Decoating of Metal Scrap for Circular Metals Economy

Scherpenzeel, 01 November 2017

PROASSORT.com
Agenda

1. Introduction
2. Circular Metals Economy (CME)
3. Harvest zinc from steel
4. Harvest tin from copper
5. Summary
CV

1978       Ph.D. Metals Engineering, TU Clausthal
1979 – 1983 Manager, hot wide strip rolling mill
1984 – 1989 Works Manager, cold rolling shop for Ni-based HPA
1990 – 1994 Vice President, steel sheet production and coating
1995 – 2000 Board Member, aluminium and steel processing
2001 –     Managing Partner, PROASSORT GmbH
                  CEO, MUT Metall Unternehmertisch e.V.
Engineering Firm for CME
Asking for information

Advanced Corrosion Protection for Steel Bridges:
„Thermal Sprayed Zinc (TSZ) DUPLEX Coating“
Industrial consortium with governmental support

Please contact:

hb.pillkahn@proassort.com
+49 173 749 2883

Osteroy bridge, Norway
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Circular Economy

Brussels, 2 December 2015

Today the European Commission adopted an ambitious new Circular Economy Package ... The proposed actions will contribute to "closing the loop" of product lifecycles through greater recycling ...

The plans will
1) extract the maximum value from all raw materials ...
2) foster energy savings and
3) reduce Green House Gas emissions.

Brussels, 14 March 2017

Circular Metals Economy

What does CME mean to Metals Industry?

- **Maximum Value**: Produce High Performance Alloys (HPA) with up to 100% recycled content.
- **Energy saving**: Melt High Performance Feedstock (HPF) and avoid refining („cold metallurgy“).
- **Green House Gas**: Use „green“ energy („eMetallurgy“).
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One of the world’s major CME project
Situation

• Share of galvanized steel is high and growing worldwide.
• Volume of galvanized new and old scrap expands.
• Black scrap with well-known alloy content is urgently needed.
• Zinc price is volatile and boosts on the long term run.
• Automotive industry is urging for closed loop recycling.
Problem

• Galvanized steel scrap as feedstock is limited in BOF route.
• Zinc is a mess for BOF off gas cleaning.
• BOF flue dust with 90% Fe$_x$O$_x$ is mainly dumped.
• EAF waelz zinc oxid (est. 1888, BAT) causes heavy environmental burden and contains chloride and fluoride.
Best Available Technology I

BOF dust with 4% Zn → Dust dump → BOF dust with 20% Zn

Kiln dust with 60% Zn → Zn ore roasting furnace
Best Available Technology II

BOF dust with ≈ 0,5% Zn

Clever?
But prepared for time to come?
Circular Steel Economy
Best Available Technology III

- EAF dust with 20% Zn
- Kiln dust with 60% Zn
- Zn ore roasting furnace
Solution

• PROASSORT DeZINCing Technology

• Chemical reactor engineered as vibrating conveyor (world patent).

• Superior electro-chemical condition; optimal conveying.

• Continuous high-duty, low cost process.

• Rewinning of pure dry zinc sulphate for input near zinc electrolysis.

• OPEX for dezincing and zinc sulphate harvesting about 30 to 40$ per ton scrap.

• Zinc sulfate sales > 40$ per ton scrap.
30kt per year Prototyp
New scrap and leach
Pickling process
Basic Life Cycle Assessment

DeZINCing vs. Waelz Process for 200.000 t galvanized steel scrap

- Energy saving: 36 GWh or 74%
- Green House Gas reduction: 26.400 t CO₂ or 88%
- Halogen loaded Waste Water prevention: 28.000 m³

Source: TU Clausthal, 2008
# Basic Business Case

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<th>100.000 tpa Foundry</th>
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<tr>
<td>ROI (a)</td>
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<td>1,2</td>
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</tbody>
</table>
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Some facts and figures about tin on copper

- World refined tin metal usage is some 330kt, heavy shortfall between offer and demand predicted.
- In Germany we use some 20kt of refined tin metal, thereof 3kt for copper coating.
- Tin coated copper stampings are mainly used in power electronics, demand is strong and growing.
Tin coated copper & brass sheet and semi products
Tin on copper as barrier for CME

• On coated copper scrap the tin completely loses its value.
• The copper price is massively reduced.
• Only pure tin-coated copper scrap is remelted to bronze.
• Other copper alloys like brass or HPA have to be multi-step refined. Alloy elements like Sn, Ni, Zn return to dust and slag.

Sn: 20.000$ per ton
Ni: 11.000$ per ton
Zn: 3.000$ per ton
From copper recycling-materials to cathodes

Sampling, material preparation

Kayser Recycling System (KRS)

Submerged lance furnace

TBRC*

Anode furnace

Copper alloy scrap

Copper scrap

Black copper (80% Cu)

Converter copper (95% Cu)

Iron silicate sand
KRS-oxide, zinc-bearing

Tin-lead rotary furnace

Tin-lead alloy

Anode casting plant

Copper tankhouse

Anode (~99 % Cu)

Cathode (~99,995 % Cu)

Precious metal production

Raw materials and recycling materials

Copper products

By-products

*Top Blown Rotary Converter

PROASSORT.com
Detinned pre-consumer scrap
Very important by-product: Tin(IV)Oxid

Product specification

Residual moisture: ~ 2 %
Sulfur content ~ 1 %
Tin met. : ~ 60 %
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Summery

• CME is metals survival training.
• CME awaits disruptive technologies, processes and decisions.
• There are mighty tools in the box to step forward.
• When you think about coating, reflect recycling!
You are heartily invited to contact us

Dr.-Ing. Hans-Bernd Pillkahn
Managing Partner

PROASSORT GmbH
Bärenstein 5
D-58791 Werdohl

Fon +49 2392 80 66 55 0
Mobil +49 173 749 2883

hb.pillkahn@proassort.com
proassort.com