European Copper Institute
Copper Alliance

Iron silicate: a sustainable and safe by-product

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Iron silicate, a by-product from copper production

The copper sector produces large quantities of iron silicate based, or final slag along the pyrometallurgical processes of the copper production. Iron silicate is produced during copper refining and recycling processes, by reduction at high temperature in molten state in a furnace (e.g. electric furnace, shaft furnace or fuming furnace) or by flotation process. In Europe, on average two tonnes of iron silicate[1] are generated per tonne of copper produced (iron silicate's production varies also depending on the level of integration or symbiosis of a company), and the amount being marketed is in some cases up to 75% of the volume produced where in other cases it may be as low as 30%, indicating that there is an important market supply potential. As per its economic value, this can be from a small amount of less than EUR 10/tonne up to over EUR 100/tonne, depending on the application and in what form the by-product is sold.

Iron silicate is an engineered mineral that mainly contains iron silicates and silicates of aluminium and calcium, in which the non-ferrous metals' contents have been reduced to the lowest levels that are economically and technically viable[2]. These trace metals are largely included in the silicate phases, hence achieving high bounding stability and low leachability, an important factor in the safety assessment of the material.

Iron silicate is an engineered mineral comparable to natural mineral aggregates from quarries, but has been already produced and available. It is used in essential fields of construction as a substitute for primary building materials in road construction, hydraulic engineering, cement, concrete, and other applications.

An engineered mineral in a Circular Economy

As an engineered mineral, replacing virgin minerals in various uses, iron silicate is regulated by REACH, and the copper industry has registered iron silicate, including a safety assessment for its uses under REACH[3]. The material is used in a massive, granulated or powder form in various applications in construction. Specific testing and robust assessment have further been completed in line with REACH and European and national product legislation. The safe use during the lifecycle of iron silicate can be guaranteed by the copper industry under REACH. With the boundary composition defined under REACH, the most coherent and straightforward legal status under the Waste Framework Directive (WFD) is to define harmonised criteria in Europe as a by-product. Moreover, it would avoid the negative perception and reputation linked to a waste status. Not using iron silicate would turn a sustainable product into waste for landfill.

Importantly, the use of iron silicate contributes to the circular economy by:

- increasing resource efficiency,
- avoiding environmental, financial and spatial burdens of landfilling,
- helping to conserve scarce natural minerals,
- facilitating industrial symbiosis with the construction sector towards greater circularity and climate neutrality

[1] Estimate of 4 Mt in 2018.

[2] Distinction is made with slags from the copper smelting and refining processes containing levels of metals that remain economic to recover, hence in Europe these materials are intermediates and not final products.

[3] The following identifiers have been used for registration under REACH: "slag, copper smelting" (EC 266-968-3) and a boundary composition defined jointly by the European copper industry.

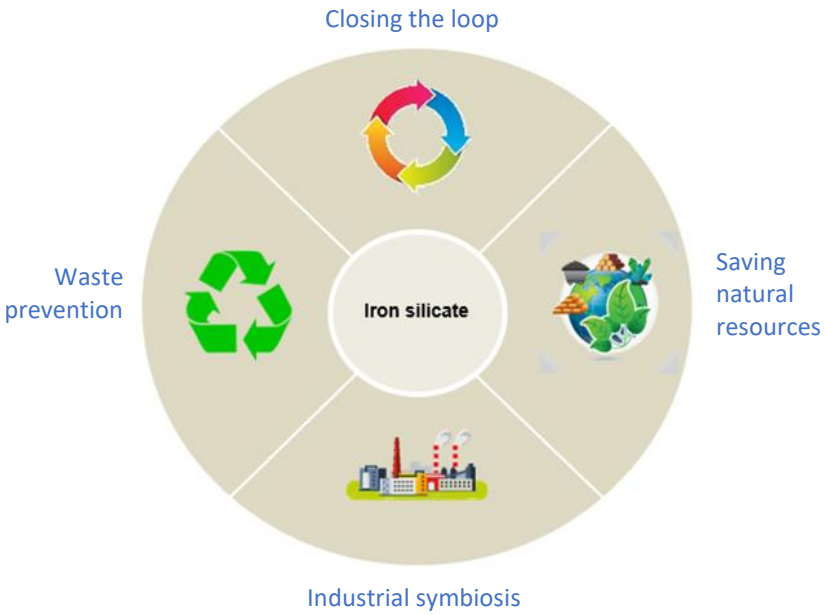
The environmental benefits of using iron silicate compared to natural minerals are confirmed by a Life Cycle Assessment. The results come to a clear conclusion: The use of iron silicate can significantly reduce CO2 emissions as well as other environmental impacts.

Encourage the use of engineered minerals

Barriers in the uptake of engineered minerals are the different interpretation of by-product versus waste status, and inconsistent single case decisions, as well as differences in regulations and standards at Member State level for construction materials. A harmonised interpretation of the by-product criteria will secure a proper legal status for iron silicate, recognising the market value and performance characteristics in construction applications. The following success factors will promote the further uptake of iron silicate:

- Recognise iron silicate as a by-product subject to harmonised rules across the EU
- Coherent ruling for safety assessment of iron silicate under REACH, the Waste Framework Directive (WFD) and Construction Products Regulation (CPR): avoid red-tape
- Encouraging the use of engineered minerals in construction, replacing natural minerals:
  - Introduce minimum recycled content quota
  - Mandatory preference to secondary mineral aggregates
  - Favour products with low overall environmental footprint
  - Promote recycling management tools (using tested, quality-controlled and available substitute building materials; improving cadastral data base and product passports)
- Securing that construction product standards do not hamper uptake of alternative materials:
  - Stimulate the update of existing standards to include engineered minerals
  - Develop new standards based on performance requirements
- Enhancing Green Public Procurement:
  - Integrate life cycle assessment
  - Minimum share of secondary and engineered minerals
  - Move towards mandatory GPP
- Promoting industrial symbiosis:
  - Reward synergies between sectors in the transition towards climate-neutral and more circular economy; using engineered minerals (e.g. iron silicate) in construction reduces the need for virgin raw materials, lowers the carbon footprint of construction products and prevents valuable resource of our industry ending up in landfill

Conclusion



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Iron silicate is produced during copper refining and recycling processes, not using it would turn a sustainable product into waste for landfill.

It is an engineered mineral, comparable to natural minerals from quarries. It can serve as a sustainable substitute of choice for scarce natural aggregates.

Substantial testing and robust assessment under REACH demonstrated no risks for human health and environment. Safe use of iron silicate is guaranteed through the whole life cycle.

Its use can significantly reduce CO2 emissions from the construction sector, as well as other environmental impacts.

ECI is the voice of the International Copper Association (ICA) in Europe. The International Copper Association, with its 35 members, represents a majority of the world's primary copper producers, and some of the largest mid-stream smelters/refiners, and 10 of the world's largest copper fabricators. It aims to bring together the global copper industry to develop and defend markets for copper and to make a positive contribution to society's sustainable development goals.

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