zinc Dust

Zinc Dust

Zinc Dust

Zinc Dust

Cu Cementation

Filtration

Filtration

Filtration

Filtration

Filtration

Filtration

Filtration

Filtration

Filtration

Filtration

Filtration

Filtration

Filtration

Filtration
Cell House

- 44 banks; 12 cells/bank; 528 cells
- 21,120 cathodes; 21,648 anodes
- Cathode area: 1.23 m²
- Anodes – 10 mm thick; Pb-Ag-Ca-Al; 0.5% Ag; 0.06% Ca; 0.012% Al
- Cathodes – 7 mm; 1050 Al alloy
- Cathode current density: 508 – 569 A/m²
- Deposition time: 24 hours
- Cathode life = 2 years
- Anode life = 6.5 years
Iron Removal

Fe solution (from Weak Acid Leach thickener) → Iron Precipitation

Spent electrolyte → Calcine

Steam → Calcine

ZnSO₄ Solution to Neutral Leach → Belt Filter

O/F → Thickener

U/F → Belt Filter

Filtrate → Belt Filter

Water → Belt Filter

Grain → Thickener

Calcine → Process Water

Zn Oxide → Slurry tank

Fe Residue to Tailings
# Iron Residue Composition

<table>
<thead>
<tr>
<th></th>
<th>Jarosite</th>
<th>VM - Goethite</th>
<th>Para-goethite</th>
<th>Zincor *</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fe content, %</td>
<td>29</td>
<td>40</td>
<td>34</td>
<td>35</td>
</tr>
<tr>
<td>Zn content, %</td>
<td>3.5</td>
<td>8.5</td>
<td>10</td>
<td>11</td>
</tr>
<tr>
<td>Overall Zn recovery, %</td>
<td>97.9</td>
<td>96.7</td>
<td>94.6</td>
<td>93.5**</td>
</tr>
<tr>
<td>Fe:Acid</td>
<td>1:1</td>
<td>1:1</td>
<td>1:1.5</td>
<td>1:1.3</td>
</tr>
<tr>
<td>Fe residue, t/100 t concentrate</td>
<td>22.5</td>
<td>16.2</td>
<td>19.2</td>
<td>23</td>
</tr>
</tbody>
</table>

* paragoethite with 50% oxides
** best
Zinc Industry

- Global slab production in 2008 was 11.6 Mt
- Over 90% of zinc is produced by electrolysis
- Largest smelters: San Juan de Nieva - 480 kt/a; Onsan – 450 kt/a
- Last cyclical peak was in 2006; price peaked at US$4500/t
- Pricing in 2009 is expected to stabilise at $1270/t
- Next predicted cyclical peak is in 2014
- Key to survival, apart from economy of scale: high zinc recovery, diversified product range and by-product recovery
Global Smelter Slab Production (kt/a)

Source: Data from Brook Hunt
73% of Zn is produced at recoveries above 95%

Source: Data from Brook Hunt
Challenges

Environmental issues

• Current residue disposal facility is nearing end of life
• Construction of new a facility and closure of existing one
• Treatment of discharge water to remove sulphates in the near future, in line with new environmental legislation

Electrical Energy

• Uncertainty over electrical energy capping for the next four years

Skills

• A general shortage of skills – common to most industries in South Africa
Challenges

Raw Materials Supply
• Uncertain long-term supply of local concentrates
• High transportation cost associated with imported material

Product Range
• Need to diversify value-added product range:
  - increase CGL grade production
  - grow local market for Ni-alloy
• Extract maximum value from associated base metals
**Challenges**

**Metallurgical issues**

Zincor needs to increase zinc recovery to 95%:

- Fuming technology, as practiced by Korea Zinc, is the most appropriate technology to treat residues and maximise recovery. This technology is not an option at present due to uncertainty in long-term local concentrate supply and high capital investment.

- Eliminate use of calcine in Fe Removal circuit by increased use of fumed zinc oxide as well as basic zinc sulphate.

- Recovery of soluble zinc from solution run-off from residue dam as a basic zinc sulphate.