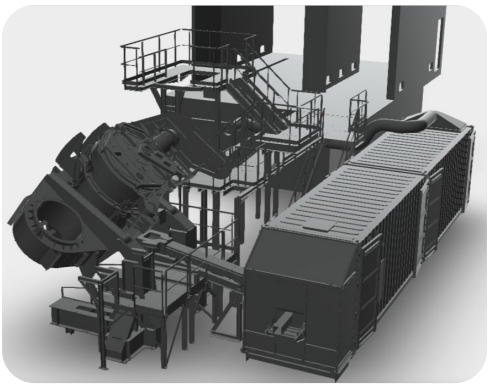

CRM GROUP

New CRM Group's upscaling capabilities at the service of industrial symbiosis – applications in steel and zinc sectors

Laurent FRAIKIN, CRM Group

PROMETIA's 12th Scientific Seminar – Metnet session
Napoli - November 26, 2025



For a better future

CRM Group in a nutshell

- Independent RTO founded in 1948
- 290+ researchers, turnover 49 M€
- Developing industrial solutions for process, product or applications involving metals in many sectors

- > 20 000 m² labs and pilot-scale facilities in Liège & Gent

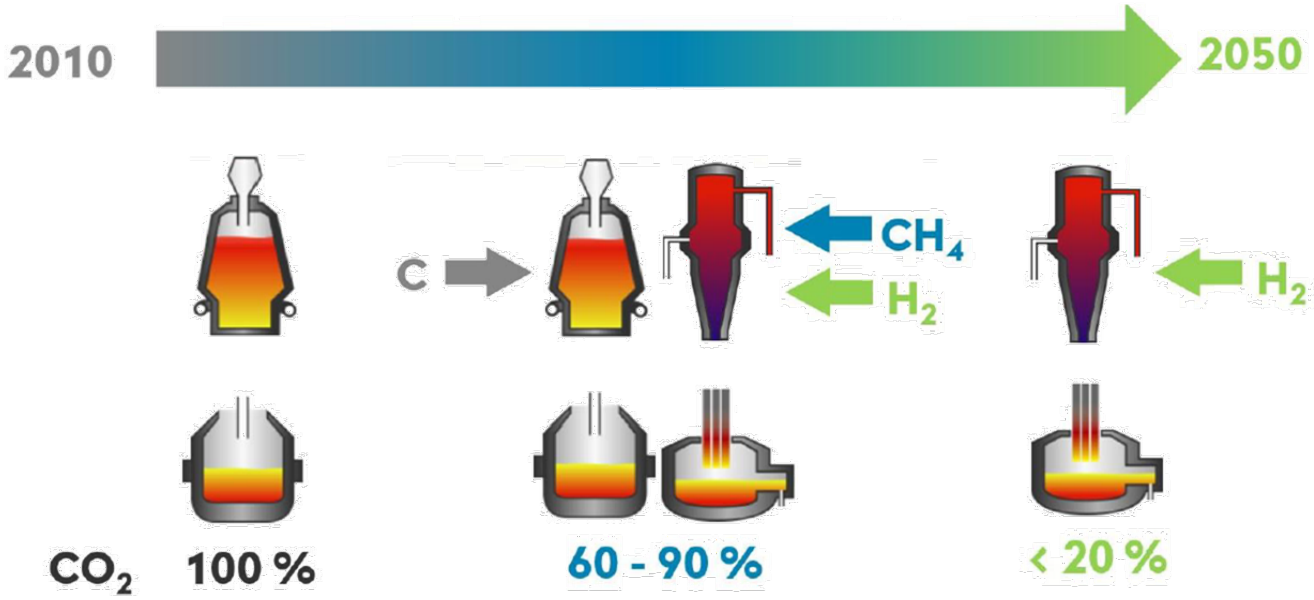
- Global presence with activities & customers all over the world

- 45+ industrial members, > 350 clients/year

John Cockerill · SARCLAD · SAFRAN · ArcelorMittal · NLMK La Louvière · Bekaert · Heidelberg Materials · Recydel · MAGOTTEAUX · PRAYON · ESW · EMG · TATA STEEL · EQUANS · AGC · PRIMETALS · Lhoist · DE LEUZE s.a. · AMEPA · Westinghouse · orbix · TI Automotive · sonaca · suez · resa · PHARMA TECHNOLOGY · BioCarbon Industries · DREVER International · Laborelec · HYDROMETAL · TMT · BEBLUE · NLMK Clabecq · Aurubis · MARICHAL KETIN · INDUCTOTHERM · Duferco · IMnI · FN BROWNING · PAUL WURTH · TECforLime · Heraeus

