LEAD METALLURGY IS FUNDAMENTAL TO THE CIRCULAR ECONOMY

Bart Blanpain, Markus Reuter, Annelies Malfliet

Pb policy brief, June 2019

Content

- Introduction - Socrates project
- Pb policy brief
  - Metal Wheel
  - Criticality of lead for the circular economy
  - Flanders Metal Valley

Socrates: Frame & concept

Europe has large quantities of secondary industrial residues that contain significant concentrations of both critical and economically important metals

SOCRATES
EU MSCA-ETN

European Training Network for the Sustainable, zero-waste valorisation of critical-metal-containing industrial process residues

From September 1, 2016 to August 31, 2020

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Socrates: Frame & concept

https://youtu.be/9ilrNeKG4D8

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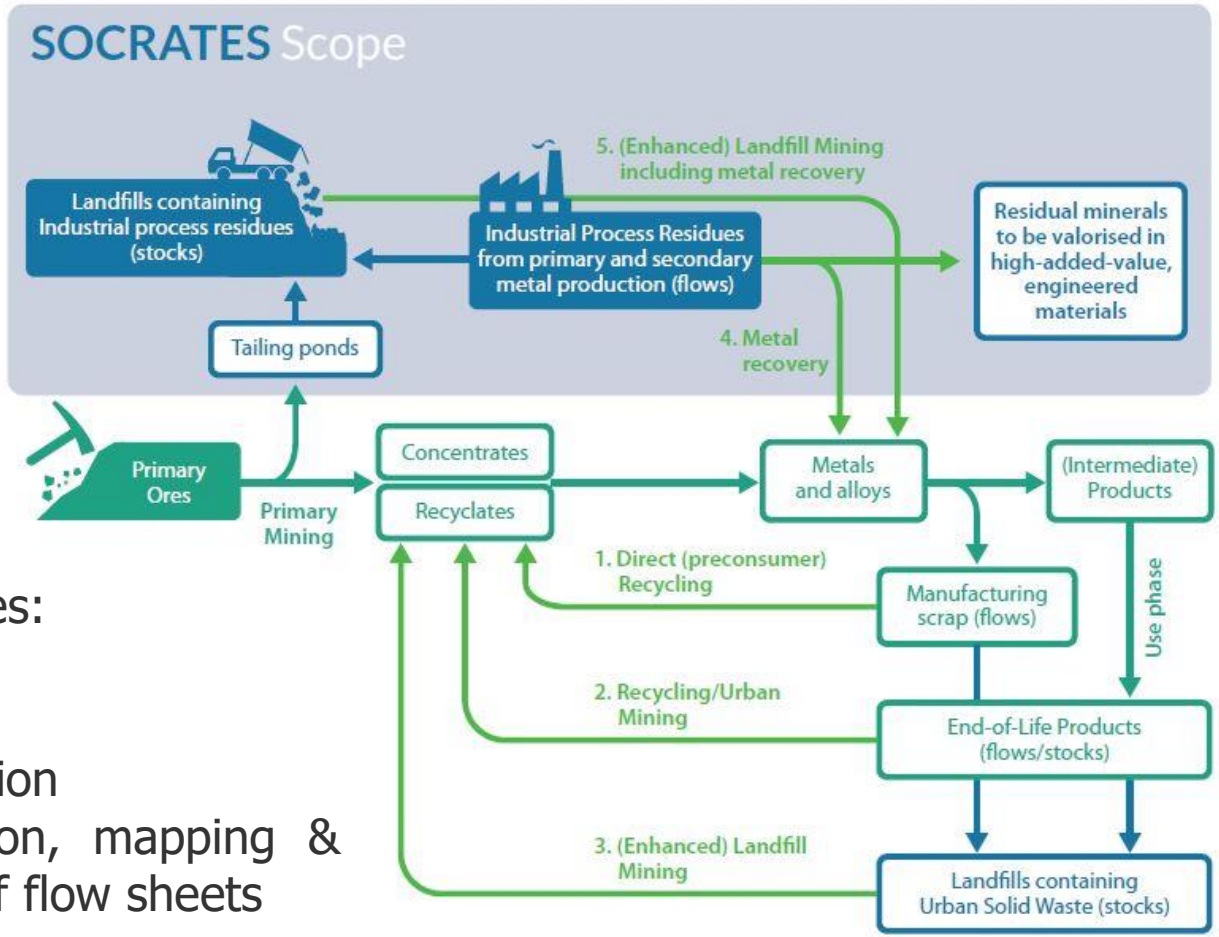
Socrates: Frame & concept

