Statement of Recognition

BREG EPD No.: R00027 Issue 02

The attached

Environmental Product Declaration

provided by:

VM BUILDING SOLUTIONS Deutschland GmbH

is Recognised by BRE Global as being in accordance with the requirements of:

EN 15804:2012+A1:2013

as verified and issued by: IBU

Reference number: EPD-UMC-20140030-IBB2-EN

This declaration is for:

PREWEATHERED ROLLED ZINC – QUARTZ ZINC® AND ANTHRA ZINC ®

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Signed for BRE Global Ltd	Emma Baker Operator	10 April 2018 Date of this Issue
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EPD Verified and issued by IBU

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ENVIRONMENTAL PRODUCT DECLARATION

as per ISO 14025 and EN 15804

Owner of the Declaration	**VM BUILDING SOLUTIONS Deutschland GmbH**
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Publisher	Institut Bauen und Umwelt e.V. (IBU)
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PREWEATHERED ROLLED ZINC – QUARTZ ZINC® AND ANTHRA ZINC®

VM BUILDING SOLUTIONS Deutschland GmbH

Institut Bauen und Umwelt e.V.

www.bau-umwelt.com / https://epd-online.com

1. General Information

VM BUILDING SOLUTIONS Deutschland GmbH

Programme holder
IBU - Institut Bauen und Umwelt e.V.
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Declaration number
EPD-UMC-20140030-IBB2-EN

This Declaration is based on the Product Category Rules:
Building metals, 07.2014
(PCR tested and approved by the independent expert committee)

Issue date
08/10/2014

Valid to
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Prof. Dr.-Ing. Horst J. Bossenmayer
(President of Institut Bauen und Umwelt e.V.)

Dr. Burkhart Lehmann
(Managing Director IBU)

PREWEATHERED ROLLED ZINC QUARTZ ZINC® AND ANTHRA ZINC®

Owner of the Declaration
VM BUILDING SOLUTIONS Deutschland GmbH
Gladbecker StraBe 413
D-45326 Essen

Declared product / Declared unit
1 kg of preweathered rolled zinc – QUARTZ ZINC® and ANTHRA ZINC® from VMZINC.

Scope:
This Environmental Product Declaration in accordance with the EN 15804 concerns the life cycle of 1 kg of preweathered rolled zinc – QUARTZ ZINC® and ANTHRA ZINC® manufactured in the French production plant located in Viviez of the company Umicore Building Products. This EPD concerns the preweathered rolled zinc from VMZINC only (QUARTZ ZINC® and ANTHRA ZINC®). The preweathered rolled zinc from VMZINC covers by this EPD can be used in the building as roof, façade or rainwater systems.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.

Verification

The CEN Norm EN 15804 serves as the core PCR
Independent verification of the declaration according to ISO 14025
☐ internally ☒ externally

Manfred Russ
(Independent tester appointed by SVA)

2. Product

2.1 Product description

The product concerns by this EPD is 1 kg of preweathered rolled zinc QUARTZ ZINC® and ANTHRA ZINC® in sheets or coils from VMZINC used for building envelop applications (roof, façade or rainwater systems). The preweathered rolled zinc from VMZINC is a copper and titanium zinc alloy in accordance with the /DIN EN 988/, which has received a surface treatment. This alloy contains mainly very high purity zinc in accordance with /DIN EN 1179/ (Grade Z1: 99,995% of purity) with very few alloy components (copper, titanium and aluminium). It has optimal mechanical and physical properties for applications in construction, in particular regarding mechanical resistance and resistance against creep deformation. From an aesthetical point of view, preweathered rolled zinc is less bright and darker than natural rolled zinc.

2.2 Application

The preweathered rolled zinc in sheets and coils is used in numerous building applications:

- Roofing,
- Facade applications,
- Flashings and coverings,
- Roof drainage systems,
- Ornaments under the brand name of "Ateliers d'Art Français".

2.3 Technical Data

The main constructional data are presented in the following table:

Constructional data

Name	Value	Unit
Tensile strength	152 - 190	N/mm²
Modulus of elasticity	9000	N/mm²
Melting point	420	°C
Thermal conductivity	110	W/(mK)
Density	7.2	kg/m³
Coefficient of thermal expansion (100°C)	2.2	mm/m
Electrical conductivity at 20°C	17	mS/m

2.4 Placing on the market / Application rules

EN 506:2000-12 Roofing products from metal sheet specification for self-supporting products of copper and zinc sheet.