Recycling processes

Context – new byproducts linked to steel decarbonisation



Reference: voestalpine

New byproducts :

- Dust & sludge
- Slags

New solutions to :

- Recycle them internally (see 2024 presentation)
- Valorize them externally (cross-sectorial topics)
  - Steel-Cement symbiosis
  - Steel-Zinc symbiosis

Steel & Cement

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ZeWa (ZEro WAste) project

Funded by the European Union

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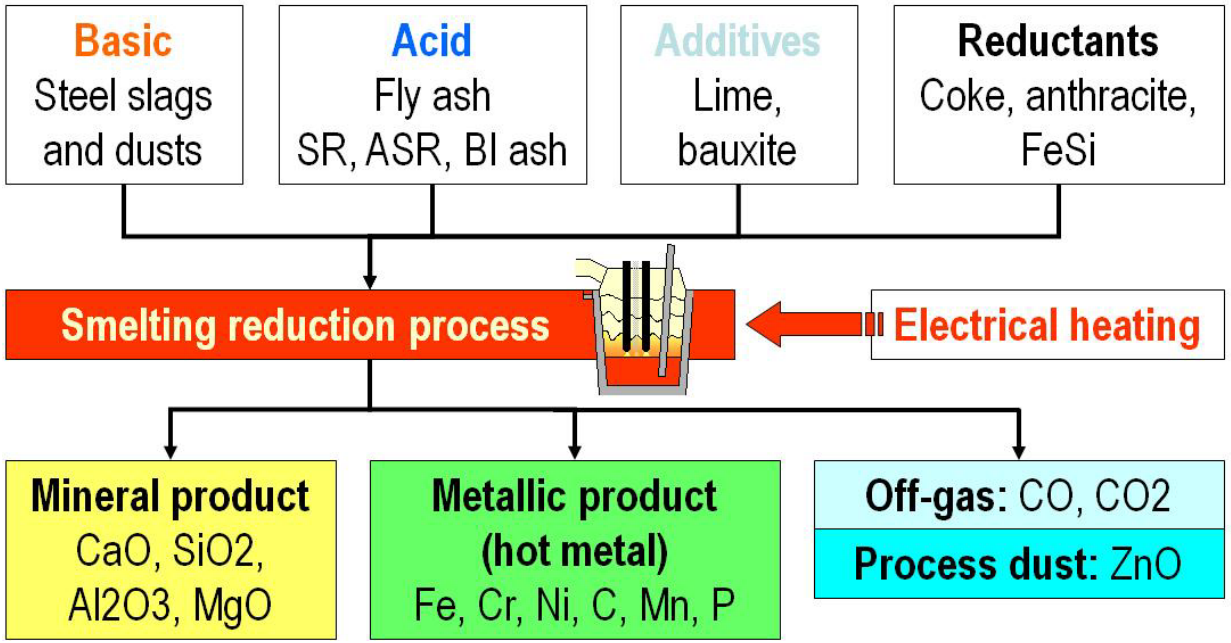
New smelting reduction technology to valorise steel-making slags in synergy with residues from other sectors



Consortium :

Steel : CRM (coordinator), VAI (equipment builder), ARCELOR (C & SS steel), Vítkovice R&D (CZ)

Cement : LAFARGE ;

Coal : ICPC (PL)

Recycling : Comet Traitements (B)