KU LEUVEN

- Targets ground-breaking metallurgical processes, incl. plasma-, bio-, solvo-, electro- and ionometallurgy, that can be integrated into **environmentally friendly, (near-)zero-waste valorisation flow sheets**
- Contributes to a more **diversified and sustainable supply chain for critical metals**
- Focus on 4 residue families
  1. Flotation tailings from primary Cu production
  2. Fe-rich sludges from Zn production
  3. Fayalitic slags from non-ferrous metallurgy
  4. Bottom ashes from incineration plants

Socrates: Scheme & WP's



Four technical work packages:

1. Metal extraction
2. Metal recovery
3. Residual-matrix valorization
4. Advanced characterization, mapping & integrated assessment of flow sheets

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Socrates: Beneficiaries & partners

BENEFICIARIES

KU LEUVEN – Sustainable Inorganic Materials Management
University of Leicester
Universiteit Utrecht
universitätbonn
Technische Universität Bergakademie Freiberg
Outotec
Imerys Aluminates
Metallo – The Furnace of Innovation

PARTNER ORGANISATIONS

Aalto University
VTT
Boliden
umicore
AVR.
Université de Lorraine

15 Early-Stage Researchers

Socrates: Communication

https://etn-socrates.eu/

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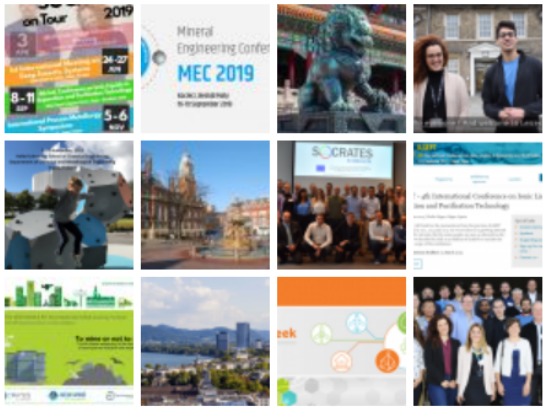

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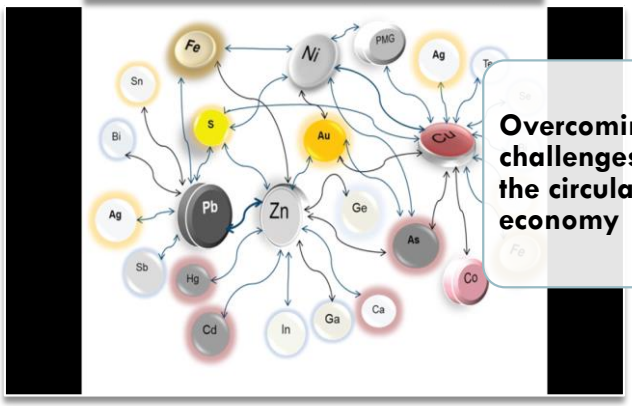
Socrates: Policy briefs

Policy Brief 1 (January 2018):



Overcoming challenges in the circular economy

Policy Brief 2 (March 2018):

The Social License to Operate for mining and recycling of critical metals

Policy Brief 3 (February 2019):