EN 612: 2005-04 Eaves gutters with bead stiffened fronts and rainwater pipes with seamed joints made of metal sheet.

EN 988: 1996-06 Zinc and zinc alloys – specification for rolled flat products for buildings.

2.5 Delivery status

Pre-weathered QUARTZ-ZINC® and ANTHRA-ZINC® offer other surface designs than natural rolled zinc. They are produced by immersing the natural rolled zinc by VMZINC® into a solution which changes the metal's crystalline surface structure up to a depth of about a µm. This treatment takes place by phosphating and leads to a permanent chemical change of the metal's surface structure.

Right for the start, the QUARTZ ZINC® has a similar look to the natural patina of bright-rolled zinc. ANTHRA ZINC® has a dark grey, anthracite coloured surface.

Ø Dimensions Panels: 1000 x 2000 mm, 1000 x 3000 mm;

Ø Coils with following blanks: 200 mm / 250 mm / 280 mm / 333 mm / 400 mm / 500 mm / 600 mm / 670 mm / 1000 mm

Ø Thickness [mm]: 0.65 mm to 1.5 mm

Ø Weight: 4.7 kg/m2 (t=0.65 mm) to 10.8 kg/m2 (t=1.5mm)

2.6 Base materials / Ancillary materials

The composition of preweathered rolled zinc from VMZINC is in accordance with /DIN EN 988/

Name	Value	Unit
Primary zinc (very high purity zinc of 99.995% with lmitied lead and cadmium contents: grade Z1 according to /DIN EN 1179/)	> 99.835	%
Copper	0.08 to 0.2	%
Titanium	0.07 to 0.12	%
Aluminium	< 0.015	%

Consumable materials for the manufacturing of 1 kg of preweathered rolled VMZINC (which doesn't remain in the composition of the final product):

- 0.86% of acid mixing *
- 0.04% of zinc phsphate
- 0.026% of lubricant

None of the end components included in the final product is included in the candidat list of the "Substances of Very High Concern for authorization".

**The acid mixing is a mixing composed by nitric, phosphoric and sulphuric acids.*

2.7 Manufacture

The manufacturing of rolled VMZINC takes place in 6 stages:

1. Pre-alloying: An alloy comprising copper, titanium and aluminium is prepared at 650°C in an alloy furnace. This master alloy is put in a second smelting furnace with the refined zinc.

2. Smelting: Refined zinc cathodes and ingots are smelted in the first induction furnace at 500°C and then are put in a second smelting furnace with the master alloy. The finished alloy is fed into the casting furnace. This loads the continuous casting machine at 500°C.

3. Casting and cooling: The molten metal is transferred into a continuous casting machine to harden there into the form of an approx. 12 millimetre thick and one metre wide continuous cast strand. The controlled cooling process in the system guarantees a fine, homogenous grain size.

4. Rolling: The cast strand is rolled into the desired thickness in three to five rolling operations. In the course of this process the temperature, rolling speed and degree of reduction are constantly monitored and adapted to achieve the desired mechanical properties and dimensions.

5. Preweathering: Preweathered QUARTZ-ZINC® and ANTHRA-ZINC® are produced from natural rolled VMZINC® through surface treatment. Preweathering is a continuous, multi-stage surface treatment process consisting of etching, phosphating, rinsing and drying. QUARTZ-ZINC® surface protection is achieved by a film of oil, ANTHRA-ZINC® surface protection is achieved by applying a thin organic coating (transparent).

6. Stretching and cutting: The final stages include stretching and cutting the rolled zinc into sheets and coils into the desired dimensions and weights.

The production plant of Viviez is certified ISO 9001 (Quality management control).

2.8 Environment and health during manufacturing

During the whole manufacturing process there are no health protection measures required beyond the legally

established industrial protection measures for tradespeople.

All production sites for Umicore construction products are certified in accordance with ISO 14001.

Measures for reducing environmental pollution triggered by the manufacturing process are:

Air: the process air is cleaned to below the officially set limits using suitable emission protection measures (filter systems).