✓ Successfully tested at demo scale

20 t ladle furnace

Slag granulation

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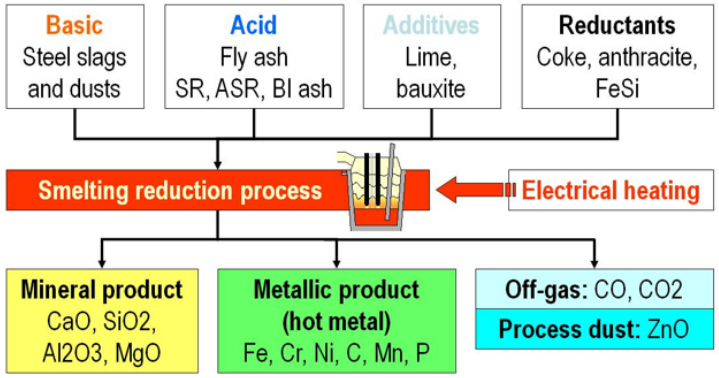
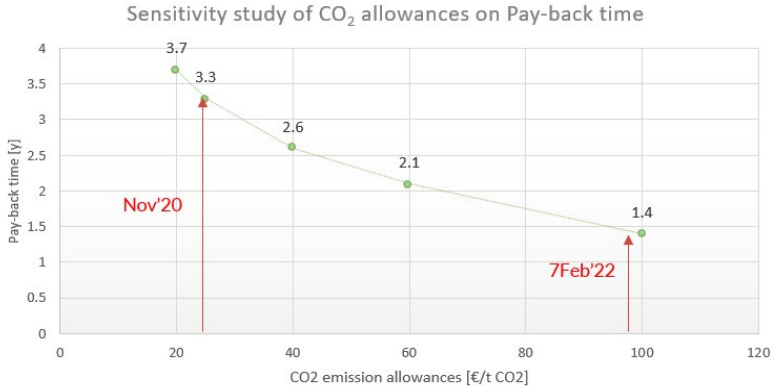
New smelting reduction technology to valorise steel-making slags in synergy with residues from other sectors



Slag engineering

Updates 2022 : ➔ profitability vs CO_2



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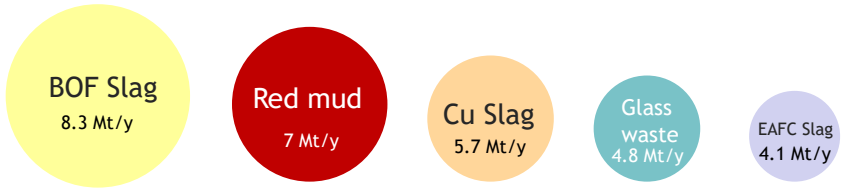
Slag granulation