Lead metallurgy is fundamental to the circular economy

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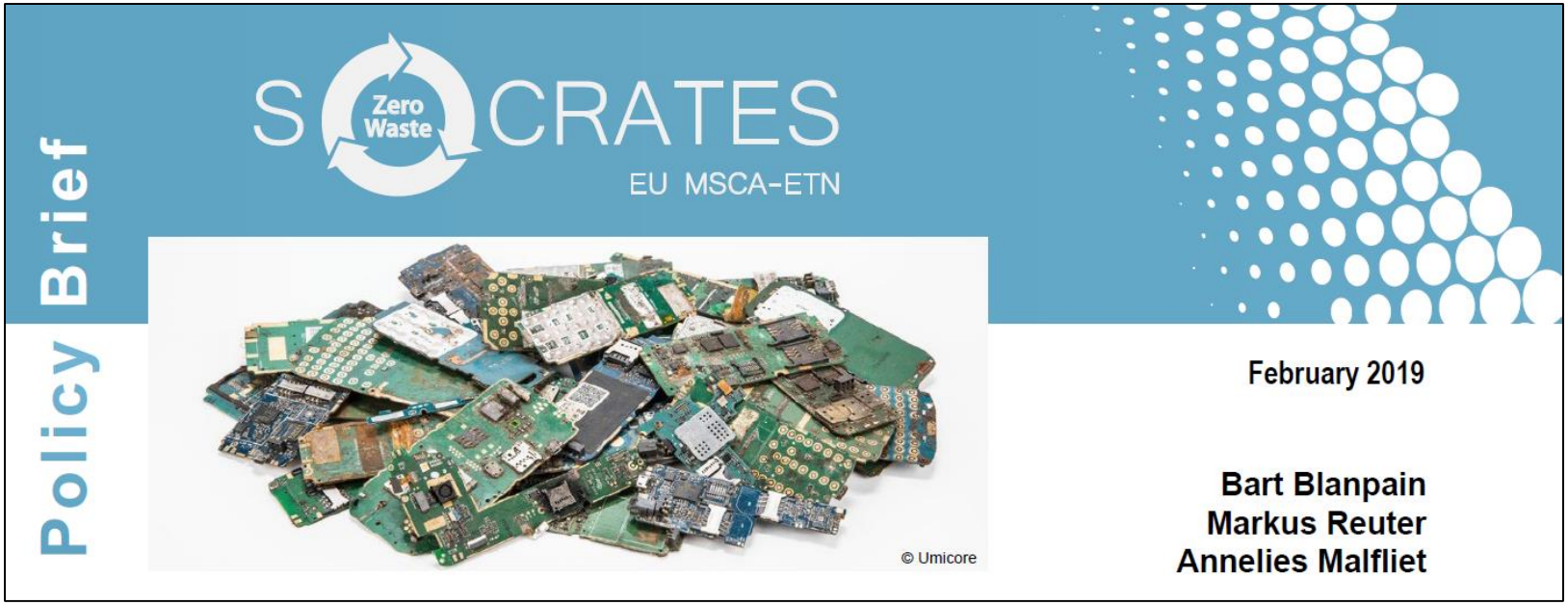
Lead Metallurgy is Fundamental to the Circular Economy



Policy brief on why restricting lead is a bad idea

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Content of the policy brief

1. Role of lead in the Circular Economy (CE)
2. Implications of restricting lead metallurgy in the EU
3. Importance of the lead metallurgy infrastructure

Role of lead in the CE

- Lead is frequently seen as a problematic metal that can be detrimental to human health;

- Much less well known is its fundamental role in extractive metallurgy and how this is closely associated with the Circular Economy
- Molten lead has unique properties that means it can act as an efficient liquid carrier for critical raw materials such as In, Bi, Cd and Te.