Water/Ground: no contamination of water or ground. The casting process cooling works with a closed water cycle. Waste water resulting from the pre-weathering process is cleaned in a neutralisation plant found at one of the production locations.

Noise: as a result of sound protection measures taken, sound level measurements have shown that all values established inside and outside the production sites lie way be-low the values required by public law.

2.9 Product processing/Installation

General principles:

Rolled zinc from VMZINC® must be stored in a dry and ventilated place. This also applies to building site storage as well as for parts stored temporarily at the installation site. Coils are to be stored on pallets, so that moisture cannot penetrate into them (later water stains). Transport may only be carried out by enclosed vehicles. If the surfaces of natural rolled VMZINC are covered with films, make sure that the surfaces are well ventilated. Wet covering films may not come into direct contact with the titanium zinc surfaces to be covered. Rolled zinc from VMZINC which is wet from water may also not be directly covered.

The material is to be processed without tension.

Take into account the expansion coefficient for the installation of the product.

If for compelling reason the rolled zinc from VMZINC work is carried out during the cold time of year, special measures are required with folding which incur additional costs. This must be in accordance with the construction management. With metal temperatures below 10°C and rapid deformation, whole batches have to be warmed up to prevent cracks forming. This particularly applies to connections, for example crimp folds and 180° handling.

Assembly of the rolled zinc from VMZINC with other metals:

Electrolytic corrosion can occur when assembling together with different metals, if the metal (-part) of the higher potential is arranged above it in the water's flow direction.

With the presence of damp or moisture, damage can occur if the VMZINC system comes into contact with copper or unprotected (no galvanized) steel due to an electrochemical reaction. The direct proximate assembly of copper and rolled zinc from VMZINC components is always to be avoided.

Assembly of rolled zinc from VMZINC with other building materials:

If VMZINC systems are to come into contact with precipitation water from unprotected bituminous roofing, these should be provided with protective coatings, as otherwise you can reckon with so-called "bitumen corrosion".

Detailed processing information as for example types of fixings, deformation and joining techniques can be found in the corresponding information material from VM BUILDING SOLUTIONS Deutschland GmbH.

Industrial safety, health and environmental protection measures:

With the processing/installation of VMZINC® products no other health protection measures are required beyond the usual industrial safety measures (like e.g. protective gloves). No significant environmental pollution is triggered by the processing/assembly of the named products. No special measures need to be taken to protect the environment.

Residual materials and packaging:

Any VMZINC® residual materials and packaging on the building site must be collected separately.

Rolled zinc products are 100% recyclable. In Europe there is an extensive network which takes back zinc waste from building sites and recycles this for a huge variety of applications.

2.10 Packaging

The packaging materials used are wooden pallets (transport), cardboard and plastics (films and wires).

All packaging can be recycled if the wastes generated in the building site are well managed.

The waste keys for the main packaging are:

-corrugated board - 15 01 01,
-wood pallets - 15 01 03.

2.11 Condition of use

The behavior of preweathered rolled zinc exposed to the atmosphere is the same than those of natural rolled zinc: a protective layer called patina occurs naturally. This protective layer ensures absolutely maintenance free of the surfaces of the rolled zinc from VMZINC and is responsible for the rolled zinc from VMZINC's high resistance to corrosion.

In the first stage zinc oxide is formed on the zinc surface. Zinc hydroxide then forms under the influence of moisture (rain). Under the influence of CO_2 from the atmosphere basic zinc carbonate is then formed, which is then the dense, adhesive and water-insoluble protective layer. This very dense and if injured, "self-healing" layer gives lifetime protection and keeps natural wear very low (see section 9.1 Runoff Rates).

2.12 Environment and health during use

Environment

Generally, zinc runoff coming from rolled zinc applications used in building does not create a risk to the environment.

Indeed, zinc is naturally present into the environment and has always been used by living organisms in their growth and development making zinc the third trace elements the most important for human being.

Furthermore, when zinc is released into the environment, a large amount reacts mainly by adsorption with the other components of the environment such as organic matters or oxides (we speak about speciation) leaving a small amount available to living organisms (we speak about bioavailability). Generally, in soil, more than 90% of zinc emitted binds to soil particles, leaving only 10% of the zinc available for living organisms; in water, 70% of zinc emissions are captured into sediments (1).

