Peute Baustoff

FACTSHEET

Iron Silicate: A Versatile and Sustainable Substitute for Natural Minerals

What is iron silicate?

Iron silicate is produced during copper refining and recycling processes. It is a manufactured mineral comparable to natural minerals from quarries, but without the disadvantage of having to massively intervene in nature. Aurubis is a leading global provider of non-ferrous metals and one of the largest copper recyclers worldwide. Iron silicate is used in various applications, especially in construction, as a substitute for primary building materials.

There are three basic products depending on the process:

Iron silicate stone, with edges up to 0.5 m in length, comparable to igneous rock

Iron silicate granulate, similar to natural volcanic glass, e.g., obsidian

Iron silicate fines (fine powder), similar to mineral flour

What does it consist of?

It mainly consists of iron silicate and silicates of aluminum and calcium. Traces of other non-ferrous metals are reduced to the lowest extent feasible. Trace metals are largely included in the silicate phases, which are therefore characterized by high bounding stability and low leachability.

Main qualities of iron silicate:

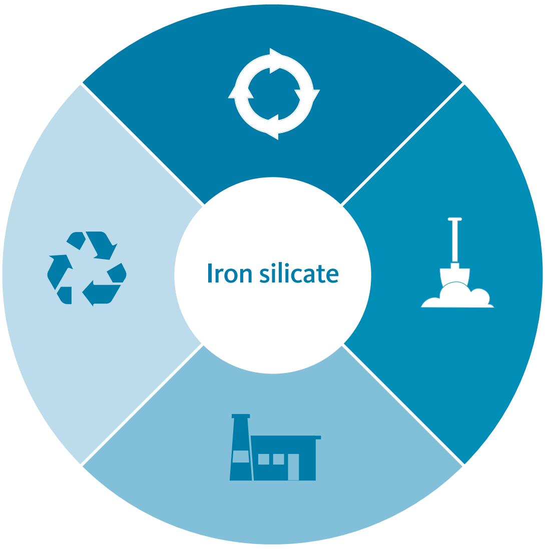
- High dry bulk and specific **density**
- Ideal **volume stability**
- Considerable **strength**
- Optimal **surface coarseness**
- **Very durable**
- Doesn't **absorb water**
- Very **hard**
- Dense pore **structure**
- Very good **frost resistance**
- Favorable **grain shape**
- High weather **resistance**
- No **linear deformations**

More durable than other materials and provides **a substitute for scarce natural aggregates.**

A heavyweight with considerable potential in the circular economy and climate protection

Closing the loop
Using this valuable manufactured mineral actively contributes to the circular economy and increases resource efficiency.

Waste prevention
Iron silicate is an integral part of copper production; not using it would turn a sustainable product into waste for landfill.



Saving natural resources
Using iron silicate helps to conserve scarce natural minerals such as gravel, sand, and mineral flour.

Industrial symbiosis
Using manufactured minerals in the construction sector facilitates industrial symbiosis towards greater circularity and climate neutrality.

Active climate protection

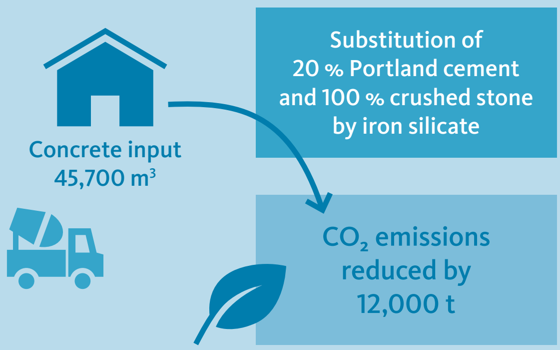
» Per year, iron silicate can save up to
- 11,400 t CO_2 as an aggregate in road construction, by preventing the extraction of gravel in quarries
- 170,000 t CO_2 as a reactive mineral additive in blended cements
- 116,000 t CO_2 as a substitute for cement and crushed stone in concrete

Baseline: Use of 1 million t of gravel, cement, and concrete. Substitution of 100 % gravel, 100 % crushed stone, and 20 % Portland cement by iron silicate.
Source: Life Cycle Assessment of different substitution scenarios for iron silicate, Quantis, technical report, September 2020 / own calculation, Aurubis

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 CO_2 emissions as well as other environmental impacts.

When constructing a larger building, CO_2 emissions could be reduced by around 12,000 t if iron silicate is used.



What is iron silicate used for?

Its technical properties enable iron silicate it to be deployed in a wide range of applications. Fifty years of practical experience and substantial testing demonstrate that it is safe to use throughout its entire life cycle. Iron silicate is registered in compliance with the EU's REACH regulation and is available at a consistent quality throughout the year.

Area	Purpose	Special advantages
Hydraulic engineering 	Protecting embankments and the beds of rivers, canals, and harbor basins against tides and waves.	» Thinner stone layers and less excavation work » Stability through high dry bulk density, cubic particle shape, and surface texture
Road construction 	Used as an anti-frost and gravel-bearing layer as well as an underlay for paving.	» Very good load-bearing capacity » Frost resistance » Water permeability
Cement production 	Fines and granules used as iron additive in clinker bricks or as reactive mineral additive in blended cements.	» Ready-to-use source of iron » Decreases burning temperature and therefore fuel consumption
Concrete production 	Versatile use as a substitute for natural aggregates and Portland cement.	» Enhances workability in its fresh state, improves mechanical properties, enhances durability » Enables special types of concrete, e.g., protecting from radiation, heavyweight concrete, etc.
Abrasives 	Granulate used for blast cleaning.	» Provides a perfect grit for blasting steel, stone, and concrete

In addition to these examples, iron silicate can also be used in **asphalt**, **ceramics**, **dry mixtures**, **coal flotation**, for **soil stabilization**, and many other uses.

Aurubis' commitment to innovation for low-carbon construction materials

We are continuously collaborating with EU innovation and research projects to further investigate the potential offered by iron silicates in new applications and to develop less carbon-intensive construction materials.

Project name

DuRSAAM

Aim: Development of a new generation of construction material/concrete with a low carbon footprint. Application in alkali-activated binders/geopolymers based on iron silicate.

Funding: Horizon 2020

Partners include: Ghent University, Delft University of Technology, Karlsruhe Institute of Technology, ETH Zurich, and 15 industrial partners

Project name

RECOVER

Aim: Upscaling project to produce full-scale inorganic polymer building materials from iron silicate, using a modular and mobile upscaling unit. This would result in a lower environmental footprint and would make metallurgical industries an important raw material supplier with integrated zero-waste processes.

Funding: EIT KIC Raw Materials

Partners include: Katholieke Universiteit Leuven, University of Athens, Resourcefull, ZAG

Project name

SOCRATES

Aim: European Training Network for the valorization of industrial process residues in added-value applications, such as supplementary cementitious materials and inorganic polymers.

Funding: Horizon 2020 MSCA-ETN

Partners include: Katholieke Universiteit Leuven, University of Leicester, Universität Bonn, TU Bergakademie Freiberg

Project name

GHRANTE

Aim: Development of innovative, recyclable inorganic polymer-based materials, based on slags from non-ferrous metallurgy.

Funding: SIM ICON MARES

Partners include: Katholieke Universiteit Leuven, VU Brussel, BRRC, Flamac

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