ZINC OXIDE

ZINC OXIDE FROM SECONDARY ZINC (HZS, DROSS)

SECVONDARY ZINC SOURCES

INTRODUCTION

This section describes the usual sources of HZS* and the processes that generate it.

It explains how the HZS forms and some of the challenges a user faces when processing the material in a zinc oxide plant

Zinc residuals, Hard zinc, Secondary zinc are currently traded and shipped in a global market running at approximately 285,000 tpy.

**HZS Hard Zinc Spelter is secondary zinc defined in the shipping section*

SOURCES

- Galvanizing hard HZS produced by
  - Continuous; Strip, Wire, Tube
  - Hot Dip
- Scrap zinc from recovery and recycling operations operations, old zinc anodes etc.
- Casting residuals
- Zinc ash usually only contains <50% metallic zinc

BOTTOM DROSS

- Produced during the process of hot dip galvanizing

• Zn	95.00%	50.0% - 97.0%
• Fe	0.75%	0.3% - 3.5%
• Pb	0.00%	0.0% - 2.5%
• Cu	0.23%	0.0% - 1.0%
• Al	0.00%	0.0% - 1.0%

- *Bottom dross is often contaminated with hooks used to hold the parts being galvanized on their rigs and parts that may have fallen off during the process.*
- *In some Asian markets Pb is added for esthetic reasons*
- *Bottom dross is more difficult to process and is usually available at a high discount*

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TOP DROSS

- Produced during continuous galvanizing of steel strip, tube and wire
- Typical composition

	Average	Range
• Zn	97.35%	50.0% - 99.0%
• Fe	0.07%	0.0% - 2.0%
• Pb	0.00%	0.0% - 0.3%
• Cu	0.23%	0.0% - 1.0%
• Al	0.24%	0.0% - 15.0%

- *Top dross usually has a more relable composition from the same source although compositions will change from source to source*
- *Top dross usually has high levels of Al which must be managed in the process*
- *Top dross is usually easier to process than bottom dross and is therefore available at lower discounts*
- *It is recommended that periodic sampling of the dross is done when the dross is collected as this will prove a more accurate number for the metallic zinc content.*

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HARD ZINC HZS

- Hard zinc is produced by a reaction at the surface of the steel when it is galvanized.
- Zinc dissolves the steel during the galvanizing process
- Most of the dissolved iron stays on the surface, forming the protective coating
- Some iron floats away from the steel and this collects in the furnace forming the dross

- Bottom dross is more dense than the molten zinc. Bottom Dross collects in the furnace with iron hooks and parts that fall off during the process where it is retrieved using perforated grabs.

- The density of top dross is intentionally manipulated to make it float on top of the zinc. This makes it easy to remove and is important in reducing production down time in a high CAPEX, high production rate process

ASH & CASTING DROSS

- The galvanizing dross formation rate is a function of the time the iron is submerged and is usually in the range 0.6% - 0.8% depending on the desired coating thickness
- Ash rates are usually taken as 0.4% – 0.6% and are a function of the area of the surface molten zinc exposed to air
- In the hot dip galvanizing process, ash may be contaminated with residual flux in the form of sulphides and chlorides
- Dross may be produced when zinc and aluminum alloys are reprocessed in a casting plant
- In some cases iron is added to the alloy to prevent soldering in the dies. Excess iron builds up in the furnace in the form of dross