This scientific knowledge about zinc behaviour into the environment (speciation and bioavailability) was incorporated into the risk assessment methods used for European regulations.

Anyway and in all cases, whatever the type of products used in the building, where it is proposed to evacuate rainwater directly into the environment, an environmental impact assessment must be carried out.

Parameters influencing zinc runoff from building products are:

- Sulfur dioxide - SO_2 atmospheric content (the more there is sulfur dioxide the more is zinc runoff rate).

-Chlorides - Cl^{2-} atmospheric content (the more there are chlorides, the more is the runoff rate).

-Slope of the constructive element (the more the slope is high, the less is the zinc runoff rate).

-Surface aspect of rolled zinc.

Zinc concentration into rainwaters, which have passed on building products in rolled zinc:

Corrosion and runoff mechanisms of rolled zinc used in building applications are very well documented. This knowledge allows modelling accurately zinc emissions, which may be obtained as a function of a number of parameters (atmospheric levels of sulfur dioxide and chloride, slop and orientation of the building elements and rolled zinc surface aspect).

Generally speaking, in average after 5 years of exposure under yearly precipitation of rain between 470 and 790 mm/year:

- zinc concentration of rainwater, which has passed on natural rolled zinc roof is around 4 mg/L (2),

- zinc concentration is reduced by 30% with preweathered rolled zinc such as QUARTZ-ZINC® or ANTHRA-ZINC® (2).

The zinc concentration may be even lower if the rainwater has passed on coated rolled zinc such as PIGMENTO®, then zinc concentration is reduced by 95% (3).

So generally in all cases, zinc concentration is lower than the drinkable threshold equal to 5 mg/L when this regulatory threshold exists (4) because in numerous countries, there is not drinkable threshold for zinc like at the European level (because zinc is not an issue).

Ground seepage:

Due to seepage there can be locally restricted slightly increased zinc concentrations in the ground/ in technical infiltration, like troughs, rigolen systems and absorbing wells. There is no risk of an excess supply of zinc for the soil/plants/animals.

Health

The use stage of the rolled zinc from VMZINC, used in the envelope applications in the building, can't have impacts on the health of the users.

Zinc is an essential element that means it is absolutely necessary for all living organisms.

For human beings, zinc is the 3rd most important.

Oligo-element after magnesium and iron and the WHO recommends zinc daily intakes of 15 mg/day for men and 12 mg/day for women.

2.13 Reference service life

The long experience, which has shown so numerous very old buildings with rolled zinc products still efficient and the deep theorical knowledge about the behavior of the rolled zinc exposed to the atmosphere lead to announce a service life of 100 years; the standard ISO 15686 has not been considered.
Influences on ageing when applied in accordance with the rules of technology
.

2.14 Extraordinary effects

Fire

Fire performance:
The VMZINC® products meet the requirements of the building material class A1 "non flammable" in accordance with the standard DIN 4102, Section 1.

Development of smoke gas / Smoke density:
Formation of zinc oxide smoke with heating above 650°C.

Fire gas toxicity:
The inhalation of zinc oxide smoke can cause zinc fever (dry throat, cough or aching muscles), which disappears 1 to 2 days after the discontinuation of omissions.

Changing the aggregate condition (burning dripping/falling material):

The smelting point is 419.5°C.

Fire protection

Name	Value
Building material class	A1
Smoke gas development	> 650°C

Water

The effect of floods on zinc coils and sheets does not lead to product change or any other negative consequences for the environment.

Mechanical destruction

None

2.15 Re-use phase

Scrap of "new" rolled zinc: rolled zinc scrap, from the VMZINC manufacturing process or from the installation of VMZINC products in the building site, are fed back completely into the melting in the VMZINC manufacturing process.

Old rolled zinc: the old rolled zinc, dismantled at its end of life during demolition or renovation works in the building site, is collected to be sold either directly to secondary smelting works or via a scrap metal dealer.

Indeed, due to its high residual value (60 to 75% of the zinc content is remunerated in value) and to a recycling market very well structured, the recycling rate of the rolled zinc products at its end of life is at least 96% in the Western Europe.

The old rolled zinc is recycled to be reused in different applications such as steel galvanizing or zinc oxides manufacturing.

The use of recycled material instead of zinc ore has a positive influence on the sustainability of the natural resources and also on the energy use (significant energy savings from 50 to 90%).

