EFFECTIVE USAGE OF SOLID WASTE IN STEEL PLANT

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CISDI Group at a Glance

- **Nearly 60 years** experience in steel industry since 1952; One of the **leading** engineering companies in China.

- Mainly **focus on** overall solution for **steel producers**, and services in rail transportation, green building, real estate and so on.

- Provide global clients with **whole-process, entire life-cycle and full functional** services

- **More than 5000** engineers and consultants with extensive experience. More than **2000** engineers focus on Iron & Steel sector.

- Headquartered in **Chongqing**, China, with **18 subsidiaries and 2 JVs** around the world, including offices in Shanghai, Beijing, Hong Kong, Brazil and UK (this year).

Sources: CISDI Overseas Business Department
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1. Introduction

SOLID WASTE RESOURCES (~600kg / ton steel)

**SLAGS**
- BF Slag
- Converter Slag etc.
  - Water Granulation
  - Slag Micro-powder
  - Iron
  - Tailing

**IRON-CONTAINING DUST & SLUDGE**
- Volatile elements (Zn, K, Na etc.)
- Sintering Process
- Cyclic accumulation in the BF
  - Landfill or Export

**OTHERS**
- Scrap Refractories
  - Refractory erosion
  - Lining scaffolding
  - Burden hanging
  - Secondary pollution
  - Resource wasting
- Hazardous waste
  - Specialized Subcontractor
  - Self-circulation or Export
1. Introduction

Surging steel capacity

Heavier air pollution

Effective usage of iron-containing waste is essential for the development of steelplant

Improper treatment is likely to cause groundwater and soil pollution

More iron-containing waste are generated

More and stricter air cleaning requirement
1. Introduction

2. Recycling Technologies for Solid Waste

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2. Recycling Technologies for Solid Waste

Diversified sources lead to various dust and sludge with different physic-chemical properties.

- Transferring fly ash (Fe etc.)
- Converter dust or sludge (Fe, Zn etc.)
- Oxidation scale (Fe etc.)
- BF bag filter dust (Fe, C, Zn etc.)
- BF cast house dust (Fe, Zn etc.)
- EAF dust (Fe, Zn etc.)

Treatment of iron-containing waste should be based on their characteristics by comprehensive ways.
2. Recycling Technologies for Solid Waste

- **RHF PROCESS**—For high zinc content iron-containing waste

- Recycling Technologies for Solid Waste
  - ~5000 t/y (Dezincification Ratio ≥ 85%)
  - Reducing coke consumption: ~220,000 t/y
  - Reducing emission of CO₂: ~147,000 t/y

- Reusing Iron-containing waste: ~200,000 t/y
  - Fe ~90,000 t/y; Zn ~2500 t/y

- Realizing resource-saving and environmentally friendly circular economy!
2. Recycling Technologies for Solid Waste

A TYPICAL RHF PROCESS

**Burden Subsystem**
- Receiving & Storage
- Dosing & Mixing, to homogenize the raw materials;

**DRI Cooling & Storage Subsystem**
- Cooling & Passivation, to facilitate the transportation and storage;

**Granulating & Drying Subsystem**
- Granulating-Screening-Drying, to achieve qualified green pellets;

**Offgas Subsystem**
- Waste heat boiler;
- ZnO powder collector;

**RHF Subsystem**
- Feeding-Reduction-Discharging, to finish the dezincification and metallization;

Fe$_x$O$_y$ + C $\rightarrow$ Fe + CO; ZnO + C $\rightarrow$ Zn(g) + CO
2. Recycling Technologies for Solid Waste

KEY TECHNOLOGIES OF RHF PROCESS——Smart Design & Operation Method

- **Parameters**
  - Composition
  - Pellets
  - Fuels
  - Furnace
  - Reduction

- **Design Instructions**
  - Theoretical Calculation System
  - Engineering Design Data
  - Engineering Application
  - Production Prediction