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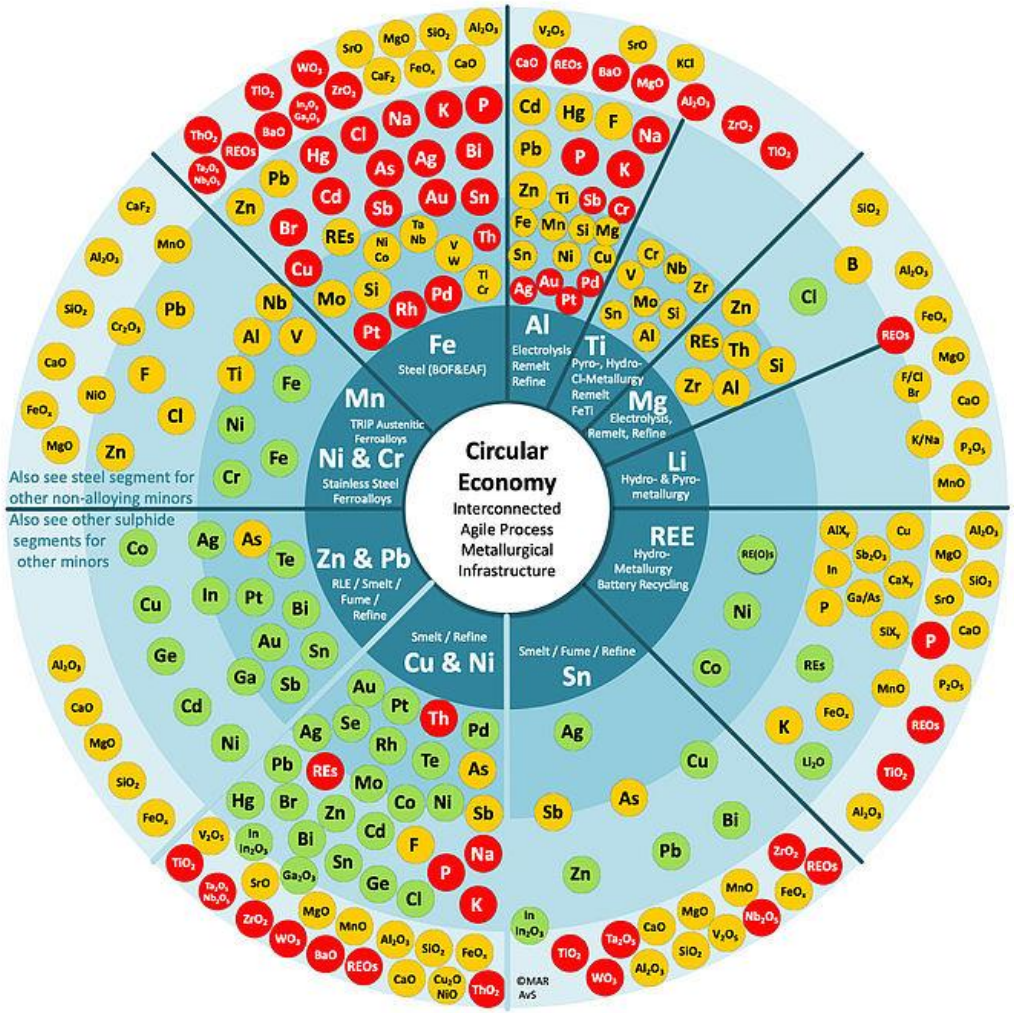
Role of lead in the CE



Metal Wheel

LEGEND

Economically viable destinations of complex resources and materials, designed functional material combinations, scrap, residues etc. to metallurgical processing infrastructure (each segment) to produce refined metal, high quality compounds and alloys in best available technology

Circular Economy's Agile Carrier Metals Processing Infrastructure
Extractive Metallurgy's Backbone, the enablers of a Circular Economy (CE) as it also recovers technology elements used e.g. in renewable energy infrastructure, IoT, eMobility etc.

Dissolves mainly in carrier metal if metallic (mainly pyrometallurgy - smelt)
Valuable elements recovered or (dissipative) lost (metallic, speiss, compounds, alloy in EoL also determines destination). Linked hydro & pyro-metallurgical infrastructure determines % recovery.

Compounds mainly to dust, slime, speiss (mainly hydrometallurgy - refine)
Collector of valuable minor elements as oxides/sulphates/chlorides etc. and mainly recovered in appropriate mainly hydrometallurgical infrastructure if economical. Often separate infrastructure.

Mainly to benign lower value building material products & dissipative loss
Relatively lower value but inevitable part of society and materials processing. A sink for metals and loss from the CE system as oxides/ compounds. Usually linked but separate infrastructure.

R — **Mainly Recovered Element**
Compatible with Carrier Metal as alloying Element or can be recovered in subsequent Processing.

R/L — **Recovered in alloy/compound or Lost if in incorrect stream/ scrap/module**
Governed by functionality, if not detrimental to Carrier Metal or Product (if refractory metals in EoL product report to slag / slag also intermediate product for cement etc.).

L — **Mainly Lost Element: not always compatible with carrier metal or product**
Detrimental to properties and cannot be economically recovered e.g. Au dissolved in steel or aluminium will be lost.