2.16 Disposal

Because of the very high and efficient recycling rate of the rolled zinc products, no rolled zinc from roofing, facade or rainwater systems goes for disposal/landfill.

Nevertheless, the waste key for zinc is: 17 04 04.

2.17 Further information

For futher information: vmzinc.com

3. LCA: Calculation rules

3.1 Declared Unit

This declaration refers to one kilogramme of preweathered rolled zinc from VMZINC under the trademark QUARTZ-ZINC® and ANTHRA ZINC®.

Declared unit

Name	Value	Unit
Declared unit	1	kg

3.2 System boundary

This declaration is a "Cradle to Gate" with options. It covers modules A1 to A3, modules C2, C3, C4 and D.

The aggregated module A1-A3 includes:

•The manufacturing and transport of raw materials (Ti, Cu, Zn etc.),
• The manufacturing of the preweathered rolled zinc (QUARTZ ZINC® and ANTHRA ZINC®),
•The manufacturing of the energy resources (electricity, thermal energy, auxiliaries),
• The manufacturing, the transport and the end of life of the packaging (including credits for electricity and thermal energy),
• The end of life of the process wastes.

The module C2 includes transports of old rolled to landfill or recycling plant.

The module C3 includes pre-treatment before recycling.

The module C4 corresponds to landfill.

The module D includes re-melting and avoided impacts due to recycling of old rolled zinc.

3.3 Estimates and assumptions

No major estimates or assumptions were necessary for this LCA excepted for recycling rate which has been assumed at 96 % (European recycling rate for rolled zinc).

3.4 Cut-off criteria

All the data from the operating data survey, all direct production wastes, all emission measurements available and all transport distances were taken into consideration.

Material and energy flows with a share less than 1 percent were also taken into consideration.

Only machines, facilities and GPL for engins required at the production plant are neglected.

It can be assumed that the sum of ignored processes may not exceed 5% of the impact categories.

3.5 Background data

The "GaBi 6" software system on comprehensive analysis developed by PE International GmbH is used for modelling the life cycle for the manufacturing and recycling of the preweathered rolled zinc. All relevant background data records for the manufacturing of zinc are taken from the GaBi 6 software database, specific data related to the production of preweathered rolled zinc were collected in the Viviez Umicore production plant.

3.6 Data quality

Consistency of the process data and used background data (GaBi) more particularly data related to the

production of primary zinc for which the most recent and the most technically and geographically representative data have been used (ELCD). Strong consistency of specific data to the Umicore production plants (complete data inventory updated in 2012).

3.7 Period under review

The life cycle assessment is based on data collection in the production plants of Umicore Bausystem made in 2012.

3.8 Allocation

Allocation was avoided as much as possible as required by EN 15804 but allocations had to be done for:

- Energy recovery of production wastes (Credits to module A3).

- Recycling of old rolled zinc at its end of life (Credits to module D).

The credit for the zinc obtained from remelting is calculated on the basis of the data record of primary zinc manufacturing.

3.9 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.

4. LCA: Scenarios and additional technical information

End of life (C1 - C4)

Name	Value	Unit
Collected separately	1	kg
Recycling	0.96	kg
Landfilling	0.04	kg

5. LCA: Results

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

PRODUCT STAGE			CONSTRUCTION PROCESS STAGE		USE STAGE							END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARYS
Raw material supply	Transport	Manufacturing	Transport from the gate to the site	Assembly	Use	Maintenance	Repair	Replacement[1)]	Refurbishment[1)]	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	MND	MND	MND	MND	MND	MND	X	X	X	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT: 1 kg of natural rolled zinc

Parameter	Unit	A1-A3	C2	C3	C4	D
Global warming potential	[kg CO_2-Eq.]	3.30E+0	4.60E-2	5.30E-3	4.10E-4	-2.50E+0
Depletion potential of the stratospheric ozone layer	[kg CFC11-Eq.]	3.20E-7	8.00E-13	6.30E-11	1.50E-13	-2.80E-7
Acidification potential of land and water	[kg SO_2-Eq.]	2.20E-2	2.90E-4	2.30E-5	1.80E-6	-1.80E-2
Eutrophication potential	[kg $(PO_4)^{3-}$ Eq.]	2.50E-3	7.10E-5	2.10E-6	3.20E-7	-2.00E-3
Formation potential of tropospheric ozone photochemical oxidants	[kg Ethen Eq.]	1.40E-3	-1.20E-4	1.80E-6	2.50E-7	-1.10E-3
Abiotic depletion potential for non fossil resources	[kg Sb Eq.]	1.50E-3	1.70E-9	2.00E-9	6.00E-11	-1.10E-3
Abiotic depletion potential for fossil resources	[MJ]	3.40E+1	6.40E-1	1.20E-1	5.90E-3	-2.30E+1

