

ENVIRONMENTAL PRODUCT DECLARATION

as per *ISO 14025* and *EN 15804+A1*

Owner of the Declaration	ArcelorMittal
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
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Valid to	10.04.2027

Granulated Blast Furnace Slag
ArcelorMittal

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ECO PLATFORM

EPD
VERIFIED



General Information

ArcelorMittal Programme holder IBU – Institut Bauen und Umwelt e.V. Panoramastr. 1 10178 Berlin Germany	Granulated Blast Furnace Slag Owner of the declaration ArcelorMittal - By-Products Sales 24-26 Boulevard d'Avranches L-1160 Luxembourg Luxembourg
Declaration number EPD-ARM-20210238-CAB1-EN	Declared product / declared unit The declaration applies to 1 metric ton of granulated blast furnace slag.
This declaration is based on the product category rules: Cement, 11.2017 (PCR checked and approved by the SVR)	Scope: The Life Cycle Assessment is based on data collected from the ArcelorMittal integrated plants producing blast furnace slag as a co-product of the steel manufacturing process, representing 100 % of the annual production from 2019.
Issue date 11.04.2022	The owner of the declaration shall be liable for the underlying information and evidence; the IBU shall not be liable with respect to manufacturer information, life cycle assessment data and evidences. The EPD was created according to the specifications of <i>EN 15804+A1</i> . In the following, the standard will be simplified as <i>EN 15804</i> .
Valid to 10.04.2027	Verification The standard <i>EN 15804</i> serves as the core PCR Independent verification of the declaration and data according to <i>ISO 14025:2010</i> <input type="checkbox"/> internally <input checked="" type="checkbox"/> externally
 Dipl. Ing. Hans Peters (chairman of Institut Bauen und Umwelt e.V.)	 Dr. Naeem Adibi (Independent verifier)
 Dr. Alexander Röder (Managing Director Institut Bauen und Umwelt e.V.)	

Product

Product description/Product definition

This EPD refers to 1 metric ton of Granulated Blast Furnace Slag.

Granulated Blast Furnace Slag (GBFS) is a by-product from the steel industry. In a blast furnace, iron contained raw material is separated from the other minerals. These minerals are evacuated in the molten phase-out of the furnace, through a runner, into a granulator. The granulator is quenching the molten stream using water.

GBFS is a sand-like material consisting mainly by CaO, SiO₂, Al₂O₃ and MgO, combined in a vitreous structure thanks to the granulation. It is sold in this state by ArcelorMittal. The GBFS purchaser/user is finely grinding the material, either separately, or combined with other materials such as clinker.

GBFS after grinding is a latent hydraulic binder used as a cement and concrete additive.

The use and application of GBFS and ground GBFS is driven by cement and concrete standardization. *EN 197-1* describes GBFS characteristics mandatory to

produce CEM II, CEM III and CEM V, as well as allowed mixed compositions. *EN 15167-1* describes ground GBFS characteristics mandatory to be used in concrete. *EN 206* describes concrete allowed mix compositions with ground GBFS.

For the use and application of the product, the respective national provisions at the place of use apply.

Application

GBFS is used as an additive to cement and concrete, after being finely grounded by the GBFS purchaser/user.

Technical Data

GBFS minimum technical specifications have to answer the criteria listed in *EN 197-1*:

- CaO+SiO₂+MgO > 66 %
- (CaO+MgO)/SiO₂ > 1
- Glass ratio > 66 %

For the use and application of the product, the respective national provisions at the place of use apply.

Base materials/Ancillary materials

GBFS is a combination of minerals mostly consisting of CaO, SiO₂, Al₂O₃ and MgO, combined in a vitreous structure.

GBFS is registered in REACH under the following references:

- EINECS N° 266-002-0
- CAS name : Slags, ferrous metal, blast furnace
- CAS N° 65996-69-2

No substances listed on the “*Candidate List of Substances of Very High Concern for Authorisation*” by the European Chemicals Agency EC 1907-2006 are contained in the GBFS in declarable quantities.

This product contains substances listed in the *candidate list* (date: 08.07.2021) exceeding 0.1 percentage by mass: no

Reference service life

A reference service life for Granulated Blast Furnace Slag is not declared. These are semi-finished products to be used in construction products with many different applications purposes. The lifetime therefore will be determined by the final usage.

LCA: Calculation rules

Declared Unit

The declaration refers to the functional unit of 1 metric ton of Granulated Blast Furnace Slag as specified in Part B requirements on the EPD for cement.

The Life Cycle Assessment is based on data collected from the following ArcelorMittal plants:

- Aviles-Gijon (Spain)
- Bremen (Germany)
- Dabrowa (Poland)
- Dunkirk (France)
- Eisenhüttenstadt (Germany)
- Fos-sur-Mer (France)
- Gent (Belgium)

The final results reflect the weighted average per production volume of European ArcelorMittal blast furnace plants. When comparing the LCA results average against specific LCA results from the sites included in this study, variance is within the expected range. For GWP, the variance was within an 8 % range.

The background data are taken from *GaBi ts* Documentation.

Declared unit

Name	Value	Unit
Declared unit	1	t
Conversion factor to 1 kg	0.001	-

System boundary

Type of the EPD: cradle-to-gate. Module A1-A3 were considered.

Modules A1-A3 of the structural steel production include the following:

- The provision of resources, additives, and energy
- Transport of resources and additives to the production site
- Production processes on-site including energy, production of additives, disposal of production residues, and consideration of related emissions
- Granulation process of slag leaving the blast furnace.

Allocation

An economical allocation was applied for the GBFS taking into account 5 years of market values of Hot Rolled Coil and GBFS.