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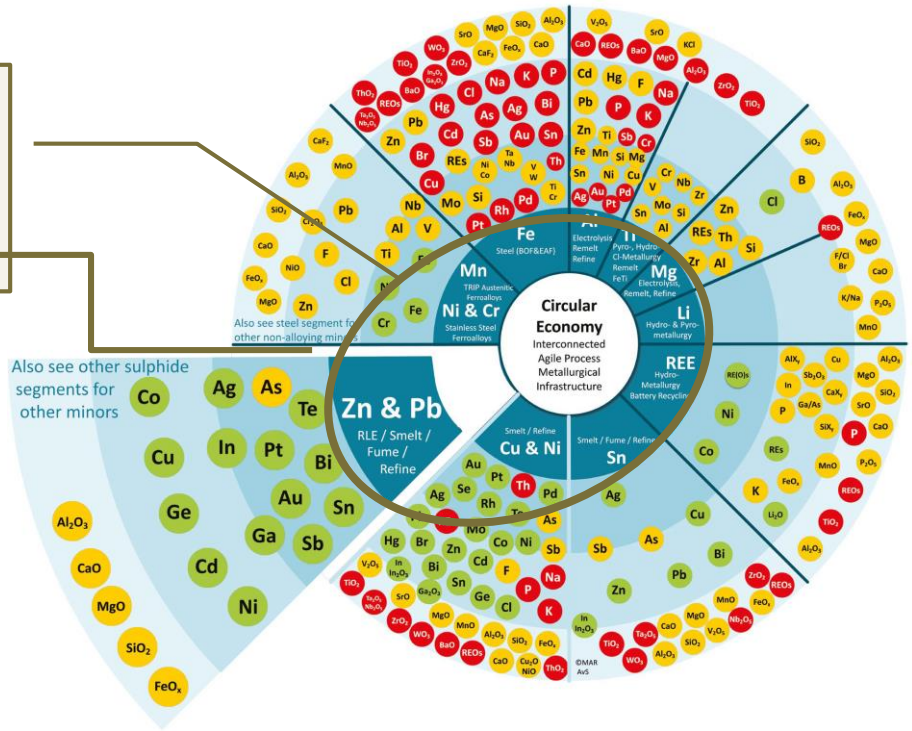
Role of lead in the CE

Backbone of the CE's extractive metallurgy and producing capacity
Carrier metals for technology elements



Especially interconnected Pb-Zn-Cu-Ni-Sn processing infrastructure required

- Circular Economy's Carrier Metals Processing Infrastructure
- Elements that dissolve in the carrier metal if metallic
- Elements that are collected as oxides/sulphates/chlorides/etc. in dust, slime, speiss
- Mainly going to lower-value building-material products and dissipative loss
- R Mainly recovered element
- R/L Recovered in alloy/compound or lost if in incorrect stream/scrap/module
- L Mainly lost element: not always compatible with carrier metal or product

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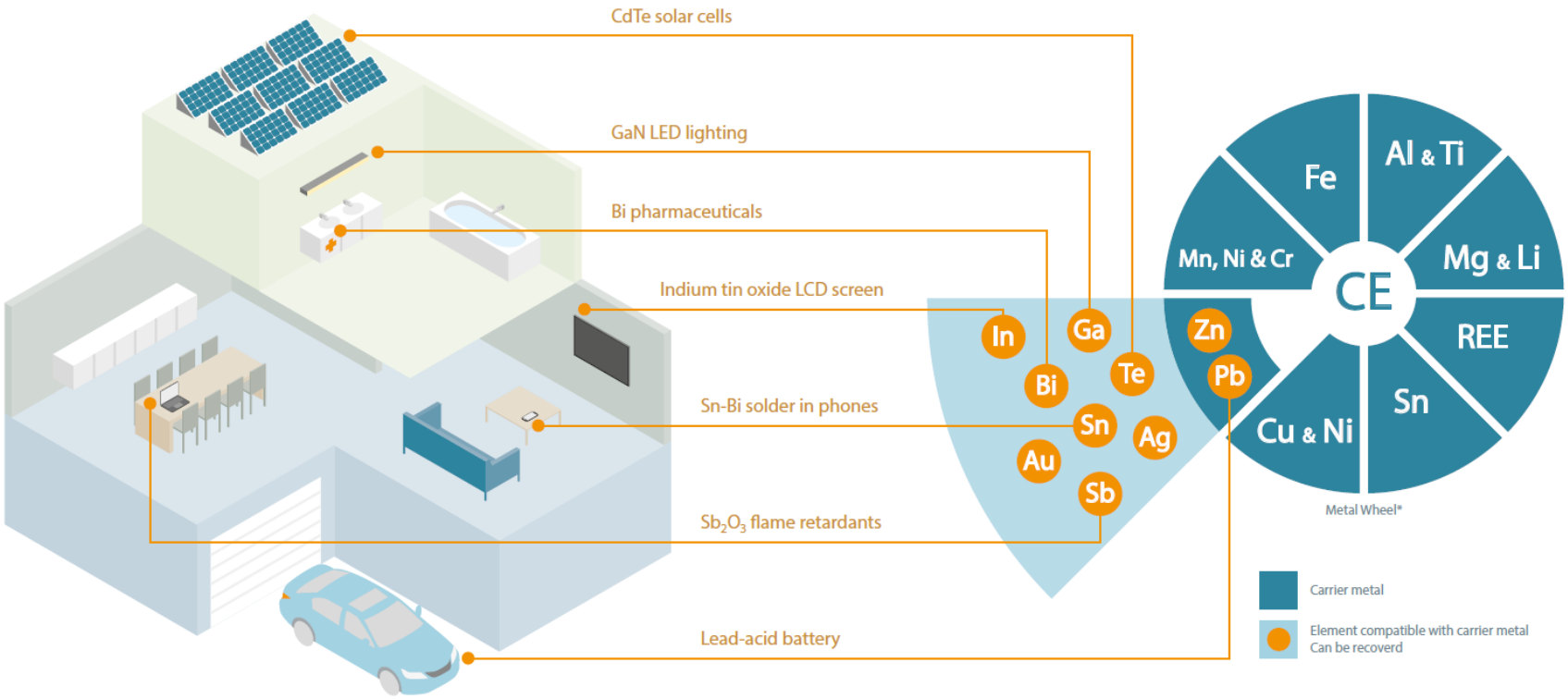
Role of lead in the CE