RESULTS OF THE LCA - RESOURCE USE: 1 kg of natural rolled zinc

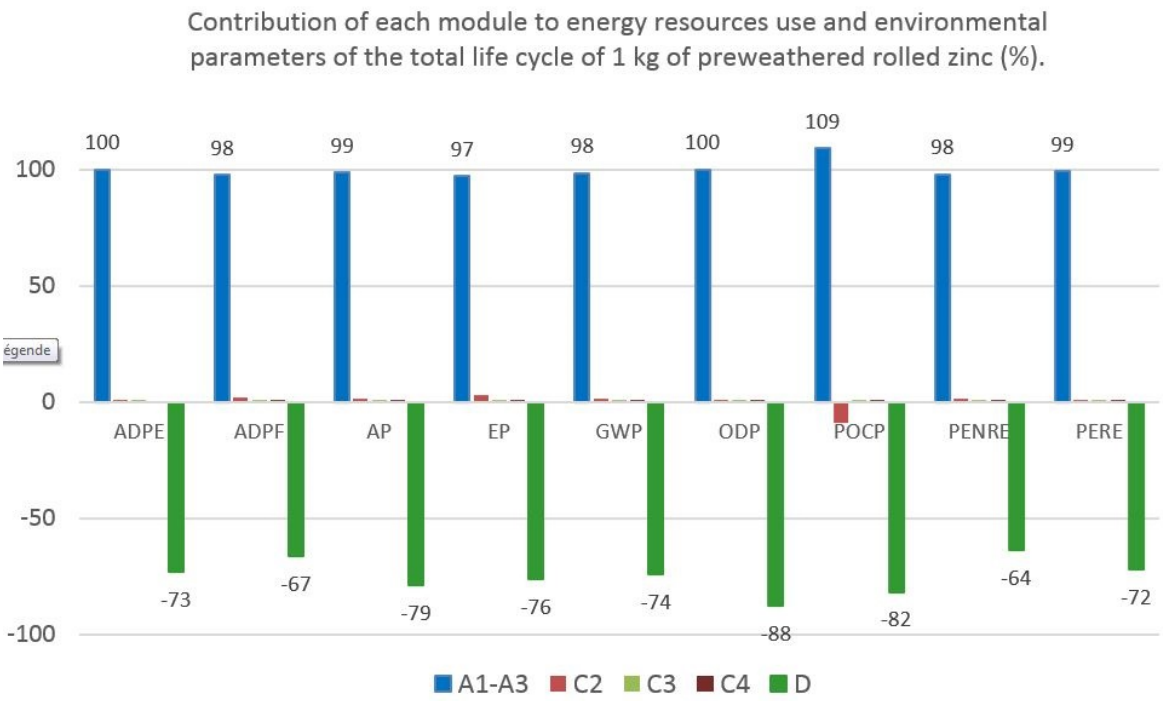
Parameter	Unit	A1-A3	C2	C3	C4	D
Renewable primary energy as energy carrier	[MJ]	8.80E+0	2.50E-2	3.40E-2	2.60E-4	-6.40E+0
Renewable primary energy resources as material utilization	[MJ]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
Total use of renewable primary energy resources	[MJ]	8.80E+0	2.50E-2	3.40E-2	2.60E-4	-6.40E+0
Non renewable primary energy as energy carrier	[MJ]	5.10E+1	6.40E-1	4.30E-1	6.10E-3	-3.30E+1
Non renewable primary energy as material utilization	[MJ]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
Total use of non renewable primary energy resources	[MJ]	5.10E+1	6.40E-1	4.30E-1	6.10E-3	-3.30E+1
Use of secondary material	[kg]	2.30E-3	IND	IND	IND	IND
Use of renewable secondary fuels	[MJ]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
Use of non renewable secondary fuels	[MJ]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
Use of net fresh water	[m^3]	IND	IND	IND	IND	IND

