

CO-PRODUCTS CELSA GROUP **TECHNICAL DATA SHEETS**



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INTRODUCTION CO-PRODUCTS



CELSA GROUP is not only a steelmaking company dedicated to the steel production. We have become the **1st recycling group in Spain and 2nd in Europe**. These premise make us to focus on the co-products generated during the production of steel in the different business units, and the need to generate added value for them and new added value applications.

At CELSA GROUP we generate close to **1.4 million tons of different co-products**, among which are: **Slag** from the EAF - electric arc furnace (black) and LF - ladle furnace (white), also known after processing as steel aggregate, **mill scale** from meltshop, rolling mill, and drawing facilities (iron oxide), **steel dust** from EAF filters (EAFD) and **refractories**.

Below, you will find recycled co-products with a **low carbon footprint**. that are suitable for manufacturing **negative carbon cements, sustainable clinker, concretes, counterweights, ferro-alloys or pigments**.

Circularity BU

01.

TECHNICAL DATA SHEETS

CO-PRODUCTS



CELSA is already low carbon.



STEEL AGGREGATE (BLACK)

**EAFS - ELECTRIC ARC
FURNACE SLAG**

DESCRIPTION

Ecological co-product, with high hardness, high specific weight and great resistance to wear. Generated in the steel-making process with Electrical Arc Furnace. It is the main by-product generated on the process of melting steel scrap with electricity to produce steel, with very low CO2 emissions.

APPLICATION



Civil engineering applications, concretes, asphalts and bituminous mixtures . Good physical, chemical and mineralogical properties. Also used as a raw material for Rockwool and Ferro Alloys production.

AVAILABILITY

02.



800.000 TPY

CELSA is already low carbon.

STEEL AGGREGATE (BLACK)

**EAFS - ELECTRIC ARC
FURNACE SLAG**



COMPOSITION

FeO	Avg % wt	33,0
CaO	Avg % wt	26,0
SiO ₂	Avg % wt	15,0
Al ₂ O ₃	Avg % wt	12,0
MnO	Avg % wt	5,5
MgO	Avg % wt	4,4
Cr ₂ O ₃	Avg % wt	2,5
P ₂ O ₅	Avg % wt	0,5

OTHER PROPERTIES

Density (Apparent / Dry)	3,8 / 3,5	UNE-EN 1097-6:2001
Basicity	2,03	(CaO% + MgO%)/SiO ₂ %
Expansivity	0,5	UNE-EN 1744-1:1998
Hardness	-	-
Los Angeles abrasion test (LA)	> LA15	UNE-EN 1097-2:1999
Polish test (PSV)	> PSV56	UNE-EN 1097-8:2010
Available sizes (mm)	0-5 / 5-11 / 11-25 / 25-50	UNE-EN 933-1:1998
Packaging	In Bulk	-

EN 12620:2002 AGGREGATES FOR CONCRETE

EN 13043:2002 AGGREGATES FOR BITUMINOUS MIXTURES AND TREATMENT OF SURFACES OF HIGHWAYS, AIRPORTS AND OTHER PAVED AREAS

EN 13242:2002 AGGREGATES FOR GRANULAR LAYERS AND LAYERS TREATED WITH CONGLOMERATE HYDRAULIC FOR USE IN STRUCTURAL LAYERS OF PAVEMENTS

CELSA is already low carbon.



STEEL AGGREGATE (WHITE)

**LFS - LADLE FURNACE
SLAG**

EWG CODE/LER: 10 02 02

DESCRIPTION

Co-product generated from the steel slag in the ladle furnace (Secondary refining). It has a high lime content (CaO), SiO₂, Al₂O₃ and MgO. With application in several construction sectors and cement industries. Without any pre-treatment, the material is powdery and fine, which favors its application in several construction sectors and cement industry.

APPLICATION



Clinker production, construction as cement substitute (Low CO₂ emissions), carbon negative concrete, Lime substitute, Ph soil amendments.

AVAILABILITY



03.