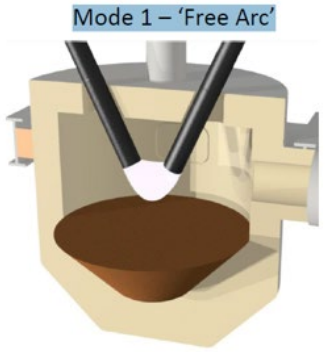
➔ other possible input materials

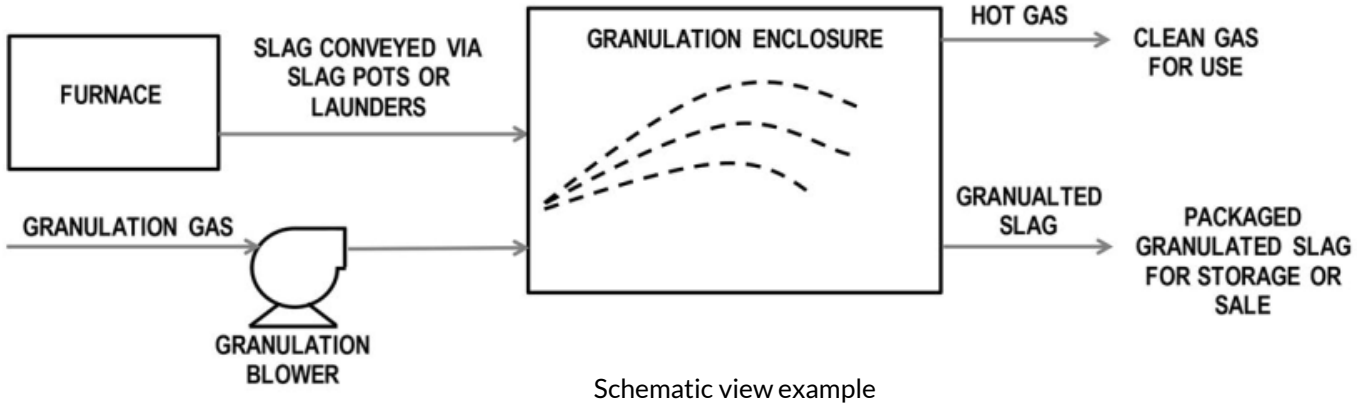


➔ new green products : geopolymers,…

Slag granulation at CRM - pilot scale

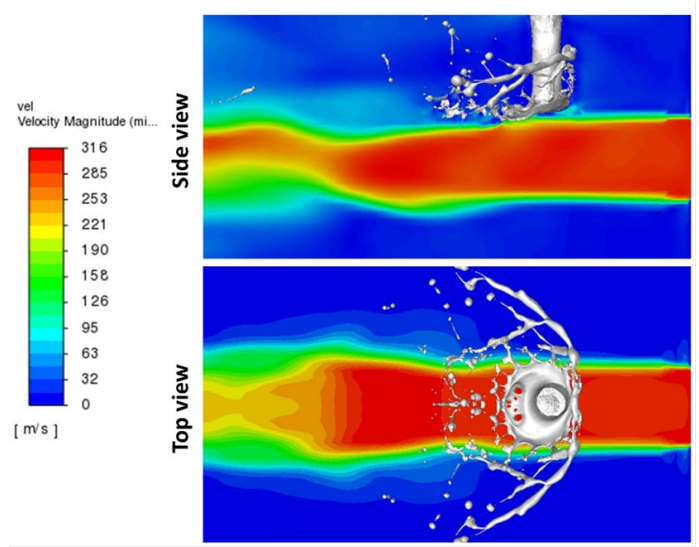
- Synthetic slags OR remelting of industrial slag
- Selected technology = dry granulation
  - reduced water consumption
  - possible heat recovery





Schematic view example

[source : Lindvall et al. (2019), Stabilization of stainless steel slag via air granulation. Journal of Sustainable Metallurgy]



CFD simulation of slag/air interaction

- Home-made design

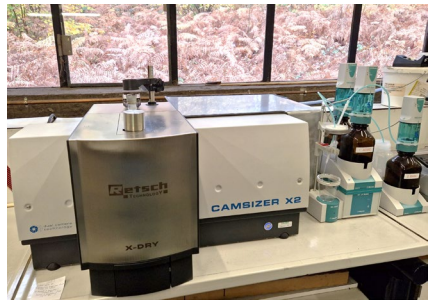
Slag granulation at CRM - pilot scale

- Melting slag in 125L “plasma” furnace

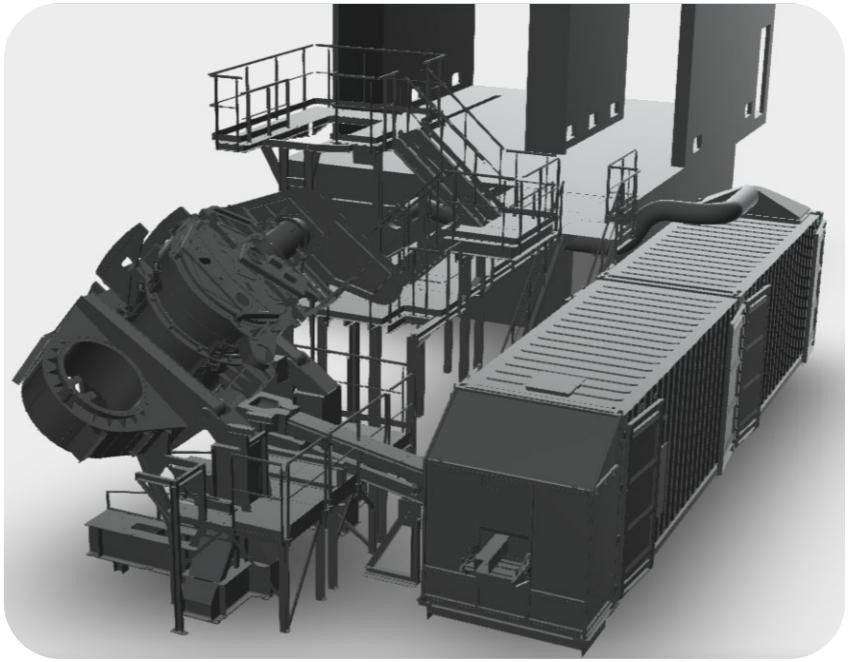
- Characterisation :
  - Liquid slag viscosity
  - PSD of produced “sand”
  - …

High T rheometer

Granulo-morphometers
(0.8µm-1.5mm; 20µm-30mm)