RESULTS OF THE LCA – OUTPUT FLOWS AND WASTE CATEGORIES: 1 kg of natural rolled zinc

Parameter	Unit	A1-A3	C2	C3	C4	D
Hazardous waste disposed	[kg]	IND	IND	IND	IND	IND
Non hazardous waste disposed	[kg]	IND	IND	IND	IND	IND
Radioactive waste disposed	[kg]	IND	IND	IND	IND	IND
Components for re-use	[kg]	IND	IND	IND	IND	IND
Materials for recycling	[kg]	IND	IND	IND	IND	9.60E-1
Materials for energy recovery	[kg]	IND	IND	IND	IND	IND
Exported electrical energy	[MJ]	IND	IND	IND	IND	IND
Exported thermal energy	[MJ]	IND	IND	IND	IND	IND

6. LCA: Interpretation

Energy resources ad environmental parameters by module (%):



The two main modules, which contribute significantly to the consumption of energy and to the environmental impacts, are the aggregated A1-A3 and the module D.

Regarding the module A1-A3, the module A1 itself contributes to 86 % of the energy resources use and between 93 and 99,9% of the environmental impact parameters.

Regarding the module A1, the production of primary zinc (SHG zinc) contributes between 98% and 99,9% of the energy resources use and the environmental impact parameters.

Regarding the module A3, the 2 main steps contributing to the environmental impacts is the “Melting to rolling” step and the “Preweathering” step.

In the module A3, the “Melting to rolling” step contributes to 73% of the ODP, 64% of the PENRT, 59 % of the GWP, 54% of the POCP, 51% of the AP and 41% for the ADEPF and ADPE. The contribution of the “Melting to rolling” step to this module is due to the production of the electricity and the thermal energy required for this step.

In the module A3, the “Preweathering” step is responsible for 35% of the EP, 33% of the GWP, 28% of the ADPF, 25% of the AP and respectively 21,7% and 21,2% for the ADPE and the POCP . The contribution of the “Preweathering” step to this module is due to the production of thermal energy required to heat the” phosphatation” bath (mainly for GWP, ADPF and partially for AP) and due also to the preweathering itself with the emissions of nitrogen oxides (mainly for EP and POCP).

In the same module, the “Packaging” step contributes to 48,9% of the PERE, 25% of the ADPE, 15% of the EP and respectively 13% and 10% for the ADPF and AP. This contribution is mainly due to the production of cardboard and wooden pallets required for the packaging (biomass production).

Regarding the module C2, it is interesting to note that it contributes to a negative impact on POCP. The reason is that nitric oxide emissions that occur during transport have a negative characterization factor in the impact assessment in accordance with CML 2001 - 2010.

Regarding the module D, it is interesting to note the significant environmental benefices due to the recycling of the old rolled zinc at its end of life.

7. Requisite evidence

Runoff rate evidences:

Experimental setup**:** Duration 1 year (June 1998 to June 1999), in Stockholm, Sweden, titanium zinc sheet 0.7 mm thick in surface qualities VMZINC® bright-rolled and pre-weathered QUARTZ-ZINC® and ANTHRA-ZINC®, inclination of roof = 45°, roof surface direction south facing.
Measuring agency**:** Royal Institute of Technology, Department of Materials Science and Engineering, Division of Corrosion Science – Stockholm in Sweden
Report of results**:** "Atmospheric corrosion of zinc-based materials: runoff rates, chemical speciation and ecotoxicity effects" – I.Odenevall Wallinder, C.Leygraf, C.Karlen, D.Heijerick and C.R.Janssen – Corrosion Science n°43 – pp 809-816 - 2001

Result:

As part of this study annual runoff rates were taken from bright-rolled VMZINC® and pre-weathered QUARTZ-ZINC® and ANTHRA-ZINC®(other zinc-based construction materials were part of this study).
The average annual SO_2 concentration at the measuring agency was 3 µg/m^3, the total amount of precipitation during the experiment was 540 mm.

The runoff rates of bright-rolled VMZINC® is the following: 2.3 g/m^2/year.

8. References

General principles
for the EPD range of Institut Bauen und Umwelt e.V. (IBU), 2011-09
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