130.000 TPY

STEEL AGGREGATE (WHITE)

**LFS - LADLE FURNACE
SLAG**



COMPOSITION

FeO	Avg % wt	1,8
CaO	Avg % wt	52,1
SiO ₂	Avg % wt	26,1
Al ₂ O ₃	Avg % wt	7,4
MnO	Avg % wt	2,3
MgO	Avg % wt	9,7
Cr ₂ O ₃	Avg % wt	<0,1
P ₂ O ₅	Avg % wt	<0,1
TiO ₂	Avg % wt	<0,5

OTHER PROPERTIES

Density (Apparent / Dry)	2,6	UNE-EN 1097-6:2001
Basicity	2,36	(CaO% + MgO%) / SiO ₂ %
Expansivity	-	UNE-EN 1744-1:1998
Available sizes (mm)	0,063 - 2 mm	UNE-EN 933-1:1998
Packaging	In Bulk	-

CELSA is already low carbon.



STEEL AGGREGATE (WHITE)

**LFS - LADLE FURNACE
SLAG B - (GRANULATED)**

EWC CODE/LER: 10 02 02

DESCRIPTION

Co-product generated from the steel slag in the ladle furnace (Secondary refining). It has a high lime content (CaO), SiO₂, Al₂O₃ and MgO. With application in several construction sectors and cement industries. This type B slag is less dusty and much more easy to transport than other ladle furnace slags.

APPLICATION



Clinker production, construction as cement substitute (Low CO₂ emissions), carbon negative concrete, Lime substitute, Ph soil amendments.

AVAILABILITY

03.



10.000 TPY

CELSA is already low carbon.

STEEL AGGREGATE (WHITE)

**LFS - LADLE FURNACE
SLAG B - (GRANULATED)**



COMPOSITION

Fe ₂ O ₃	Avg % wt	1,6
CaO	Avg % wt	38,6
SiO ₂	Avg % wt	39,5
Al ₂ O ₃	Avg % wt	1,4
MnO	Avg % wt	2,9
MgO	Avg % wt	9,2
Cr ₂ O ₃	Avg % wt	<0,1
P ₂ O ₅	Avg % wt	<0,1
TiO ₂	Avg % wt	<0,5

OTHER PROPERTIES

Density (Apparent / Dry)	2,6	UNE-EN 1097-6:2001
Basicity	1,21	(CaO% + MgO%) / SiO ₂ %
Expansivity	-	UNE-EN 1744-1:1998
Available sizes (mm)	On demand	-
Packaging	In Bulk	-



IRON OXIDE MILL SCALE I

ROLLING MILL

EWC CODE/LER: 10 02 10

DESCRIPTION

Layered and brittle material generated in the surface of billets, slabs, plates, sheets or profiles when they are manufactured during a rolling process. Is mainly composed by iron oxides FeO (Wustite), Fe_2O_3 (hematite), Fe_3O_4 (magnetite).

APPLICATION



Iron ore sinter, iron ore pellets, cement clinker, heavy concrete and aggregates, electrodes for alkaline batteries, preparation and uses of catalyst, ferro alloys (FeP , FeMo , FeSi SiMn), phosphate fertilizer, mineral wool, colored glass, oxide pigments, flocculant production, counterweights, magnets, etc.

AVAILABILITY

04.



90.000 TPY

CELSA is already low carbon.

IRON OXIDE

MILL SCALE I

ROLLING MILL



COMPOSITION

Fe Total	Avg % wt	71,8	ICP
Fe ₂ O ₃ (Hematite)	Avg % wt	44,4	ICP
FeO (Wüstite)	Avg % wt	48,2	ICP
SiO ₂	Avg % wt	0,45	ICP
CaO	Avg % wt	0,17	ICP
Al ₂ O ₃	Avg % wt	0,11	ICP
P	Avg % wt	< 0,03	ICP
Zn	Avg % wt	< 0,03	ICP
S	Avg % wt	< 0,03	LECO
Cl	Avg % wt	<0,02	Ionic Chromatography

OTHER PROPERTIES

Density	kg/m ³	2600	
Moisture	Avg % wt	< 3	Stove
Oils	Avg % wt	< 0,5	CEA 1185

Size distribution: **0,1 - 10 mm**

CELSA is already low carbon.



IRON OXIDE MILL SCALE II

WIRE DRAWING MILL SCALE

EWG CODE/LER: 10 01 02

DESCRIPTION

Layered, fine and brittle material generated in the surface of wire rod in the drawing process. Is mainly composed by iron oxides FeO (Wustite), Fe_2O_3 (hematite), Fe_3O_4 (magnetite).

APPLICATION



Iron ore sinter, iron ore pellets, cement clinker, heavy concrete and aggregates, electrodes for alkaline batteries, preparation and uses of catalyst, ferro alloys (FeP , FeMo , FeSi SiMn), phosphate fertilizer, mineral wool, colored glass, oxide pigments, flocculant production, counterweights, magnets, etc.