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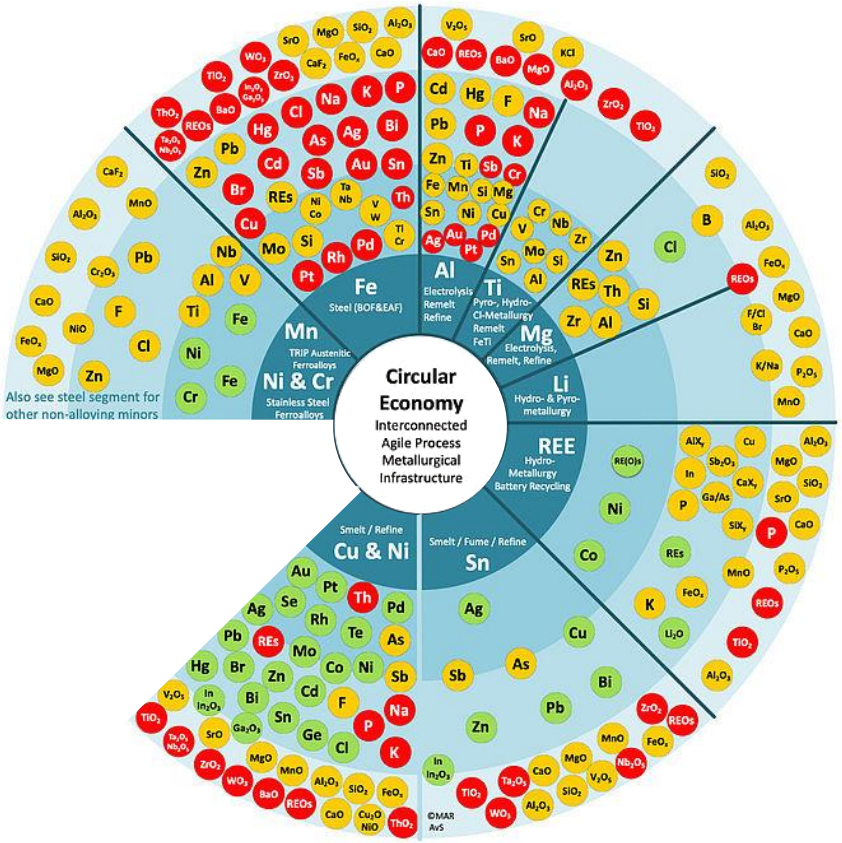
Restricting lead in the EU

- Restricting lead metallurgy in the EU would not only have a detrimental impact on the lead industry, but also on all the industries linked to it that work with elements like Ag, Cu, Sb, Sn, Te, and Zn.

We could ask the question…

What would happen if we remove lead from the Metal Wheel, from the metallurgical infrastructure?