- **Operation Instructions**
  - Optimization
  - Operation Controlling System

- **Big Data Analysis (Sigma)**

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Optimization

Instructions
2. Recycling Technologies for Solid Waste

- Key Technologies of RHF Process——Screw Discharger

**Issues**
- Heavy abrasion under high temperature
- Badly uneven load distribution during discharging

**Solutions**
- Optimized screw blades shape with specialized steel alloy application and reasonable cooling design
- Reinforced structure and flexible driving

Simulation of discharging → Analysis of cooling → Optimization of structure
2. Recycling Technologies for Solid Waste

- **KEY TECHNOLOGIES OF RHF PROCESS**——Rotary Cylinder Cooler

**Issues**
- Quick and effective cooling of high temperature DRI
- Efficient and wear-resistant inner guide plates

**Solutions**
- Precise and homogenous cooling system with passivation protection
- Special combined horizontal and spiral plates design

Optimized structure design + Discharging DEM simulation
2. Recycling Technologies for Solid Waste

KEY TECHNOLOGIES OF RHF PROCESS——Waste Heat Boiler

Issues

- Complex components in offgas with high stickiness
- Being corrosive to the tube bank due to the chlorine ion

Solutions

- Controlling the temperature range by optimizing the inner heat transfer structure to avoid formation of low melting temperature phases and reducing the chlorine corrosion
- Combined dedusting facilities to prevent blockage
2. Recycling Technologies for Solid Waste

- COLD BRIQUETTED PELLET PROCESS — For steelmaking iron-containing waste

- Being favorable for cooling and slag-formation;
- Less consumption of CaO and being beneficial for the lining;
- Substituting various kinds of slag materials and simplifying the operation;
- A simple and short closed-loop process which is economical and green for steelmaking;
2. Recycling Technologies for Solid Waste

- HOMOGENIZATION PROCESS — For low zinc content iron-containing waste

- Simple and efficient
- Environmental friendly
- Large capacity
- Economical Fe recycling
### 3. Reference Projects

<table>
<thead>
<tr>
<th>No.</th>
<th>Process</th>
<th>Location</th>
<th>Capacity (t/a)</th>
<th>Year</th>
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<td>Homogenization</td>
<td>Anshan Steel</td>
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<td>5</td>
<td>RHF</td>
<td>Yanshan Steel</td>
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<td>6</td>
<td>Disposal Center</td>
<td>Zhanjiang Steel</td>
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<td>2016</td>
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</table>
3. Reference Projects

A Integrated Iron-containing Waste Disposal Center

- Centralized management, flexible operation and optimized reutilization
- Zero emission of the iron-containing waste

Scales Pretreatment
OG Sludg Pretreatment
Homogenization Process (800,000 t/a) Including public material receiving unit
Cold-Briquetted Pellet Process (200,000 t/a)
RHF Process (200,000 t/a reserved)
RHF Process (200,000 t/a)

~50,000 m²
3. Reference Projects

- MIXING MACHINE
- SCREW DISCHARGER
- ROTARY CYCLINDER COOLER
- DRI PELLETS
- ROLL PRESSURE GRANULATOR
- VIBRATION FEEDER
- HEAT RECOVERY BOILER
- ZnO POWDER
- DEDUSTING SYSTEM
4. Prospect

Building Centralized management platform and comprehensive disposal unions

Solid Waste Disposal Center

Iron-containing waste

- RHF
- Cold briquetted pellet
- Homogenization
- Reprocessing

- **System planning** based on the whole steelmaking process, more reasonable and economical;
- **Centralized management** and **integrated solutions** for iron containing waste recycling, more efficient and effective;
4. Prospect

- **Supporting workshop for the newly planned integrated steel plants**
  - **Location**: Newly planned large integrated steelmaking plants;
  - **Position**: Providing centralized management and comprehensive treatment of the ferrous waste in the plant;

- **Regional independent technical disposal contractor**
  - **Location**: Traditional old steel industrial district with small steel plants;
  - **Position**: Providing technical disposal solutions to iron-containing dust and sludge for the plants;
Thanks for your attention!

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