- Dry granulation
  - Home-made design
  - 12 m container

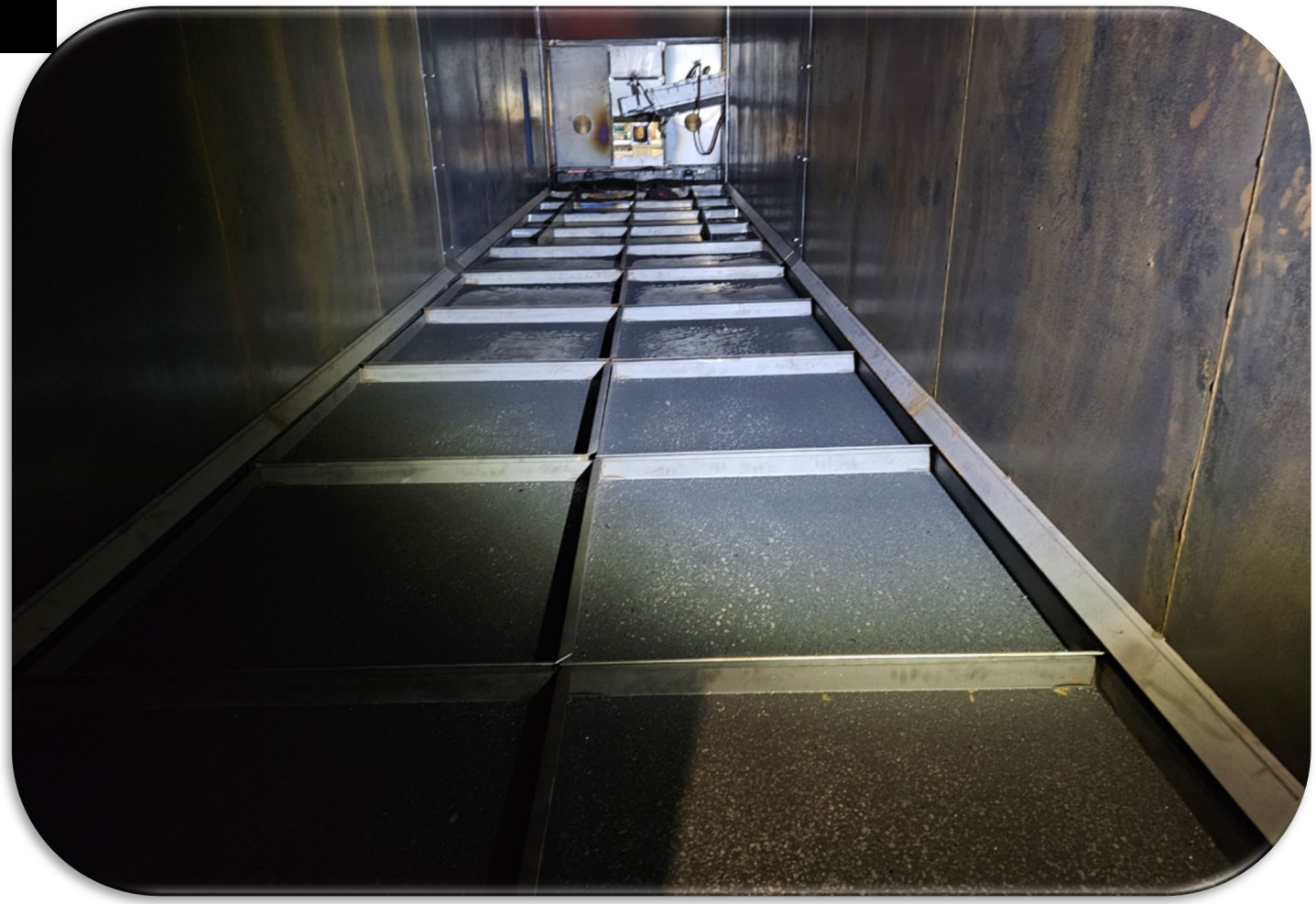


Slag granulation in practice

Slag runner view

Air nozzle view

Granulated Slag



Steel & Zinc

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Zhyron

Valorisation of iron-rich & Zinc-containing steelmaking by-products via HYdrogen-based ReductiON