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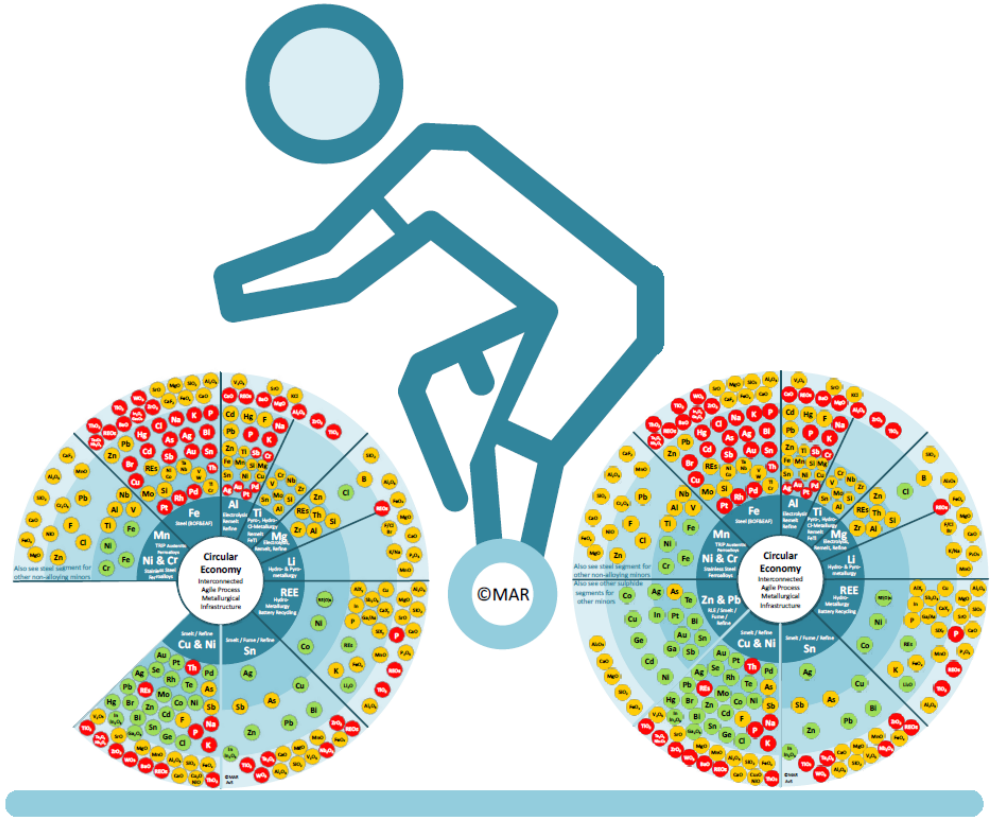
Need for lead (metallurgy)

- By removing lead and its metallurgy, the wheel will not function anymore



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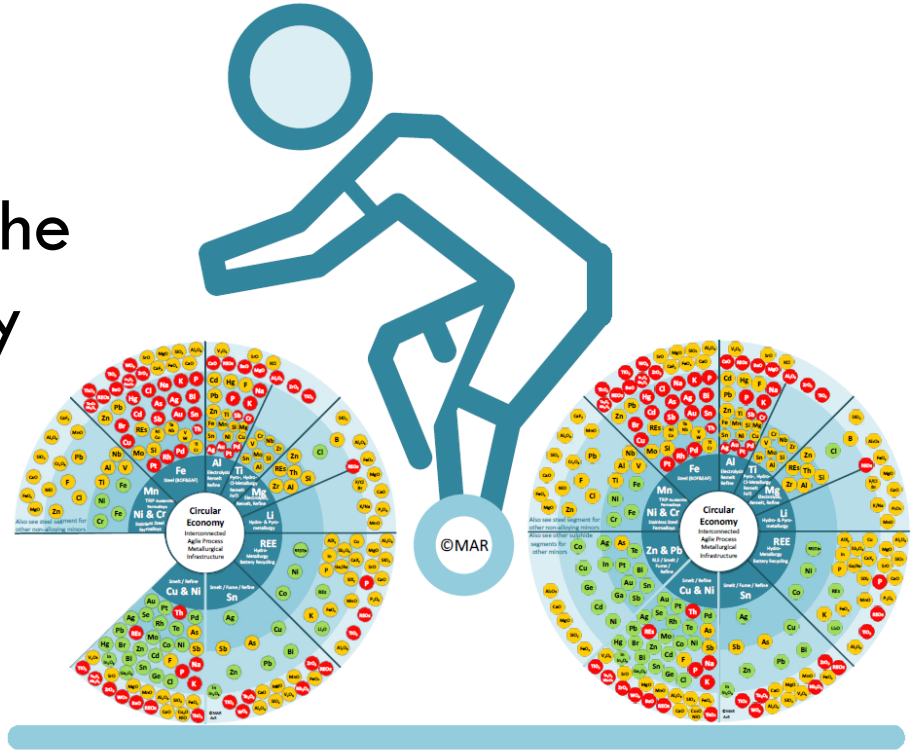
Need for lead (metallurgy)