Other materials and chemicals used were modelled using the allocation rule most suitable for the respective product. For further information on a specific product see *Gabi Documentation* and *Worldsteel Association Methodology Report*.

Comparability

Basically, a comparison or an evaluation of EPD data is only possible if all the data sets to be compared were created according to *EN 15804* and the building context, respectively the product-specific characteristics of performance, are taken into account.

GaBi ts Software version 10.0.1.92 was used with *GaBi Database 2021.1* to calculate this EPD.

LCA: Scenarios and additional technical information

Since the GBFS are further processed and used by the cement industry, no scenarios were used behind the gate of production plants.

LCA: Results

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; MND = MODULE NOT DECLARED; MNR = MODULE NOT RELEVANT)

PRODUCT STAGE			CONSTRUCTION PROCESS STAGE		USE STAGE							END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARIES
Raw material supply	Transport	Manufacturing	Transport from the gate to the site	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	MND	MND	MND	MND	MNR	MNR	MNR	MND	MND	MND	MND	MND	MND	MND

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT according to EN 15804+A1: 1 metric ton of Granulated Blast Furnace Slag

Parameter	Unit	A1-A3
Global warming potential	[kg CO ₂ -Eq.]	8.28E+1
Depletion potential of the stratospheric ozone layer	[kg CFC11-Eq.]	2.90E-13
Acidification potential of land and water	[kg SO ₂ -Eq.]	1.40E-1
Eutrophication potential	[kg (PO ₄) ³ -Eq.]	1.43E-2
Formation potential of tropospheric ozone photochemical oxidants	[kg ethene-Eq.]	3.48E-2
Abiotic depletion potential for non-fossil resources	[kg Sb-Eq.]	8.45E-6
Abiotic depletion potential for fossil resources	[MJ]	6.42E+2

RESULTS OF THE LCA - INDICATORS TO DESCRIBE RESOURCE USE according to EN 15804+A1: 1 metric ton of Granulated Blast Furnace Slag

Parameter	Unit	A1-A3
Renewable primary energy as energy carrier	[MJ]	8.01E+1
Renewable primary energy resources as material utilization	[MJ]	0.00E+0
Total use of renewable primary energy resources	[MJ]	8.01E+1
Non-renewable primary energy as energy carrier	[MJ]	7.42E+2
Non-renewable primary energy as material utilization	[MJ]	0.00E+0
Total use of non-renewable primary energy resources	[MJ]	7.42E+2
Use of secondary material	[kg]	0.00E+0
Use of renewable secondary fuels	[MJ]	0.00E+0
Use of non-renewable secondary fuels	[MJ]	0.00E+0
Use of net fresh water	[m ³]	1.13E+0

RESULTS OF THE LCA – WASTE CATEGORIES AND OUTPUT FLOWS according to EN 15804+A1: 1 metric ton of Granulated Blast Furnace Slag

Parameter	Unit	A1-A3
Hazardous waste disposed	[kg]	1.74E-7
Non-hazardous waste disposed	[kg]	4.55E-1
Radioactive waste disposed	[kg]	3.57E-2
Components for re-use	[kg]	0.00E+0
Materials for recycling	[kg]	0.00E+0
Materials for energy recovery	[kg]	0.00E+0
Exported electrical energy	[MJ]	0.00E+0
Exported thermal energy	[MJ]	0.00E+0

References

EN 197-1

EN 197-1:2011, Cement - Part 1: Composition, specifications and conformity criteria for common cements.

EN 206

EN 206:2013+A2:2021, Concrete - Specification, performance, production and conformity.

EN 15167-1

EN 15167-1:2006, Ground granulated blast furnace slag for use in concrete, mortar and grout - Part 1: Definitions, specifications and conformity criteria.

EN 15804

EN 15804+A1:2013, Sustainability of construction works — Environmental Product Declarations — Core rules for the product category of construction products.

PCR Part A

PCR - Part A: Calculation Rules for the Life Cycle Assessment and Requirements on the Project Report, Institut Bauen und Umwelt e.V., www.ibu-epd.com, 2021.

PCR Part B

Requirements on the EPD for Structural steels - Institut Bauen und Umwelt e.V., Berlin (pub.): From the range of Environmental Product Declarations of Institute Construction and Environment e.V. (IBU), 2017.

Candidate List of Substances of Very High Concern for Authorisation

Regulation (EC) No 1907/2006 of the European Parliament and of the Council on the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH)
<https://echa.europa.eu/candidate-list-table>

CAS

Common Chemistry. CAS, a division of the American Chemical Society, n.d.
https://commonchemistry.cas.org/detail?cas_rn=65996-69-2 (retrieved 2022-04-08) (CAS RN: 65996-69-2)

EINECS

European Inventory of Existing Commercial Chemical Substances. *Download at November February* (2021).

GaBi ts Software

GaBi ts Software and Databases for Life Cycle Engineering. LBP, University of Stuttgart und PE International, 2013.

GaBi ts Documentation

GaBi ts Documentation of the GaBi datasets for Life Cycle Engineering. LBP, University of Stuttgart und PE International, 2011.
<http://documentation.gabi-software.com>

IBU 2021

General Instructions for the EPD programme of Institut Bauen und Umwelt e.V. Version 2.0, Berlin: Institut Bauen und Umwelt e.V., 2021.
www.ibuepd.com

Worldsteel Association Methodology Report

Life cycle inventory methodology report for steel products.
 © World Steel Association 2017.
<https://worldsteel.org/wp-content/uploads/Life-cycle-inventory-methodology-report.pdf>.

**Publisher**

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