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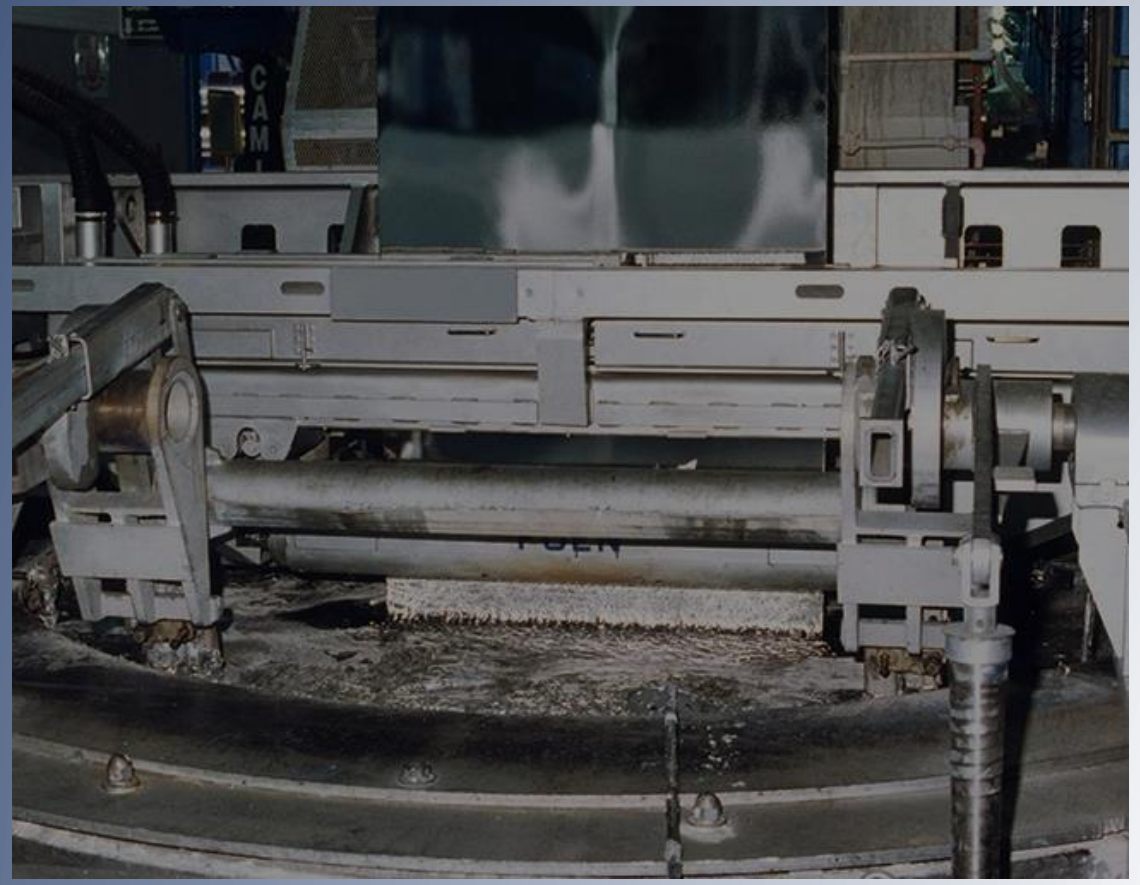
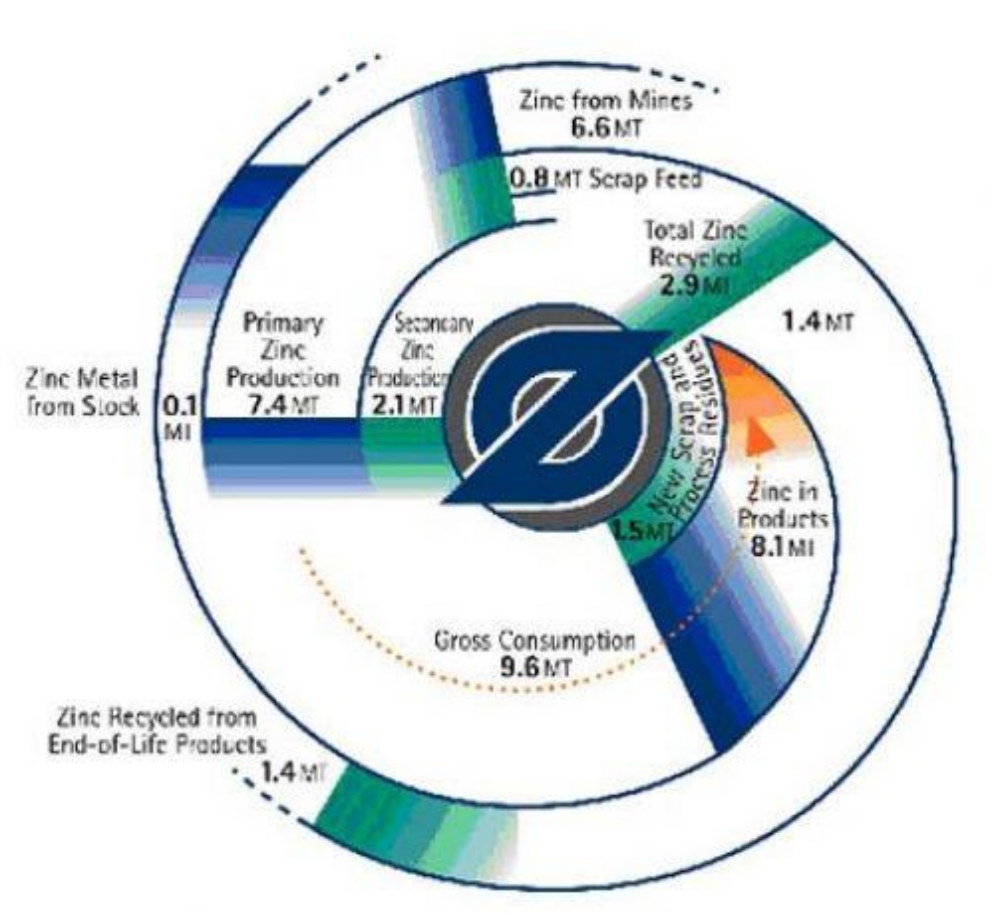
HZS COMPOSITION



- Dross is a zinc alloy containing the dissolved components of the metals being galvanized
  - Top dross from a single source usually has a compositional range without large variations, usually containing Fe, Cu, Ni, Cr, Mn, Mg.
  - Bottom dross has greater compositional variation and can contain Pb < 1.5% and Fe < 3.5% along with the other trace contaminants

AVAILABILITY



- IZA estimates the global secondary zinc market is 2.1Mt/yr
- The estimated demand increase if BURNS technology is widely implemented is 2.5%
- Estimated growth of all galvanizing markets 6% - 8%

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THE FINANCIAL CASE

- We have prepared a separate power point which provides details. In summary
  - Avoidance of the LME premium provides a potential revenue improvement of between $150/t - $650/t
  - Discounts may add another $100/t - $250/t
  - Processing and administrative costs are substantially less than the potential revenue gain

- BURNS is offering current BACT (Best Available Current Technology) to the zinc oxide producer for SHG and HZS feed zinc
- BURNS is committed to continuous process improvement
- BURNS engineers are available to assist with plant design
- During the engineering process, BURNS will assist with the plant certification process in accordance with Basel Convention requirements

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