- Constraining lead metallurgy would have a detrimental impact, not only on the lead industry itself, but also on all the industries linked to it
- End of the "CE ride" if the Metal Wheel is seriously disturbed by eliminating lead



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Need for lead (metallurgy)

- The focus must be on correctly and comprehensively minimizing the risks of lead-containing materials for society and carefully managing them, rather than attempting to ban the use of lead.

- An environmentally friendly and energy-efficient lead infrastructure together with the associated research and know-how in Europe is absolutely vital if the continent is to maintain its global leadership in the Circular Economy

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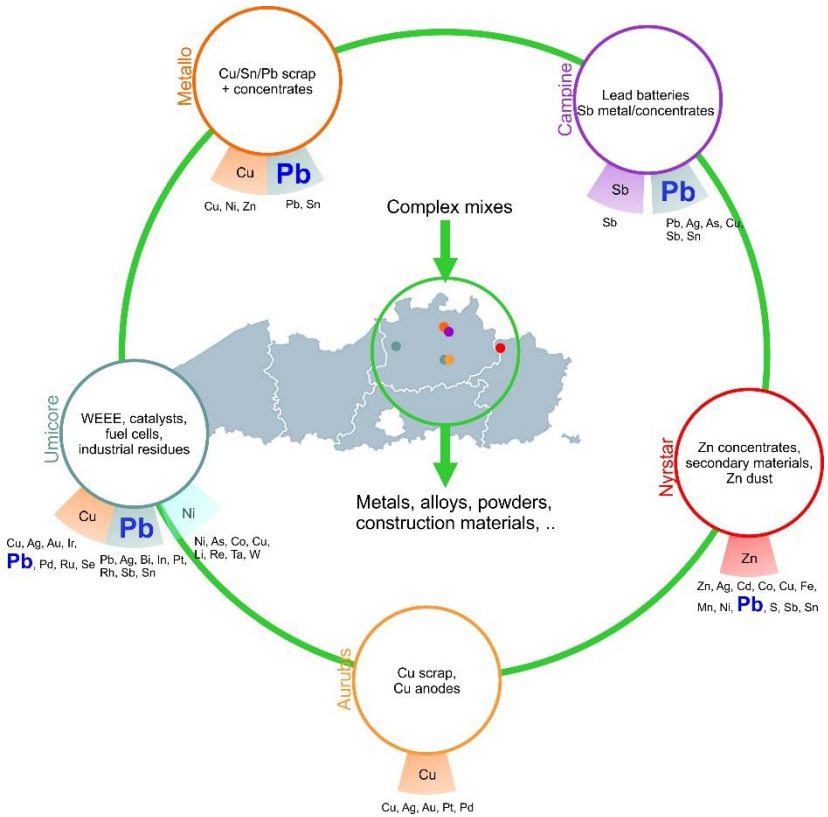
Lead processing in Europe

- Infrastructure and know-how on lead and base-metal metallurgy have been developed in the EU to treat Pb-containing ores and residues and to recycle complex EoL products
- Connectivity of lead to the Zn-Co-Ni-Sn processing infrastructure is for example reflected in Flanders Metal Valley (FMV)

Flanders Metal Valley

Flanders Metal Valley



- The know-how and technology to treat Pb-containing materials is in place
- Lead metallurgy is a well-developed process to recover technology elements
- Lead metallurgy is part of a complex, industrial symbiosis system to manage complex input material

Conclusion

- No smart future without lead metallurgy
  - Disrupting a basic metallurgy infrastructure in the EU will have far-reaching consequences
    - Negative impact on the inflow, production, recycling, and availability of many other metals
    - Thereby jeopardizing our future plans for energy storage, smart cities and clean technologies in the EU
  - Key to keep and further develop the metals infrastructure and know-how in Europe to continue its global leadership role in the CE in the most environmentally friendly and energy-efficient manner

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