Funded by
The European Union

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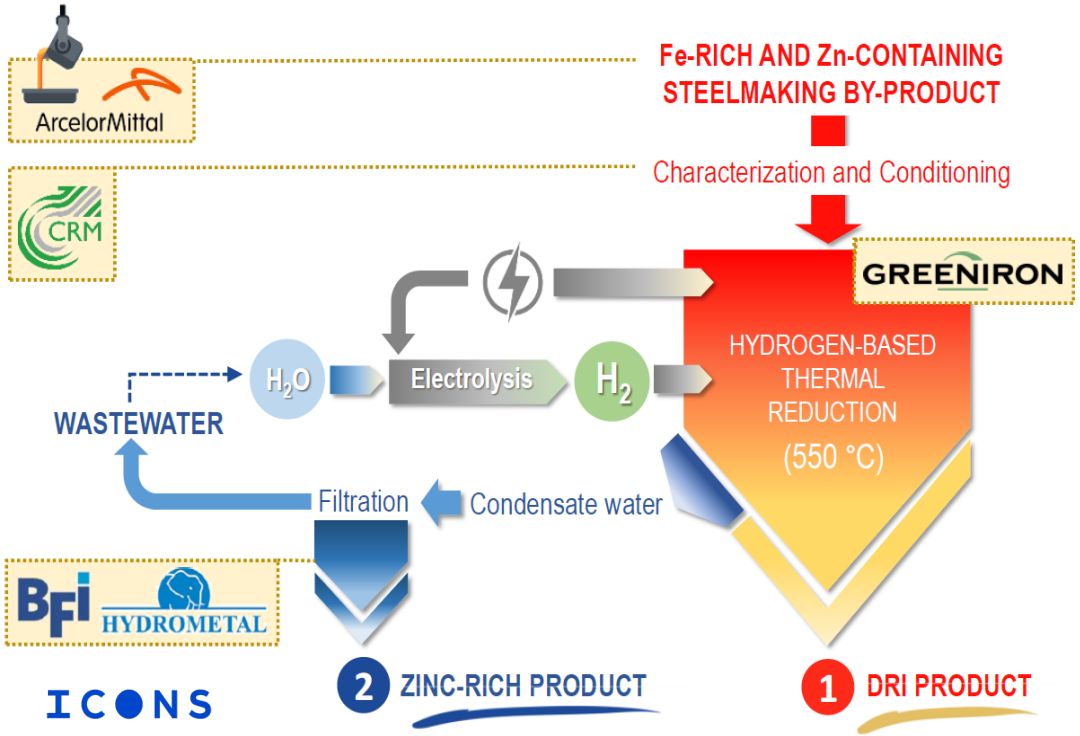
Unlocking the value of steel-making by-products through green hydrogen



- cold-agglomeration

- green hydrogen
  - iron-rich
  - zinc containing
- process wastewater
  - high quality zinc-material
  - safe water for disposal or reuse.

https://zhyron.eu/

ZINCVAL

Funded by
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Valorisation of low zinc-containing residues

- Topic : develop technologies integrated with steel production that enable recovery of Iron and Zinc from low Zn by-products (dusts and sludges) & avoid landfilling.
  - Collection and characterisation of low Zn by-products
  - Treatment and valorisation of dusts and sludges
    - Selection of treatment methods
      1. Hydro-cyclone treatment → Zn enriched fraction
      2. Pyrometallurgical Zn extraction = RHF – RK – Oxyfine burner
      3. Hydrometallurgy
      4. By-products agglomeration
    - Monitoring
    - Technical/economic/environmental assessment
  - Products usage
- CRM contributions :
  - By-products pre-treatment (agglomeration)
  - Pyrometallurgical Zn extraction:
    - **RHF** (lab furnace) and **RK**
    - Lab trials with dusts captation
    - Treatment qualification
  - Injection of EAF dusts in steel melt for enrichment
  - On-line monitoring (dust counting-sizing)

Partner	RTO / industrial	Country
Swerim	RTO	Sweden
CRM	RTO	Belgium
Rina-CSM	RTO	Italy
Tata Steel	Industrial	Netherlands
ADI Taranto	Industrial	Italy
O.R.I. MARTIN	Industrial	Italy
AGA	Industrial	Sweden

https://www.swerim.se/en/zincval

PureZinc project

Objectives :

- Development of innovative zinc recycling route at pilot scale for various secondary RMs:
  - “old scrap” (Zamak, rolled zinc, battery powders…)
  - “new scrap” (overspray powders, dross cakes and skimmings from galvanization,…)
- Compliance to upcoming EU regulation ➔ stricter limit values for Pb & Cd in Zinc
- Purification up to 4N5 grade (automotive), 5N (battery applications), or even 6N (medical applications)

Process steps ⇔ partnership :

Zamak, Zorba, rolled zinc…

Sensor-based sorting (for Zorba,…)

Pyrolysis (for painted & organic coated scrap,…)

Vacuum distillation

Zinc ingots to end user

Copper-rich residues valorisation

Cross-sectoral industrial symbiosis at CRM

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WIN 4C
WALLOON INITIATIVE FOR CIRCULAR MATERIALS

For a better future