AVAILABILITY

04.



2000 TPY

CELSA is already low carbon.

IRON OXIDE

MILL SCALE II



WIRE DRAWING MILL SCALE

COMPOSITION

Fe Total	Avg % weight	75
Insoluble	Avg % weight	< 0,5
Mn	ppm / %	3500 / 0,35%
Cu	ppm / %	2900 / 0,29%
Ni	ppm / %	580 / 0,058%
Cr	ppm / %	200 / 0,020%
Zn	ppm / %	37 / 0,0037%
C	ppm / %	410 / 0,041%
S	ppm / %	420 / 0,042%

OTHER PROPERTIES

Fe ₃ O ₄ (Magnetite)	Avg % weight	47,9
FeO (Wüstite)	Avg % weight	44,8
Fe ₂ O ₃ (Hematite)	Avg % weight	2,0
Fe Met.	Avg % weight	1,5

Humidity	ppm / %	< 0,1
Oils	ppm / %	0
BET	m ² /g	0,4



IRON OXIDE MILL SCALE III

MILL SCALE SLUDGES

EWG CODE/LER: 10 02 10

DESCRIPTION

Layered and brittle material generated in the surface of billets, slabs, plates, sheets or profiles when they are manufactured during a wire drawing process. Is mainly composed by iron oxides FeO (Wüstite), Fe_2O_3 (hematite), Fe_3O_4 (magnetite). In sludge format as material has been processed and de-oiled in a wat material

APPLICATION



Iron ore sinter, iron ore pellets, cement clinker, heavy concrete and aggregates, electrodes for alkaline batteries, preparation and uses of catalyst, ferro alloys (FeP , FeMo , FeSi SiMn), phosphate fertilizer, mineral wool, colored glass, oxide pigments, flocculant production, counterweights, magnets, etc.

AVAILABILITY

04.



50.000 TPY

CELSA is already low carbon.

IRON OXIDE MILL SCALE III

MILL SCALE SLUDGES



COMPOSITION

Fe Total	Avg % wt	>70	ICP
Fe ₂ O ₃ (Hematite)	Avg % wt	44,4	ICP
FeO (Wüstite)	Avg % wt	48,2	ICP
SiO ₂	Avg % wt	0,45	ICP
CaO	Avg % wt	0,17	ICP
Al ₂ O ₃	Avg % wt	0,11	ICP
P	Avg % wt	< 0,03	ICP
Zn	Avg % wt	< 0,03	ICP
S	Avg % wt	< 0,03	LECO
Cl	Avg % wt	<0,02	Ionic Chromatography

OTHER PROPERTIES

Density	kg/m ³	2600	
Moisture	Avg % wt	< 6	Stove
Oils	Avg % wt	< 0,5	CEA 1185

Size distribution: **0,1 - 2 mm**



ZINC OXIDE

EAFD

DUST FROM EAF ASPIRATION

EWG CODE/LER: 10 02 07

DESCRIPTION

Electric-arc furnace dust (EAFD) is a co-product generated in mini mills during steel production, mainly in the EAF dust filter. It has valuable zinc that can be recovered in WAEZLZ furnaces.

APPLICATION



Production of enriched zinc oxide that can be further processed for very different applications as pharmaceutical, animal food industry, ceramics and galvanizing.

AVAILABILITY

05.



120.000 TPY

ZINC OXIDE

EAFD

DUST FROM EAF ASPIRATION



COMPOSITION

Zn	Avg % wt	37,8
Fe	Avg % wt	18,8
Ca	Avg % wt	4,0
Pb	Avg % wt	1,7
Mn	Avg % wt	1,6
Si	Avg % wt	1,4
Mg	Avg % wt	1,1
K	Avg % wt	1,0
S	Avg % wt	0,6
Al	Avg % wt	0,6

OTHER PROPERTIES

ZnO	Avg % wt	>30
ZnFe ₂ O ₄	Avg % wt	25,3
CaO	Avg % wt	7,5
Zn ₅ (OH) ₈ Cl ₂ ·H ₂ O	Avg % wt	18,3
C	Avg % wt	9,9
Ca TiO ₃	Avg % wt	7,5
FeO(OH)	Avg % wt	5,0
CaCO ₃	Avg % wt	10,0

CIRCULARITY BUSINESS UNIT

CO-PRODUCTS

